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DUKE POWER

April 26, 1993

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Wasnington, DC 20555

Subject: Catawba Nuclear Station, Units 1 and 2
Docket Nos. 50-413 and 50-414
1992 Annual Radiological Environmental Operating Report

Pursuant to Technical Specification 6.9.1.6, find attached the 1992 Annual Radiological Environmental Operating Report. This report covers the operation of Catawba Units 1 and 2 during the 1992 calendar year.

Very truly yours,

M. S. Tuckman

M. S. Tuckman

KEN/92REOR

Attachment

xc: (W/O Appendix E of Attachment)

S. D. Ebneter
Regional Administrator, Region II

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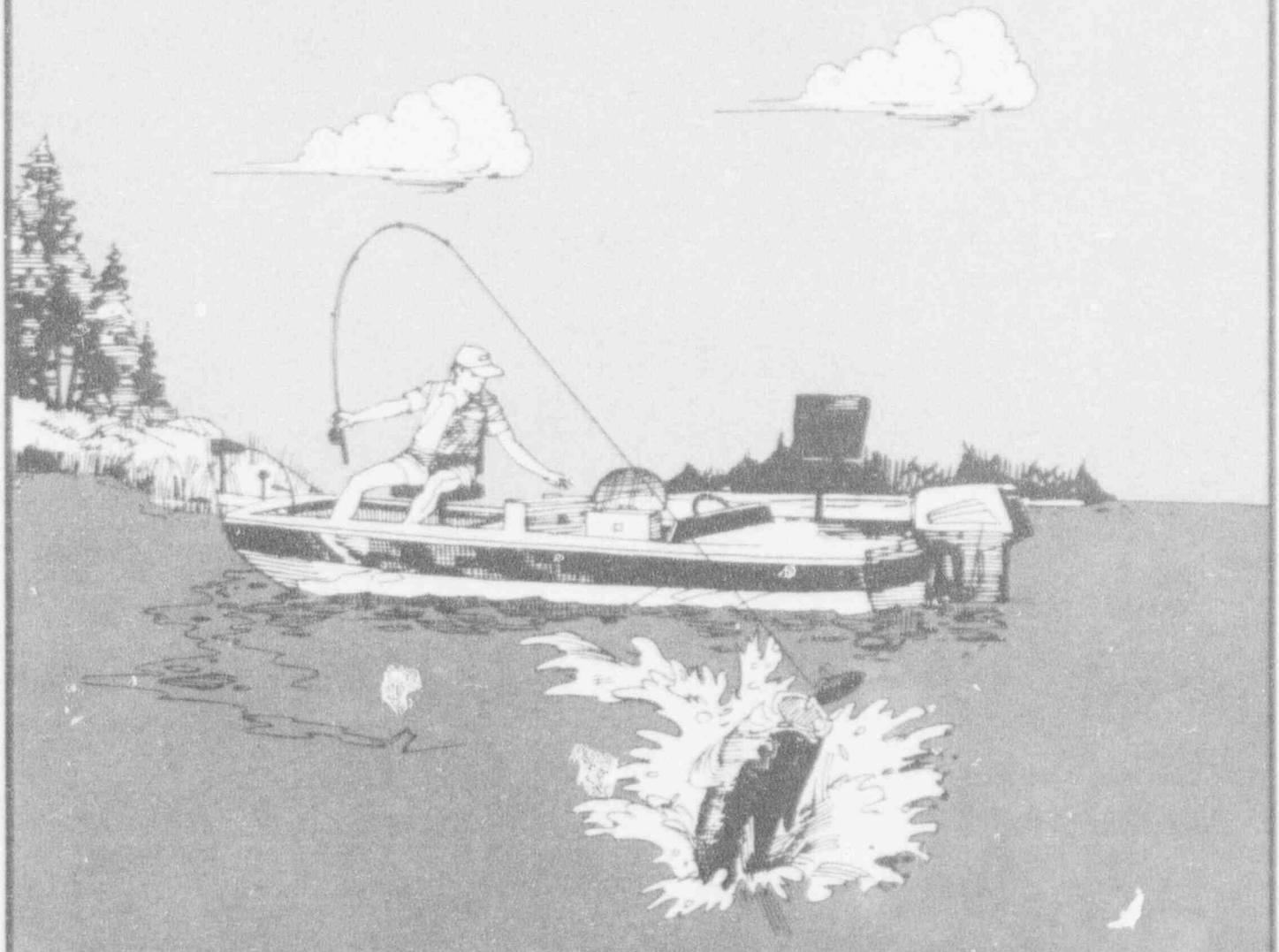
Senior Resident Inspector

R. E. Martin, ONRR

IE25
1/1

DUKE POWER COMPANY

Catawba Nuclear Station
Units 1 and 2



Annual Radiological Environmental Operating Report

1992

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

DUKE POWER COMPANY

CATAWBA NUCLEAR STATION

UNITS 1 AND 2

JANUARY 1, 1992 - DECEMBER 31, 1992

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SECTION 1

EXECUTIVE SUMMARY

This Annual Radiological Environmental Operating Report describes the Catawba Nuclear Station Radiological Environmental Monitoring Program, and the results of the program for the 1992 calendar year.

Included in the report are regulatory requirements associated with the program, identification of sampling locations, descriptions of environmental sampling and analysis procedures, results of the Annual Land Use Census, a summary of sample analysis results, discussion of the results, comparisons of present environmental radioactivity levels with preoperational data, analysis of trends in environmental radioactivity levels, comparisons of dose estimates based upon environmental measurements with estimates calculated using effluent release data, discussion of quality assurance activities associated with the program, and identification of deviations from program requirements.

Sampling activities were conducted as prescribed by Technical Specifications. In addition, supplemental fish and sediment samples were collected to better monitor these media. Required sample analyses were performed and detection capabilities met technical specification requirements for all samples.

The following predominant nuclides, detected in sample media collected from the discharge canal, could be attributable to the operation of Catawba:

	Mn-54	Co-58	Co-60	Cs-134	Cs-137
Shoreline Sed.	I	I	I	I	I
Fish	S	D	I	S	S
Bottom Sediment	I	I	I	D	D
Surface Water	Tritium - I				
I = Increasing (from 1991), D = Decreasing, S = Steady					

These trends in nuclide concentrations observed over the past year, generally reflected comparable changes in nuclide activities discharged annually or cumulatively via liquid effluents. No other significant trends regarding environmental radioactivity levels were evident in the sampling results.

Dose estimates based upon environmental measurements were compared with those calculated based upon effluent release data. The estimates correlated well.

Catawba's contribution to environmental radioactivity is small. The highest dose calculated from environmental sampling (excluding TLD results) during 1992 was only 0.28 mrem. All positive indications of radioactivity attributable to station operations were well below the reporting levels imposed by Technical Specifications. Operation of Catawba has had no significant radiological impact upon the health and safety of the general public.

SECTION 2

INTRODUCTION

2.1 SITE DESCRIPTION AND SAMPLE LOCATIONS

Duke Power Company'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 cycle system incorporating cooling towers, instead of utilizing 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 difference results in greater radionuclide concentrations in the discharge canal given comparable liquid effluent source terms.

A map depicting the site and the area within one mile of CNS can be found in Figure 2-C. An area map encompassing a ten mile radius from the station can be found in Figure 2-D.

The CNS Radiological Environmental Monitoring Program (REMP) sampling locations are summarized in Tables 2-A and 2-B. Table 2-A lists the environmental Thermoluminescent Dosimeter (TLD) locations. Table 2-B lists all other sampling locations. The REMP sampling and analysis procedures are summarized in Appendix A.

Figures 2-C, 2-D, and 2-E are maps depicting the specific positions of all REMP sampling locations. The location numbers shown on these maps correspond to those listed in Tables 2-A and 2-B. Figure 2-C comprises all sample locations within one mile of CNS. Figure 2-D comprises all remaining locations. Figure 2-E identifies Location 208 (Discharge Canal) shoreline sediment (1S, 2S, and 3S) and bottom sediment (1M, 2M, and 3M) sampling points. Of these six sediment samples, only shoreline sediment at Location 208-1S is required by CNS Technical Specifications; the remaining five are supplemental samples first collected during 1986.

2.2 SCOPE AND REQUIREMENTS OF THE ENVIRONMENTAL MONITORING PROGRAM

The Radiological Environmental Monitoring Program required by CNS Technical Specification 3/4.12.1 provides representative measurements of radiation and radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposures to members of the public resulting from plant operation. This monitoring program implements Section IV.B.2 of Appendix I to 10 CFR Part 50 and thereby supplements the Radiological Effluent Monitoring Program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of effluent measurements and modeling of environmental exposure pathways. Guidance for this monitoring program is provided by the Radiological Assessment Branch Technical Position on Environmental Monitoring.

The Annual Land Use Census required by CNS Technical Specification 3/4.12.2 is performed to ensure that changes in the use of areas at or beyond the site boundary are identified and that modifications to the Radiological Environmental Monitoring Program are made if required by changes in land use. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50. The results of this census are required to be included in this annual report by Technical Specification Administrative Control 6.9.1.6.

Participation in an approved Interlaboratory Comparison Program as required by CNS Technical Specification 3/4.12.3 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 10 CFR Part 50. A summary of the results obtained as part of this comparison program are required to be included in this annual report by Technical Specification Administrative Control 6.9.1.6.

This Annual Radiological Environmental Operating Report is required by CNS Technical Specification Administrative Control 6.9.1.6, and it adheres to the content requirements of this specification.

CNS Technical Specification 3.12.1 (Table 3.12-1) specifies the conduct of the Radiological Environmental Monitoring Program. The Duke Power Company Offsite Dose Calculation Manual further defines the specific types, frequencies, and locations of sampling and measurement.

CNS Technical Specification Tables 3.12-2 and 4.12-1 list thirteen radionuclides; 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. These thirteen radionuclides are collectively referred to throughout this annual report as "Radionuclides Listed in Technical Specifications", or "Technical Specification Nuclides".

CNS Technical Specification Table 3.12-2 provides reporting levels as a function of sample type and radionuclide. These reporting levels are listed in Table 2-F of this report. If sample radionuclide activity exceeds 100% of reporting level (when summed over all detected nuclides having a reporting level for the applicable sample type and when the sums are averaged by location over the applicable calendar quarter), a special report must be submitted to the Nuclear Regulatory Commission. When radionuclides other than those listed in Table 3.12-2 are detected, they must be addressed in this annual report. Not all radionuclides have a reporting level for a given sample type. For example, there are no reporting levels listed for gross beta analysis of any sample type and sediment samples have no reporting levels for any radionuclides.

CNS Technical Specification Table 4.12-1 lists required Lower Limit of Detection (LLD) capabilities for REMP sample analyses as a function of sample type and radionuclide. These LLD values are listed in Table 2-G of this report. Refer to Part 2.3.2 for the definition of LLD and Minimum Detectable Activity (MDA). Not all radionuclides have a required LLD for a given sample type. Any analyses for which the required LLD values were not achievable must be discussed in this annual report.

2.3 STATISTICAL AND CALCULATIONAL METHODOLOGY

2.3.1 ESTIMATION OF THE MEAN VALUE

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

$$\bar{X} = \frac{\sum_{i=1}^{i=N} X_i}{N} \qquad \text{(Equation 2-1)}$$

Where:

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

i = individual sample,

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

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

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

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

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

The LLD, as defined in the Technical Specifications, is the smallest concentration of radioactive material in a sample that will yield a net count, above 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 values for each sample medium and selected radionuclides are given in the Technical Specifications.

The MDA may be thought of as an "actual" LLD for a particular sample measurement remembering that the MDA is calculated using a sample background instead of a system background. In gamma spectroscopy analyses, the sample background may be elevated above the system background due to the continuum produced by higher energy gamma rays from other radionuclides (either man-made or naturally produced).

The continuum increases the smallest concentration of a particular radionuclide that could be positively identified in the sample. Therefore, to insure that the "required" LLD is not exceeded for any radionuclide in a sample medium, the MDA is calculated based on the actual background in the area of the identifying gamma energy and is compared to the "required" LLD. If the MDA exceeds the "required" LLD, the sample is counted for a longer time period so that the standard deviation of the sample background is minimized. If the "required" LLD exceeds the MDA, then the analysis of the sample meets the requirements for the detection capability for environmental sample analysis.

For "gross" counters (such as alpha/beta proportional counters and liquid scintillation counters), the MDA is calculated using the average of batch background counts. The average is used to account for background fluctuations over longer counting periods. The MDA is then compared to the "required" LLD. If the MDA exceeds the "required" LLD, the sample is counted for a longer time period so that the standard deviation of the batch background is minimized. If the "required" LLD exceeds the MDA, then the analysis of the sample meets the requirements for the detection capability for environmental sample analysis. For "gross" counters, a critical level calculation is also performed to determine statistically significant levels of activity. The critical level is defined as the net count rate which must be exceeded before the sample is said to contain any measurable activity above background. In general, the critical level is equal to one-half of the MDA. Activities exceeding the critical level are reported for gross counters to minimize data biases, since most detectable activities fall within this range.

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. Historically, this has been done by looking at data (including preoperational data) and determining if a trend exists. For the past several years, the various liquid effluent pathways have been evaluated based on a number of parameters (which are discussed in detail and tabularly later in this report). From these parameters certain conclusions have been made which reflect how radionuclides which have been released from the station appear to be taken into the environment. The various pathways available: fish, shoreline sediment, milk, broadleaf vegetation, display different characteristics of uptake and buildup. Therefore, each pathway is discussed separately and conclusions made for both the reporting year and for prior years including in most cases preoperational years.

2.3.4 Test Statistic

In some cases, we would not expect to observe a buildup of radionuclides in the environment, but instead would expect to see a measurable increase in levels over a short duration. This is the case for direct radiation measurements, where the radiation level is measured over a finite period and is dependent upon whether plant discharges were occurring at that time or not. If we assume that the naturally occurring radiation levels around the plant are normally distributed and that the effluents are not affecting the environment outside of this normal distribution, then we can compare the values of two sets of measurements taken at different times around the plant. One measurement can be taken when we are certain no effect is occurring and one when an effect may be occurring, to determine if they are statistically different from one another.

The statistic that compares the means from two sets of measurements to determine if there is a statistically significant difference is called the test statistic, or t-statistic, and is calculated as follows:

$$t = \frac{\overline{X_1} - \overline{X_2}}{S_P \sqrt{1/n_1 + 1/n_2}}$$

Where:

$\overline{X_1}$ = the mean value of the first set of measurements

$\overline{X_2}$ = the mean value of the second set of measurements

S_P = the average standard deviation of the two sets of measurements

$$= \sqrt{S^2_P}$$

Where:

$$S^2_P = \frac{(n_1 - 1)S_1 + (n_2 - 1)S_2}{n_1 + n_2 - 2}$$

n_1 = the number of measurements in the first set

n_2 = the number of measurements in the second set

The calculated value of the test statistic is then compared to expected values of the test statistic tabulated based on the number of measurements taken and the degree of confidence required for the results. For our purposes, the expected value of the test statistic will always be chosen to give a 95% confidence level that a positive result is truly positive with only a 5% probability that a positive result is truly negative. This confidence level is chosen since it is consistent with the standard confidence levels specified for similar measurements.

Due to the existence of naturally occurring differences in background radiation levels over time (as a result of solar cycles and other meteorological phenomena) and systematic errors due to instrument variability, ratios of measurements can be used to calculate the t-statistic instead of individual measurements. By using ratios, the errors associated with the measurement process then cancel each other out and allow us to more accurately compare results from one year to the next. Specifically, in the case of TLD measurements, the inner ring of TLD results is ratioed with the outer ring of TLD measurements in a given year and the ratio for one year is compared to the ratio for another year.

As with other environmental samples, outside factors may affect the results observed and the resulting trends identified. Therefore, the significance of trends will be based in part on judgement of plant personnel familiar with the factors affecting environmental levels, as well as the statistical results.

TABLE 2-A

CATAWBA RADIOLOGICAL MONITORING PROGRAM SAMPLING LOCATIONS
(TLD LOCATIONS)

LOCATION	DESCRIPTION	DISTANCE (MILES)	SECTOR
200	Site Boundary	0.6	NNE
201	Site Boundary	0.5	NE
202 *	Site Boundary	0.6	E
203	Site Boundary	0.4	ESE
204	Site Boundary	0.5	SSW
205	Site Boundary	0.3	SW
206	Site Boundary	0.7	WNW
207	Site Boundary	0.9	NNW
212	Special Interest	3.3	E
217	Control	10.0	SSE
222	Site Boundary	0.7	N
223	Site Boundary	0.6	E
224 *	Site Boundary	0.6	ESE
225	Site Boundary	0.7	SE
226	Site Boundary	0.5	S
227	Site Boundary	0.5	WSW
228	Site Boundary	0.6	W
229	Site Boundary	0.8	NW
230	4 - 5 Mile Radius	4.4	N
231	4 - 5 Mile Radius	4.2	NNE
232	4 - 5 Mile Radius	4.1	NE

* Deleted 09/14/89

TABLE 2-A
(Continued)

CATAWBA RADIOLOGICAL MONITORING PROGRAM SAMPLING LOCATIONS
(TLD LOCATIONS)

LOCATION	DESCRIPTION	DISTANCE (MILES)	SECTOR
233	4 - 5 Mile Radius	4.0	ENE
234	4 - 5 Mile Radius	4.5	E
235	4 - 5 Mile Radius	4.0	ESE
236	4 - 5 Mile Radius	4.2	SE
237	4 - 5 Mile Radius	4.8	SSE
238	4 - 5 Mile Radius	4.2	S
239	4 - 5 Mile Radius	4.6	SSW
240	4 - 5 Mile Radius	4.1	SW
241	4 - 5 Mile Radius	4.7	WSW
242	4 - 5 Mile Radius	4.6	W
243	4 - 5 Mile Radius	4.6	WNW
244	4 - 5 Mile Radius	4.1	NW
245	4 - 5 Mile Radius	4.2	NNW
246	Special Interest	8.1	ENE
247	Control	7.5	ESE
248	Special Interest	7.0	SSE
249	Special Interest	8.1	S
250	Special Interest	10.3	WSN
251	Control	9.8	WNW
255 **	Site Boundary	0.6	ENE
256 **	Site Boundary	4.1	SSE

** Added 09/14/89

TABLE 2-B

CATAWBA RADIOLOGICAL MONITORING PROGRAM SAMPLING LOCATIONS
(OTHER SAMPLING LOCATIONS)

Location	Description, Distance, and Sector	Required Sample Collection Frequency								
		Air	SW	DW	SS	Milk	Fish	BV	GW	FP
200	Site Boundary (0.6 miles NNE)	W						M		
201	Site Boundary (0.5 miles NE)	W						M		
203	Site Boundary (0.4 miles ESE) <Deleted>							<M>		
205	Site Boundary (0.3 miles SW)	W								
208	Discharge Canal (0.5 miles S)		BW		SA		SA			
209	Woods Dairy (7.0 miles SSW)					SM				
210	Ebenezer Access (2.4 miles SE)				SA					
211	Wylie Dam (4.0 miles ESE)		BW							
212	Tega Cay (3.3 miles E)	W								
213	Fort Mill Water Supply (7.5 miles ESE)			BW						
214	Rock Hill Water Supply (7.3 miles SE)			BW						
215	River Pointe - Hwy 49 (4.1 miles NNE) Control		BW		SA					
216	Hwy 49 Bridge (4.0 miles NNE) Control						SA			
217	Rock Hill Substation (10.0 miles SSE) Control	W						M		
218	Belmont Water Supply (13.5 miles N) Control			BW						
219	Pursley Dairy (6.0 miles SW)					SM				
220	Dairy (8.0 miles WSW) <Deleted>					<SM>				
221	Oates Dairy (13.0 miles NW) Control					SM				
226	Site Boundary (0.5 miles S)							M		
252	Residence (0.7 miles SW)								Q	
253	Irrigated Garden at Downstream Residence (2.1m SSE)									M(a)
254	Residence (0.8 miles N)								Q	

(a) During Harvest Season

Sample Type Codes

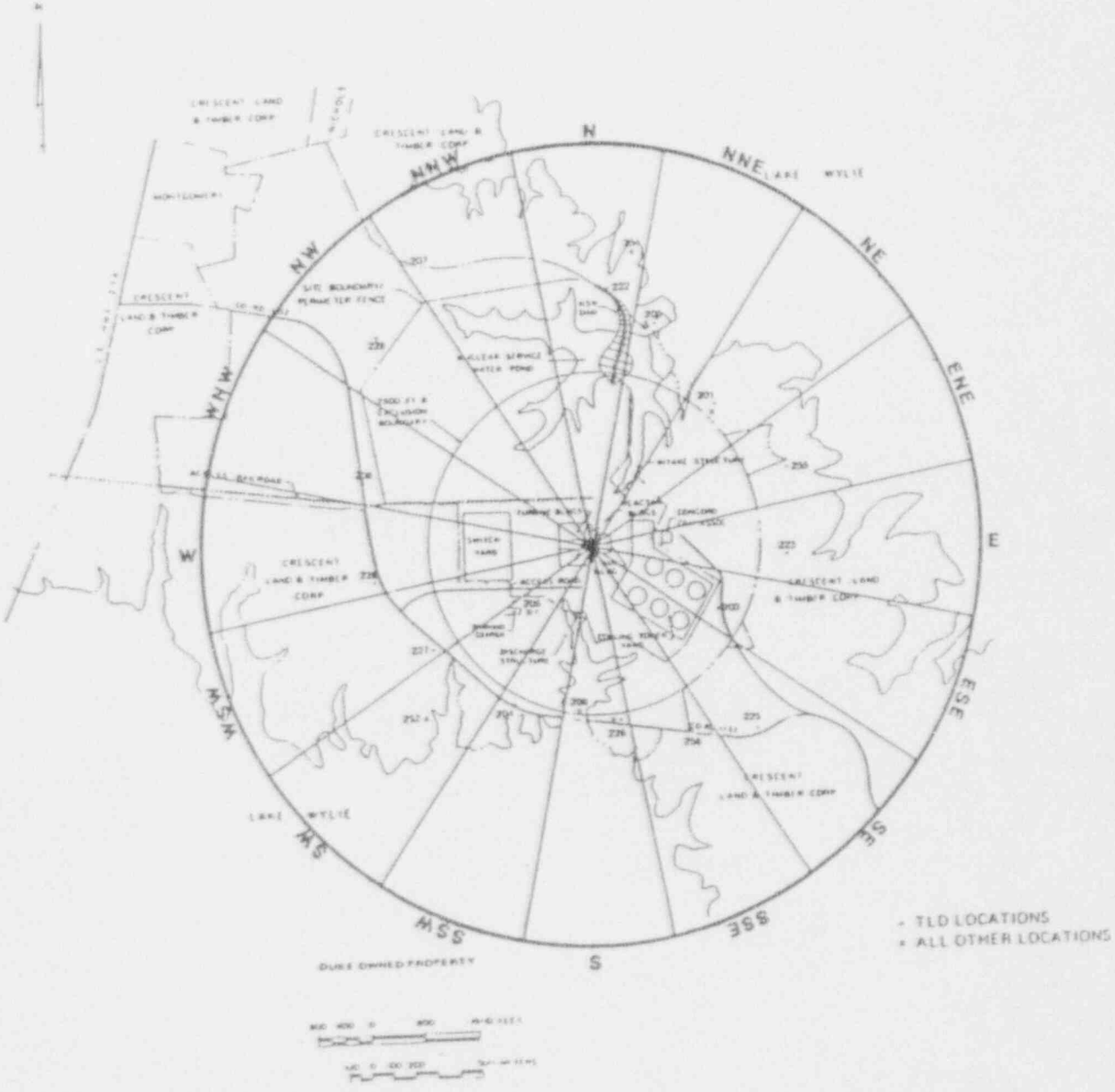
SW - Surface Water
DW - Drinking Water
SS - Shoreline Sediment
BV - Broadleaf Vegetation
GW - Ground Water
FP - Food Products

Collection Frequency Codes

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

FIGURE 2-C

MAP OF RADIOLOGICAL MONITORING PROGRAM SAMPLING LOCATIONS
(NEAR TO CATAWBA)




▲218(IN BEL
NNW
10 MILE
N
▲221
5 MILE
230
245
231
215
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212
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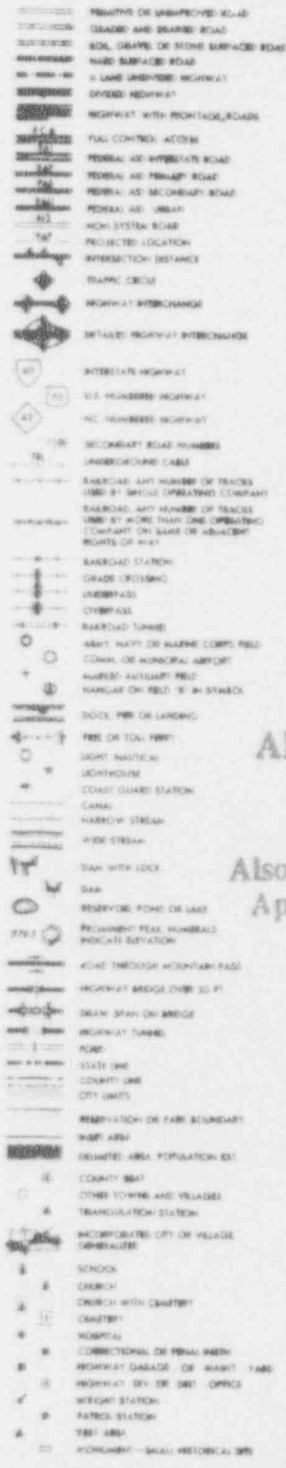
238
220
219
209
248
SW
S
217



• TLD LOCATIONS

▲ ALL OTHER LOCATIONS

SCALE OF MILES

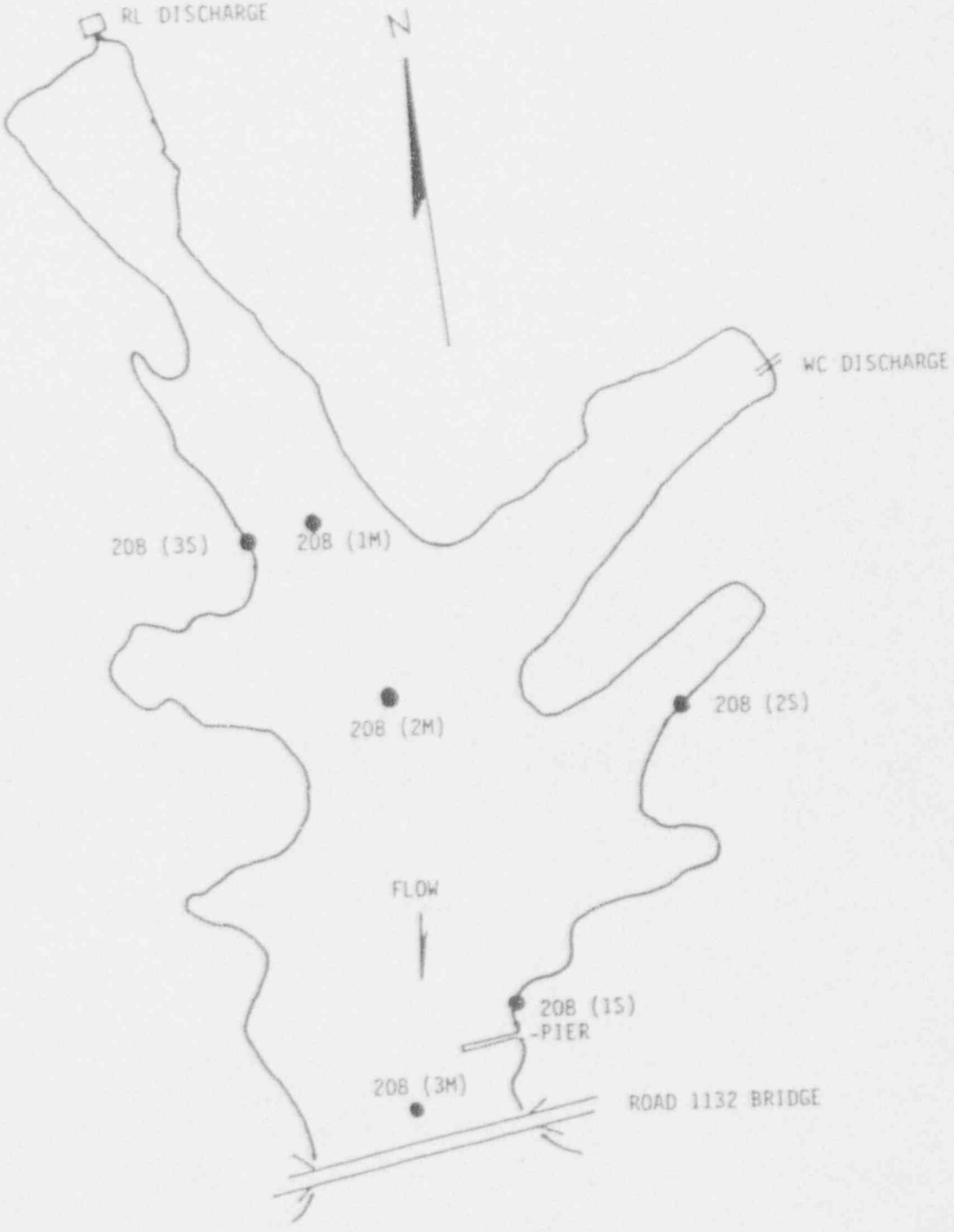
0 1 2 3 4

CATAWBA NUCLEAR STATION

Figure 2 - D
REMP Sampling
Locations (Far)

FIGURE 2-E

MAP OF RADIOLOGICAL MONITORING PROGRAM SAMPLING LOCATIONS
(LOCATION 20B SHORELINE AND BOTTOM SEDIMENT SAMPLING POINTS)



CATAWBA NUCLEAR STATION DISCHARGE CANAL

TABLE 2-F

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Analysis	Water (pCi/liter)	Airborne Particulates or Gases (pCi/cubic meter)	Fish (pCi/kg wet)	Milk (pCi/liter)	Food Products (pCi/kg wet)	Sediment (pCi/kg dry)
H-3	20,000[(a)]					
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		

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

TABLE 2-G

LOWER LIMIT OF DETECTION (LLD) CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS

Analysis	Water (pCi/liter)	Airborne Particulates or Gases (pCi/cubic meter)	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		

Notes: (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.

SECTION 3

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM DISCUSSION, INTERPRETATION, AND TRENDING OF RESULTS

GENERAL INFORMATION

In addition to the "required" sampling and analyses described in CNS Technical Specification Table 3.12-1, the following "supplemental" measures were taken during 1992. These supplemental measures were first adopted during 1986 to better assess the impact of CNS operations on the environment in a more timely and reliable manner:

1) Shoreline sediment, requiring collection at only one point along the CNS discharge canal (Location 208-1S), was collected at three points (Locations 208-1S, 208-2S, and 208-3S).

2) Shoreline sediment, requiring collection semiannually, was collected quarterly. The first and third quarter samples from Locations 208-1S, 210, and 215 were considered to be the required samples and all remaining samples were considered supplemental.

3) Fish, requiring collection from Locations 208 and 216 semiannually, were collected quarterly. This year the second and fourth quarter samples were considered to be the required samples and the third quarter samples were considered supplemental. The sample schedule was altered as a result of sampling/personnel errors at the Applied Sciences Center.

4) Bottom sediment, not requiring collection at all, was collected quarterly at CNS Discharge Canal Locations 208-1M, 208-2M, and 208-3M. These were considered to be supplemental samples.

Summary tables containing 1992 information required by CNS Technical Specification Administrative Control 6.9.1.6 for each required REMP sample type, can be found in Appendix B. These summary tables are based upon required sample results only, the supplemental sample results are not reflected in these tables. The mean values tabulated in these 1992 summary tables are based upon detectable measurements only.

All deviations from the sampling and analytical requirements of CNS Technical Specification Table 3.12-1 which occurred during 1992, are addressed in Appendices C and D, respectively. For all 1992 CNS REMP samples collected, required as well as supplemental, the reporting level limitations of Technical Specification 3.12.1 were not exceeded. For 1992 CNS REMP analyses, the LLD requirements of Technical Specification Surveillance Requirement 4.12.1 were met for all required and supplemental samples. The required reporting levels and LLD capabilities for CNS REMP samples are listed in Tables 2-F and 2-G, respectively.

CNS Technical Specification Table 3.12-2 (included as Table 2-F) provides reporting levels, as a function of sample type and radionuclide. If sample radionuclide activity exceeds 100% of reporting level (when summed over all detected nuclides having a reporting level for the applicable sample type, and when the sums are averaged by location over the applicable calendar quarter), a special report must be submitted to the Nuclear Regulatory Commission. Table 3-A contains the maximum percent of reporting level (when averaged over a calendar quarter) reached during 1992 for each sample type and location combination. No such values are listed for shoreline sediment or bottom sediment samples, as there are no corresponding technical specification reporting levels.

With two exceptions, all of the 1992 maximum percent of reporting level values were less than 15%, well below the 100% action level. The highest value reached during 1992 was 45.2%, for surface water collected during the second quarter at CNS discharge canal Location 208. The second highest value was 18.2% for fish (bottom feeder) collected at CNS discharge canal on 4/8/92.

CNS Technical Specification 3.12.1 addresses the actions to be taken when nuclides other than the thirteen radionuclides listed in technical specifications are detected in REMP samples. Table 3-B summarizes those nuclides. The occurrences of these nuclides are the result of CNS liquid effluents which contained the nuclides. The naturally occurring radionuclides of Table 3-B (K-40 and Be-7) were considered to have resulted from natural background radioactivity, not plant effluents.

The Nuclear Data ND6620 gamma spectroscopy system (which was used to analyze CNS REMP samples collected during 1984, 1985, 1986, and most of 1987) was replaced by the Nuclear Data ND9900 gamma spectroscopy system on September 1, 1987. When the ND6620 system was used to analyze samples prior to September 1, 1987, a small but steady percentage (approximately five percent) of measurements for most of the thirteen radionuclides listed in technical specifications, yielded detectable low-level activity, even when the presence of such activity was highly unlikely as for control location samples and preoperational samples collected during 1984. This phenomenon has not occurred using the ND9900 system, thus ending this trend and suggesting that the ND6620 system may have been vulnerable to false-positive results, possibly due to the method by which it estimated net activity even when its peak search routine failed to detect a peak.

This attribute must be considered when trending and comparing recent REMP results to those generated during the preoperational period and the operational period through August, 1987.

During 1984, the last completely preoperational year at CNS, tritium and Cs-137 were detected with sufficient frequency to imply their existence as background radioactivity (See Table 3-C). For ground water, drinking water, and surface water samples, tritium was frequently detected (at levels of about 300 pCi/liter), and I-131 was occasionally detected in surface water at all three locations when performing low-level radioiodine analysis (at levels ranging from 0.3 to 1.7 pCi/liter). For all sample types other than water, Cs-137 was detected occasionally during 1984. Note that for shoreline sediment, Cs-134 was detected at all three locations in four of six samples at levels ranging from 24 to 39 pCi/liter. For the reasons discussed earlier (ND6620 sensitivity phenomenon), the predominant nuclides of Table 3-G, excluding I-131 and Cs-134, are likely to be the only nuclides listed in technical specifications that actually existed in preoperational samples.

All 1992 REMP analysis results were reviewed in order to detect and identify any significant trends. Many sources of information were examined to accomplish this and the resultant trending observations were included in Parts 3.1 through 3.11. Quarterly REMP verification reports were generated in order to track technical specification requirements, and these reports were also used to evaluate potential trends occurring during periods shorter than a year. The 1992 Summary of Analysis Results tables from Appendix B, as well as the analogous tables for the years 1984 and the years 1987 through 1991, were reviewed.

To aid in trending, additional summaries were generated for each individual location for each sample type, as well as for key groups of locations for each sample type. These additional summaries were not included in this annual report. With the exception of certain 1986 results affected by the Chernobyl accident, these summaries incorporated all required and supplemental REMP sample results.

Parts 3.1 through 3.12 discuss 1992 REMP results for each sample type specifically, and for the Annual Land Use Census. Unless noted otherwise, these discussions are based on REMP sample results, required as well as supplemental (with exception of certain 1986 results affected by the Chernobyl accident).

3.1 AIRBORNE RADIOIODINES AND PARTICULATES

3.1.1 RADIOIODINES

During 1992, 258 radioiodine samples were analyzed, 208 from the four indicator locations and 50 from the control location.

The term "airborne radioiodines" is used throughout this report to generically categorize sample results for the air charcoal cartridge filter. Radioactive iodines and other halogens are the only nuclides (other than some which occur naturally) one could normally expect to detect in these REMP samples. However, for the purpose of this report, the term "airborne radioiodines" refers to any and all nuclides reported in REMP air charcoal cartridge sample results, not just radioiodines.

K-40 and Be-7 which occur naturally, were routinely detected in most REMP charcoal cartridge samples collected during 1992 and were the only radionuclides identified during the year.

3.1.2 PARTICULATES

During 1992, 258 particulate filter samples were analyzed, 208 from the indicator locations and 50 from the control location.

Be-7, which occurs naturally, was routinely detected in REMP airborne particulate filter samples collected during 1992. K-40 was occasionally detected in these samples. No other radionuclides were detected in any 1992 airborne particulate filter samples. These results were consistent with 1991 sample results.

3.2 GROUND WATER

K-40 was the only radionuclide reported in CNS REMP ground water samples collected during 1992. The K-40 results were relatively consistent with results from previous years. There are no control ground water sample locations.

Tritium was detected in both Location 252 and 254 in 1990. The average detectable concentration was 560 pCi /liter, or a 3.02% maximum quarterly percent of reporting level during 1990, third quarter. These results were essentially consistent with each other and also with ambient background levels.

3.3 DRINKING WATER

K-40 and tritium, both of which occur naturally, were the only radionuclides detected in CNS REMP drinking water samples collected during 1992. Tritium was detected in six of the twelve samples (50% frequency). During 1989 and 1990, the frequencies were 33%. This detection frequency was less than in 1984, when tritium was detected in eleven of the twelve samples (92% frequency).

During 1992, tritium was detected in two of the four samples collected from indicator Location 213, at an average concentration of 765 pCi/liter. It was detected in three of the four samples collected from indicator Location 214, at an average concentration of 675 pCi/liter. At the control Location 218, tritium was detected in one of the four samples with a concentration of 538 pCi/liter.

During 1984 (preoperation) and 1985, tritium was detected in drinking water samples with 71% frequency, at average detectable concentrations ranging from approximately 300 to 400 pCi/liter. During the period from 1986 through 1989, tritium was detected in drinking water samples with 41% frequency, at average detectable concentrations ranging from approximately 500 to 800 pCi/liter. This concurrent decrease in detection frequency and increase in average detectable concentration, is probably attributable to the change in tritium analysis laboratories occurring during 1986, from a contractor laboratory to the Radioanalysis Laboratory.

The tritium detection frequencies and low average concentrations which were reported during 1992 and previous years for all CNS REMP drinking water locations, were consistent with ambient background levels, and were probably not affected by CNS effluents. The maximum quarterly average percent of reporting level reached during 1992 was only 4.63% for drinking water collected from Location 214 during the second quarter, and was attributable solely to tritium.

3.4 SURFACE WATER

K-40, Be-7, and tritium, all of which occur naturally, were detected in CNS REMP surface water samples collected during 1992. Tritium was detected in nine of the twelve samples, all of which were collected from discharge canal Location 208.

Tritium was detected in all 33 surface water samples collected from Location 208 during the seven year period from 1984 to 1991. Table 3.4-A lists the annual average Location 208 surface water sample tritium concentrations for this period. The table also lists the total tritium activity released into the CNS discharge canal via liquid effluents during each year. Ratios of the tritium sample concentration divided by the tritium effluent activity are also included.

Tritium concentrations in surface water collected from Location 208 exceed ambient background levels. CNS liquid effluents appear to be affecting discharge canal surface water tritium concentrations. The concentration/activity ratios are relatively consistent, considering the uncertainties inherent in such an evaluation. The ratios indicate a good overall correlation between Location 208 surface water tritium concentrations and liquid releases of tritium from CNS. The average percent of reporting level values for surface water collected from Location 208 for the four calendar quarters of 1992 were 23.3%, 39%, 45.2%, and 30.8%, respectively. Tritium was solely responsible for these percent of reporting level values. During 1993, tritium data will be monitored closely to maintain effective trending of concentrations at Location 208.

TABLE 3.4-A

SURFACE WATER SAMPLE TRITIUM RESULTS - LOCATION 208

Year	Surface Water Average H-3 Conc. (pCi/liter)	Total H-3 Activity Released in Liquid Effluents (Curies)	Concentration/ Activity Ratio
1984	313	0	N/A
1985	1190	175	6.8
1986	2340	236	9.9
1987	4170	728	5.7
1988	6030	706	8.5
1989	5270	890	5.9
1990	3980	594	6.7
1991	4868	646	7.5
1992	6583	774	8.5
1985 - 1992 Average	**4304**	**594**	**7.4**

TABLE 3-A

1992 MAXIMUM CALENDAR QUARTER AVERAGE PERCENT OF REPORTING LEVELS

Sample Type	Sample Location	% of Rpt. Level	Calendar Quarter Sampling Dates
Airborne Radioiodines	200	0	ALL
	201	0	ALL
	205	0	ALL
	212	0	ALL
	217 Control	0	ALL
Airborne Particulates	200	0	ALL
	201	0	ALL
	205	0	ALL
	212	0	ALL
	217 Control	0	ALL
Airborne Radioiodines and Particulates	200	0	ALL
	201	0	ALL
	205	0	ALL
	212	0	ALL
	217 Control	0	ALL
Ground Water	252	0	ALL
	254	0	ALL
Drinking Water	213	4.68	06/10/92 - 09/30/92
	214	3.92	12/26/91 - 03/18/92
	218 Control	2.69	12/26/91 - 03/18/92
Surface Water	208	45.20	06/10/92 - 09/30/92
	211	5.55	9/30/92 - 12/23/92
	215 Control	4.08	09/30/92 - 12/23/92
Milk	209	0.36	11/15/92 - 03/25/92
	219	0	ALL
	221 Control	1.02	10/7/92 - 12/30/92

TABLE 3-A
(Continued)

1992 MAXIMUM CALENDAR QUARTER AVERAGE PERCENT OF REPORTING LEVELS

Sample Type	Sample Location	% of Rpt. Level	Calendar Quarter Sampling Dates
Broadleaf Vegetation	200	0	ALL
	201	1.37	04/08/92 - 06/03/92
	217 Control	0	ALL
	226	3.44	10/7/92 - 12/2/92
Fish (Predator)	208	5.15	04/08/92
	216 Control	1.39	11/03/92
Fish (Forager)	208	10.50	04/08/92
	216 Control	1.33	11/03/92
Fish (Bottom Feeder)	208	18.24	04/08/92
	216 Control	1.39	04/08/92
Food Products	253	0	ALL

TABLE 3-B

RADIONUCLIDES DETECTED DURING 1992 AND NOT LISTED
IN TECHNICAL SPECIFICATIONS

SHORELINE SEDIMENT		
Co-57	36.5 pCi/dry Kg	Location 208-3 S
Sb-122	26.7 pCi/dry Kg	Location 208-1 S
Sb-125	205 pCi/dry Kg	Location 208-2 S
Sb-125	118 pCi/dry Kg	Location 208-3 S

FISH (FORAGER)		
Ag-110m	17.3 pCi/dry Kg	Location 208

BOTTOM SEDIMENT		
Cr-51	266.0 pCi/dry Kg	Location 208 - 1M
Co-57	27.0 pCi/dry Kg	Location 208 - 1M
Sb-125	425.0 pCi/dry Kg	Location 208 - 1M
Co-57	155.0 pCi/dry Kg	Location 208 - 2M
Sb-125	627.0 pCi/dry Kg	Location 208 - 2M
Sb-125	472.0 pCi/dry Kg	Location 208 - 3M

Most Sample Types and Locations

K-40
Be-7

TABLE 3-C

FRACTION AND PERCENT OF 1984 NUCLIDE MEASUREMENTS YIELDING DETECTABLE ACTIVITY

SAMPLE TYPE	ALL LOCATIONS		PREDOMINANT NUCLIDES		
Airborne Radioiodines	99/2068	4.8	Cs-137	26/188	13.8
Airborne Particulates	108/2717	4.0	Cs-137	22/247	8.9
Ground Water	2/52	3.8	H-3	2/4	50.0
Drinking Water	35/465	7.5	H-3	11/12	91.7
Surface Water	30/454	6.6	H-3 I-131/LL	12/12 5/24	100.0 20.8
Milk	43/960	4.5	Cs-137	12/80	15.0
Broadleaf Vegetation	24/396	6.1	Cs-137	9/36	25.0
Shoreline Sediment	7/66	10.6	Cs-134 Cs-134	4/6 2/6	66.7 33.3
Fish	4/132	3.0	Cs-137	2/12	16.7
Food Products	Not Sampled				
Bottom Sediment	Not Sampled				
All Sample Types	352/7310	4.8			

3.5 MILK

K-40, which occurs naturally in milk, was detected in every CNS REMP milk sample collected during 1992. Cs-137 was the only other radionuclide reported in these samples.

Cs-137 was detected in milk samples collected during 1992 with frequencies of 7.7% (2/26), 0% (0/26), and 3.8% (1/26), at indicator Locations 209 and 219, and at control Location 221, respectively. The accompanying average detectable Cs-137 concentrations were 3.4, 0, and 5 pCi/liter. These concentrations are very comparable to the results obtained since 1987.

During 1984, Cs-137 was detected with 15.0% frequency (12/80), at concentrations ranging from 5.00 to 10.0 pCi/liter.

The following factors deserve consideration when assessing Cs-137 activity in 1992 REMP milk samples. All three detections of Cs-137 in 1992 indicator location milk samples occurred during the first and second quarters. Cs-137 was not detected in airborne effluents from CNS during the second, third, and fourth quarters of 1989, nor during the first, second, and fourth quarters of 1992. It was an extremely minor airborne effluent during the third quarter of 1992. Considering that the milk sampling locations are six, seven, and thirteen miles from CNS, any Cs-137 in airborne effluents from CNS would have been greatly dispersed before reaching these locations. Also, Cs-137 attributable to past nuclear weapons testing is known to exist in many environmental media (and subsequently, milk) at low, highly variable levels.

Based upon the overall consistency between indicator location, control location, and preoperational milk sample results, as well as the other considerations listed above, low-level Cs-137 activity in milk samples collected during 1992 cannot reasonably be attributed to CNS effluents. The maximum quarterly average percent of reporting level was only 1.96%, for milk collected from indicator Location 219 during the second quarter, and was attributable solely to Cs-137 activities.

3.6 BROADLEAF VEGETATION

K-40, which occurs naturally, was detected in all 48 CNS REMP broadleaf vegetation samples collected during 1992. Be-7, which also occurs naturally, was detected in 45 of these samples. Cs-137 was the only other radionuclide reported in these samples.

Low levels of Cs-137 were detected in broadleaf vegetation samples collected throughout 1992 with frequencies of 0% (0/12), 33.3% (4/12), 33.3% (4/12), and 0% (0/12), at indicator Locations 200, 201, and 226, and at control Location 217, respectively.

These frequencies were comparable to each other and to both 1990 and 1991 values. The respective average detectable Cs-137 concentration's were 0, 63.7, 97.4, and 0 pCi/wet kilogram.

During 1984, Cs-137 was detected with 25.0% frequency (9/36), at concentrations ranging from 20.1 to 130 pCi/wet kilogram.

The following factors deserve consideration when assessing Cs-137 activity in 1992 REMP broadleaf vegetation samples. Only one of the seven detections of Cs-137 in 1992 indicator location broadleaf vegetation samples occurred during the third quarter. Cs-137 was not detected in airborne effluents from CNS during the second, third, and fourth quarters of 1989, nor during the first, second, and fourth quarters of 1992. It was an extremely minor airborne effluent during the third quarter of 1992. Also, Cs-137 attributable to past nuclear weapons testing is known to exist in many environmental media (including vegetation) at low, highly variable levels.

Based upon the overall consistency between indicator location, control location, and preoperational broadleaf vegetation sample results, as well as the other considerations listed above, low-level Cs-137 activity in broadleaf vegetation samples collected during 1992 is not likely attributable to CNS effluents. The maximum quarterly average percent of reporting level was only 3.47%, for broadleaf vegetation collected from indicator Location 226 during the second quarter, and was attributable solely to Cs-137 activities. Quarterly percent of reporting level values for broadleaf vegetation were calculated using technical specification reporting levels for food products, as reporting levels for broadleaf vegetation are not listed in CNS Technical Specifications.

3.7 SHORELINE SEDIMENT

K-40, which occurs naturally, was detected in all twenty CNS REMP shoreline sediment samples collected during 1992. Be-7, which also occurs naturally, was detected in four of these samples. Cs-137 was detected in one of the four samples collected from indicator Location 210 at a low concentration of 20.7 pCi/dry kilogram. No nuclide detections other than these were reported in control Location 215 or indicator Location 210 shoreline sediment samples collected during 1992. The occurrence of Cs-137 in the sample collected from Location 210 was probably attributable to past nuclear weapons testing. This is supported by the fact that since 1986, low levels of Cs-137 have been detected with comparable frequency at indicator Location 210 and control Location 215 (20% and 15%, respectively).

During 1984, Fe-59 was reported in one of the six shoreline sediment samples, at a concentration of 67.3 pCi/dry kilogram. Cs-134 was reported in four of these samples, at concentrations ranging from 24.4 to 39.2 pCi/dry kilogram. Cs-137 was reported in two of these samples, at concentrations of 41.7 and 173 pCi/dry kilogram.

With exception of Cs-137, it was unlikely that these nuclides were present in these preoperational samples; their detection was probably attributable to the ND6620 sensitivity phenomenon discussed previously. No other technical specification nuclides were detected in any 1984 shoreline sediment samples.

During 1992, Mn-54, Co-58, Co-60, Cs-134, and Cs-137 were detected in nearly all of the twelve shoreline sediment samples collected from CNS discharge canal Locations 208-1S, 208-2S, and 208-3S. These five nuclides have been predominant in these samples every year since 1986. These same five nuclides have been predominant in fish and bottom sediment samples collected from the discharge canal. The only other nuclides reported in these twelve samples (besides K-40 and Be-7) were Co-57, Sb-122 and Sb-125 (see Table 3-B). All nine detected nuclides other than K-40 and Be-7 were attributable to liquid effluents from CNS. Such effluents contained prevalent levels of these same nuclides, with exception of Sb-122, which was a minor contributor to effluent activity. The only noted difference observed between the three sample locations during 1992 was the fact that Location 208-1S showed significantly lower reported activities when compared with the other two locations. As an example, the average concentration of Cs-137 from 208-2S and 208-3S was 130 pCi/dry kg, whereas Location 208-1S' concentration was 59.2 pCi/dry kg. An updated characterization of the CNS discharge canal will be performed during 1993 and additional trending information should be available in subsequent annual reports.

Table 3.7-A summarizes shoreline sediment sample results for discharge canal Location 208 during the five year period from 1987 to 1992.

From 1987 through 1991, average detectable concentrations correlated reasonably well with annual activities released in liquid effluents, as indicated by the similar ratios of these values [Parameter D]. Conversely, average detectable concentrations (excluding those for Co-58) did not correlate as well with cumulative, decay-corrected activities released in liquid effluents since preoperation [Parameter E], as indicated by the decreasing ratios of these values [Parameter F]. Note that parameters D and F were nearly identical for Co-58, due to its short, 70.8 day half-life. For 1992, however, the parameter D tended to increase over the trend from 1987 to 1991. This may show that the deposition rate of released activity is greater than the rate at which the environment removes the deposited activity from the shoreline sediment. Also, Parameter F displays a similar increase over previous data.

This observation implies that with 1992 data, annual activity released in liquid effluents may play an additive role to previously deposited activity in Location 208 shoreline sediment samples.

TABLE 3.7-A

SHORELINE SEDIMENT SAMPLE RESULTS - LOCATION 208-1S, 2S, AND 3S

Nuclide	Parameter	1987	1988	1989	1990	1991	1992
Mn-54	[A]	88.3	116.	45.8	58.8	137	155
	[B]	8/12	11/12	12/12	11/12	4/12	9/12
	[C]	39.4	42.8	14.4	34.4	30.2	23.2
	[D]	2.2	2.7	3.2	1.7	4.5	6.7
	[E]	60.1	69.6	45.4	54.6	54.5	47.5
	[F]	1.5	1.7	1.0	1.1	2.5	3.3

Nuclide	Parameter	1987	1988	1989	1990	1991	1992
Co-58	[A]	408.	. 329	194.	227.	404.	1227.
	[B]	10/12	12/12	12/12	11/12	6/12	11/12
	[C]	308.	234.	149.	244.	196.	364.
	[D]	1.3	1.4	1.3	0.9	2.1	3.4
	[E]	315.	243.	156.	248.	203.	370.
	[F]	1.3	1.4	1.2	0.9	2.0	3.32

Nuclide	Parameters	1987	1988	1989	1990	1991	1992
Co-60	[A]	161.	287.	121.	193.	488.	633.
	[B]	12/12	11/12	12/12	11/12	5/12	11/12
	[C]	132.	108.	46.2	127.	156.	116
	[D]	1.2	2.7	2.6	1.5	3.1	5.5
	[E]	240.	318.	325.	412.	517.	569.
	[F]	0.7	0.9	0.4	0.5	0.9	1.1

[A] Average Detectable Concentration (pCi/dry kilogram)
[B] Fraction of Total Measurements Yielding Detectable Activity
[C] Annual Activity Released in Liquid Effluents (mCi)
[D] Concentration/Annual Activity Ratio (pCi/dry kilogram per mCi)
[E] Decayed Cumulative Activity Released in Liquid Effluents (mCi)
[F] Concentration/Cumulative Activity Ratio (pCi/wet kilogram per mCi)

TABLE 3.7-A
(Continued)

SHORELINE SEDIMENT SAMPLE RESULTS - LOCATION 208-1S, 2S, AND 3S

Nuclide	Parameter	1987	1988	1989	1990	1991	1992
Cs-134	[A]	60.8	51.8	18.0	33.2	16.3	50.8
	[B]	8/12	6/12	11/12	6/12	2/12	4/12
	[C]	8.5	11.8	4.7	10.2	5.6	4.3
	[D]	7.1	4.4	3.8	3.3	2.9	11.8
	[E]	21.1	26.9	23.9	27.3	25	23.8
	[F]	2.9	1.9	0.8	1.2	.65	2.1

Nuclide	Parameter	1987	1988	1989	1990	1991	1992
Cs-137	[A]	126.	107.	57.7	81.8	64.9	107.
	[B]	11/12	12/12	12/12	12/12	6/12	12/12
	[C]	16.0	18.5	8.5	17.7	9.5	8.9
	[D]	7.9	5.8	6.8	4.6	6.9	12.0
	[E]	58.4	75.6	82.4	98.2	105.	104.
	[F]	2.2	1.4	0.7	0.8	0.6	1.0

[A] Average Detectable Concentration (pCi/dry kilogram)
[B] Fraction of Total Measurements Yielding Detectable Activity
[C] Annual Activity Released in Liquid Effluents (mCi)
[D] Concentration/Annual Activity Ratio (pCi/dry kilogram per mCi)
[E] Decayed Cumulative Activity Released in Liquid Effluents (mCi)
[F] Concentration/Cumulative Activity Ratio (pCi/wet kilogram per mCi)

3.8 FISH

K-40, which occurs naturally, was detected in all 24 CNS REMP fish samples collected during 1992. Be-7, which also occurs naturally, was detected in three of these samples.

During 1984, Zn-65 was reported in one of the twelve fish samples, at a concentration of 148 pCi/wet kilogram. Nb-95 was reported in one of these samples at a concentration of 189 pCi/wet kilogram. Cs-137 was reported in two of these samples, at concentrations of 25.7 and 64.6 pCi/wet kilogram. With exception of Cs-137, it was unlikely that these nuclides were present in these preoperational samples; their detection was probably attributable to the ND6620 sensitivity phenomenon discussed previously. No other technical specification nuclides were detected in any 1984 fish samples.

The maximum quarterly percent of reporting level reached for fish during 1992 was 18.2%, for bottom feeder fish collected at discharge canal Location 208 during the third quarter. However, the forager fish collected at Location 208 contained the highest average concentration for the year, with reported activities of 40.3, 236, and 186 pCi/wet kg for Mn-54, Co-58 and Co-60, respectively. As Table 3.8-A shows the average detectable concentration for all fish collected at Location 208 exhibits various changes over 1992, with Mn-54, Cs-134 and Cs-137 remaining relatively stable and Co-58 decreasing in concentration. Co-60 showed the highest positive change. Co-60, Co-58, Mn-54 accounted for the majority of the reporting level activity during 1992. The three reporting level values for 1992 were: 18.2%, 0%, 0.65%, and 1.5%.

During 1992, Mn-54, Co-58, Co-60, and Cs-137 were frequently detected in the nine fish samples collected from CNS discharge canal Location 208. These four nuclides have been predominant every year since 1986. These nuclides have also been predominant in shoreline and bottom sediment samples collected from the discharge canal. All six detected nuclides other than K-40 and Be-7 were attributable to liquid effluents from CNS. Such effluents contained prevalent levels of these same nuclides, with exception of Ag-110m which was a minor contributor to effluent activity.

1992 REMP sample results for fish collected at indicator Location 208, were reviewed by type of fish. These results showed that all nuclide detection frequencies and concentrations were higher for forager fish than for predatory and bottom feeding fish.

Table 3.8-A summarizes fish sample results for discharge canal Location 208 during the six year period from 1987 to 1992.

From 1987 through 1992, average detectable concentrations correlated acceptably with annual activities released in liquid effluents [Parameter D] which is an important aspect of this report and of the data contained in the Table. For 1992, there were noticeable changes in this parameter. Mn-54 and Co-60 showed increases which could be explained by having only one detectable occurrence in nine samples analyzed. Observation suggests that annual average detectable nuclide concentrations at Location 208 fish samples were primarily dependent on the annual and the cumulative activities released via liquid effluents.

TABLE 3.8-A

FISH SAMPLE RESULTS - LOCATION 208

Nuclide	Parameter	1987	1988	1989	1990	1991	1992
Mn-54	[A]	86.9	114.	33.1	100	94.4	121.
	[B]	1/12	3/12	3/12	3/12	4/12	1/9
	[C]	39.4	42.8	14.4	34.4	30.2	23.2
	[D]	2.2	2.7	2.3	2.9	3.1	5.2
	[E]	60.1	69.6	45.4	54.6	54.5	47.4
	[F]	1.5	1.6	0.7	1.8	1.7	2.5

Nuclide	Parameter	1987	1988	1989	1990	1991	1992
Co-58	[A]	182.	329.	194.	301.	292.	270.7
	[B]	5/12	6/12	5/12	7/12	6/12	3/9
	[C]	308.	234.	149.	244.	196.	364.
	[D]	0.6	1.2	2.1	1.2	1.5	0.7
	[E]	315.	243.	156.	248.	203.	436
	[F]	0.6	1.2	2.0	1.2	1.4	0.6

Nuclide	Parameters	1987	1988	1989	1990	1991	1992
Co-60	[A]	115.	291.	115.	311.	387.	557.
	[B]	5/12	4/12	4/12	3/12	4/12	1/9
	[C]	132.	108.	46.2	127.	156.	116
	[D]	0.9	2.7	2.5	2.4	2.5	4.8
	[E]	240.	318.	325.	412.	517.	569.
	[F]	0.5	0.9	0.4	0.8	0.7	0.9

[A] Average Detectable Concentration (pCi/dry kilogram)
[B] Fraction of Total Measurements Yielding Detectable Activity
[C] Annual Activity Released in Liquid Effluents (mCi)
[D] Concentration/Annual Activity Ratio (pCi/dry kilogram per mCi)
[E] Decayed Cumulative Activity Released in Liquid Effluents (mCi)
[F] Concentration/Cumulative Activity Ratio (pCi/wet kilogram per mCi)

TABLE 3.8-A
CONTINUED

FISH SAMPLE RESULTS - LOCATION 208

Nuclide	Parameter	1987	1988	1989	1990	1991	1992
Cs-134	[A]	23.0	66.7	22.1	31.7	25.7	38.
	[B]	2/12	3/12	8/12	5/12	6/12	3/9
	[C]	8.5	11.8	4.7	10.2	5.6	4.3
	[D]	2.7	5.7	4.7	3.1	4.6	8.8
	[E]	21.1	26.9	23.9	27.3	25.1	22.3
	[F]	1.1	2.5	0.9	1.2	1.0	1.7

Nuclide	Parameters	1987	1988	1989	1990	1991	1992
Cs-137	[A]	51.2	89.9	43.7	55.9	45.9	51.8
	[B]	10/12	11/12	12/12	10/12	12/12	8/9
	[C]	16.0	18.5	8.5	17.7	9.5	8.9
	[D]	3.2	4.9	5.1	3.2	4.9	5.8
	[E]	58.4	75.6	82.4	98.2	105.	111.
	[F]	0.9	1.2	0.5	0.6	0.4	0.5

[A] Average Detectable Concentration (pCi/dry kilogram)
[B] Fraction of Total Measurements Yielding Detectable Activity
[C] Annual Activity Released in Liquid Effluents (mCi)
[D] Concentration/Annual Activity Ratio (pCi/dry kilogram per mCi)
[E] Decayed Cumulative Activity Released in Liquid Effluents (mCi)
[F] Concentration/Cumulative Activity Ratio (pCi/wet kilogram per mCi)

3.9 DIRECT GAMMA RADIATION (TLD)

Forty thermoluminescent dosimeters (TLD's) are located in the vicinity of CNS in order to monitor direct gamma (whole-body) radiation. The TLD locations can be divided into four major subgroups; three control locations, sixteen site boundary ring locations, sixteen 4-5 mile radius ring locations (one in each meteorological sector) and five special interest locations. The doserate for these groups of TLD's were 64.5 mR/yr, 80.4 mR/yr, 72.5 mR/yr and 66.2 mR/yr, respectively, for 1992. The average doserate for all indicator locations was 74.3 mR/yr. This data is shown in Table 3.9-A along with the respective values for previous years. Additional review of Table 3.9-A shows the average doserate has increased 31% over 1991, but is 10% lower than in the preoperational period.

Further review of the data in Table 3.9-A reveals that doserates around Catawba have varied considerably from year to year and group to group. However, the relationship between groups of TLD's has remained relatively constant. For instance, the average doserate for the control group was 19% lower than during preoperation (1984) and 12% lower than the 4-5 mile ring group. Each of the subgroup values are approximately 34% higher in 1992 than in 1991. This provides an indication that CNS did not impact the direct radiation levels since such an impact would affect each subgroup differently. However, we cannot simply look at differences between TLD subgroups to determine if an affect occurred or not.

In order to determine whether Catawba operations were having a significant impact on the direct radiation levels, the t-statistic, or t-test was used by Radwaste Processing Staff of Nuclear Technical Services to compare 1992 TLD results to TLD measurements taken during preoperation. More specifically, the ratio of the site boundary ring and 4-5 mile ring results were compared for 1992 and preoperation. Since the inner ring of TLD's is most likely to be affected by plant operations, the hypothesis was used that a significant change in the ratio from one year to the next would be indicative of an environmental affect, or at least some other phenomena requiring investigation. A statistically significant change in the ratio was determined by comparing the calculated t-value to expected values in the t-statistic based on the number of measurements and the desired accuracy of the results.

The value of the t-statistic calculated by comparing preoperational results to 1992 was -0.223. As shown in Table 3.9-B, this was well within the boundary values of $\pm$ 2.042, based on 32 measurements and a 95% confidence interval. From this evaluation it can be concluded that the doserates measured around CNS during 1992 did not differ significantly from those existing during preoperation.

TABLE 3.9-A

DIRECT GAMMA RADIATION (TLD) RESULTS

Year	All Locations (40 Locations)	Site Boundary Ring (16 Locations)	4-5 Mile Ring (16 Locations)	Special Interest (5 Locations)	Control Locations (3 Locations)
	Avg. Exposure (mR)	Avg. Exposure (mR)	Avg. Exposure (mR)	Avg. Exposure (mR)	Avg. Exposure (mR)
1984	82.9	87.5	82.6	71.2	79.3
1985	110.7	116.9	108.7	98.6	108.9
1986	98.9	104.3	98.5	85.7	94.4
1987	90.0	97.0	87.4	78.6	84.7
1988	70.9	74.6	70.3	63.1	67.1
1989	62.6	67.1	60.8	54.3	60.0
1990	46.4	52.0	44.5	39.1	39.1
1991	56.7	62.0	54.1	48.0	46.7
1992	74.3	80.4	72.5	66.2	64.5

TABLE 3.9-B

Comparison of Inner Ring/Outer Ring TLD Results		
	1992 (mR/qtr)	Preop. (mR/qtr)
Inner Ring	18.69	21.87
Outer Ring	17.13	20.65
Ratio	1.12	1.10
Variance	0.05	0.07
t-value	-0.223	
t-table	-2.042	

3.10 FOOD PRODUCTS

Collection of food product samples from an extensive irrigated garden at a residence located on Lake Wylie downstream from CNS (Location 253) started in July, 1989. During 1992, eight samples were collected from this location on a monthly basis throughout the harvest season from May through December.

During 1992 the naturally-occurring nuclide K-40 was detected in eight of the samples. No other nuclides were reported in any of these food product samples. These results were consistent with all sample results since 1989.

3.11 BOTTOM SEDIMENT

K-40, which occurs naturally, was detected in all twelve CNS REMP bottom sediment samples collected during 1992. Be-7, which also occurs naturally, was detected in three of these samples.

During 1984, REMP bottom sediment samples were not collected. These samples were first collected during 1986 from three points in the discharge canal. Bottom sediment control samples have never been collected.

During 1992, Mn-54, Co-58, Co-60, Cs-134, and Cs-137 were detected in nearly all of the twelve bottom sediment samples collected from CNS discharge canal Locations 208-1M, 208-2M, and 208-3M. These five nuclides have been predominant in these samples every year since 1986. These same five nuclides have been predominant in shoreline sediment samples collected from the discharge canal, samples for which average detectable concentrations are considerably lower, as should be expected. In addition Nb-95, Cr-51, Co-57, and Sb-125 were identified in samples. Only Sb-125 was detected in more than one sample (11 of 12) with an average concentration of 473 pCi/dry kg. See Table 3-B. All eleven detected nuclides other than K-40 and Be-7 were attributable to liquid effluents from CNS during 1992. Such effluents contained prevalent levels of these same nuclides with the exception of Co-57 which was a minor contributor to the effluent activity. With the exception of Co-60, whose average detectable concentration was less in samples collected from Location 208-1M, no reliably significant differences were observed between the 1992 bottom sediment sample results for the three discharge canal locations.

The remainder of this evaluation will address all three locations collectively.

Table 3.11-A summarizes the bottom sediment sample results for discharge canal Location 208 during the period from 1987 to 1992. Detection frequencies remained high and relatively stable throughout the period, as did the frequencies for shoreline sediment. Average detectable concentrations of Mn-54 and Cs-137 during 1992 remained comparable to the 1991 levels. Average detectable concentration for Co-60 increased from the 1991 level by 39%. Average detectable concentration of Co-58 increased by 232% from 1991 levels. There was a comparable increase in 1992 liquid effluent concentration releases for Co-58, 186% over 1991's. The remaining predominant nuclides' effluent activities decreased during 1992 by the following percentages: Mn-54 (30%), Co-60 (26%), Cs-134 (23%), and Cs-137 (6%). Therefore, the impact of CNS operation on bottom sediment from Location 208 was at an expected level considering liquid effluent release data.

From 1986 through 1992, average detectable concentrations for bottom sediment correlated reasonably well with cumulative, decay corrected activities released in liquid effluents since preoperation [Parameter E], as indicated by the constant ratios of these values [Parameter F]. Conversely, average detectable concentrations (excluding those for Co-58) did not correlate favorably with annual activities released in liquid effluents, as shown by the increasing ratios of these values [Parameter D] through 1989, and then a sudden decrease in 1990. These values remained relatively stable for all nuclides, except Cs-134 and Cs-137. These tendencies differed from those for shoreline sediment and for fish, where the concentrations were more dependent on annual, rather than on cumulative, effluent activities. The values for Parameter D (excluding those for Co-58, which has a short, 70.8 day half-life) increased through 1989. This indicated that the remaining nuclides which were released in liquid effluents accumulated significantly in bottom sediment, until 1990. The parameter has shown some increases through 1992, however, values for parameter F have been almost constant through the period. This indicates that no significant environmental "removal" processes limited Co-60 accumulations to levels below what would be expected based solely upon cumulative, decay corrected activities released in liquid effluents since preoperation. This observation additionally indicates that an environmental "removal" process did limit Mn-54, Cs-134, and Cs-137 accumulations to levels slightly below what would be expected based solely on cumulative activities.

The observations tend to imply that annual average detectable nuclide concentrations in Location 208 bottom sediment samples were largely dependent on the cumulative and to a moderate degree for Mn-54, Cs-134 and Cs-137, on the annual activities released via liquid effluents. It appears then that for the CNS discharge canal, activity deposited annually in bottom sediment is not removed by environmental processes at a rate such as shown by the activity measured in shoreline sediment and in fish.

TABLE 3.11-A

BOTTOM SEDIMENT SAMPLE RESULTS - LOCATION 208-1M, 2M, AND 3M

Nuclide	Parameter	1987	1988	1989	1990	1991	1992
Mn-54	[A]	723	578.	398	381	453	525
	[B]	7/9	12/12	12/12	12/12	11/12	12/12
	[C]	39.4	42.8	27.6	34.4	30.2	23.2
	[D]	18.4	13.5	14.4	11.1	15.0	22.6
	[E]	60.1	69.6	45.4	54.6	54.5	47.4
	[F]	12.0	8.3	8.8	7.0	8.3	11.1

Nuclide	Parameter	1987	1988	1989	1990	1991	1992
Co-58	[A]	1730	1040	670.	783.	691.	1603
	[B]	7/9	11/12	8/12	8/12	10/12	7/12
	[C]	308.	234.	149.	244.	196.	364.
	[D]	5.6	4.4	4.5	3.2	3.5	4.4
	[E]	315.	243.	156.	248.	203.	423
	[F]	5.5	4.3	4.3	3.2	3.4	3.8

Nuclide	Parameters	1987	1988	1989	1990	1991	1992
Co-60	[A]	2460.	3180	3420.	4120.	5100.	7095
	[B]	8/9	12/12	12/12	12/12	12/12	12/12
	[C]	132.	108.	46.2	108.	156.	116
	[D]	18.6	29.4	74.0	29.4	32.7	61.2
	[E]	240.	318.	325.	318.	517.	569.
	[F]	10.3	10.0	10.5	10.0	9.9	12.5

[A] Average Detectable Concentration (pCi/dry kilogram)
[B] Fraction of Total Measurements Yielding Detectable Activity
[C] Annual Activity Released in Liquid Effluents (mCi)
[D] Concentration/Annual Activity Ratio (pCi/dry kilogram per mCi)
[E] Decayed Cumulative Activity Released in Liquid Effluents (mCi)
[F] Concentration/Cumulative Activity Ratio (pCi/wet kilogram per mCi)

TABLE 3.11-A
(Continued)

BOTTOM SEDIMENT SAMPLE RESULTS - LOCATION 208-1M, 2M, AND 3M

Nuclide	Parameter	1987	1988	1989	1990	1991	1992
Cs-134	[A]	166	211	140.	127	122	78
	[B]	6/9	7/12	9/12	9/12	8/12	7/12
	[C]	8.5	11.8	4.7	10.2	5.6	4.3
	[D]	19.4	17.9	29.5	12.5	21.7	18.1
	[E]	21.1	26.9	23.9	27.3	25.1	22.3
	[F]	7.9	7.8	5.9	4.7	4.9	3.5

Nuclide	Parameters	1987	1988	1989	1990	1991	1992
Cs-137	[A]	403.	570	504	506	548	494
	[B]	10/12	12/12	12/12	12/12	12/12	11/12
	[C]	16.0	18.5	8.5	17.7	9.5	8.9
	[D]	3.2	30.8	59.3	28.6	57.9	55.6
	[E]	58.4	75.6	82.4	98.2	105.	111.
	[F]	6.9	7.5	6.1	5.2	5.2	4.5

[A] Average Detectable Concentration (pCi/dry kilogram)
[B] Fraction of Total Measurements Yielding Detectable Activity
[C] Annual Activity Released in Liquid Effluents (mCi)
[D] Concentration/Annual Activity Ratio (pCi/dry kilogram per mCi)
[E] Decayed Cumulative Activity Released in Liquid Effluents (mCi)
[F] Concentration/Cumulative Activity Ratio (pCi/wet kilogram per mCi)

3.12 LAND USE CENSUS

The 1992 Annual Land Use Census was conducted as required by CNS Technical Specification 3/4.12.2, and as described in Part A.11 of Appendix A. Table 3.12-A summarizes the census results. For those data in Table 3.12-A for which a distance value was not listed, no corresponding location was identified in the sector within a distance of five miles from CNS.

Based upon 1992 Annual Land Use Census results for the nearest residences and gardens, dose evaluations were performed to ensure that the current air and broadleaf vegetation sampling locations complied with the requirements of CNS REMP Technical Specification 3.12.1 (Sections 2 and 4c of Table 3.12-1), and that no changes or additions to these locations were required pursuant to CNS Land Use Census Technical Specification 3.12.2-b. The evaluations showed that all existing air and broadleaf vegetation sampling locations complied with technical specification requirements. No changes or additions to these locations were required, or made, as a result of the 1992 Annual Land Use Census.

The 1992 Annual Land Use Census included a search for all locations within a distance of five miles (eight kilometers) from CNS where any cattle or goats were kept (not just the nearest location in each sector). Numerous locations were identified within the five mile radius. Each location was investigated to determine whether the animals were being used for meat production, milk production, reproduction, or a combination of these purposes. Investigation of all locations revealed that none of the animals were "milking animals", as their milk was not being consumed by humans. It should be noted that the three current CNS REMP milk sampling locations (dairies located at distances greater than five miles from CNS), have been sampled since preoperation in excess of technical specification requirements. No changes or additions to CNS REMP milk sampling locations were made as a result of the 1992 Annual Land Use Census.

TABLE 3.12-A

1992 CATAWBA NUCLEAR STATION ANNUAL LAND USE CENSUS RESULTS

Dates Census Performed: June - 1992

SECTOR	DISTANCE (Miles)	SECTOR	DISTANCE (Miles)
(N)		(ESE)	
Nearest Residence	0.64	Nearest Residence	0.84
Nearest Meat Animal	4.60	Nearest Meat Animal	—
Nearest Garden	1.13	Nearest Garden	2.37
Nearest Milk Cow	—	Nearest Milk Cow	—
Nearest Milk Goat	—	Nearest Milk Goat	—
(NNE)		(SE)	
Nearest Residence	0.59	Nearest Residence	1.15
Nearest Meat Animal	—	Nearest Meat Animal	—
Nearest Garden	—	Nearest Garden	1.52
Nearest Milk Cow	—	Nearest Milk Cow	—
Nearest Milk Goat	—	Nearest Milk Goat	—
(NE)		(SSE)	
Nearest Residence	0.59	Nearest Residence	0.74
Nearest Meat Animal	—	Nearest Meat Animal	—
Nearest Garden	—	Nearest Garden	1.92
Nearest Milk Cow	—	Nearest Milk Cow	—
Nearest Milk Goat	—	Nearest Milk Goat	—
(ENE)		(S)	
Nearest Residence	0.63	Nearest Residence	0.64
Nearest Meat Animal	—	Nearest Meat Animal	4.09
Nearest Garden	0.63	Nearest Garden	0.92
Nearest Milk Cow	—	Nearest Milk Cow	—
Nearest Milk Goat	—	Nearest Milk Goat	—

TABLE 3.12-A
(Continued)

1992 CATAWBA NUCLEAR STATION ANNUAL LAND USE CENSUS RESULTS

SECTOR	DISTANCE (Miles)	SECTOR	DISTANCE (Miles)
(E)		(SSW)	
Nearest Residence	0.65	Nearest Residence	0.78
Nearest Meat Animal	4.00	Nearest Meat Animal	3.31
Nearest Garden	0.87	Nearest Garden	0.78
Nearest Milk Cow	—	Nearest Milk Cow	—
Nearest Milk Goat	—	Nearest Milk Goat	—
(SW)		(WNW)	
Nearest Residence	0.61	Nearest Residence	1.15
Nearest Meat Animal	2.75	Nearest Meat Animal	160
Nearest Garden	0.81	Nearest Garden	1.14
Nearest Milk Cow	—	Nearest Milk Cow	—
Nearest Milk Goat	—	Nearest Milk Goat	—
(WSW)		(NW)	
Nearest Residence	0.78	Nearest Residence	1.35
Nearest Meat Animal	3.21	Nearest Meat Animal	2.00
Nearest Garden	0.81	Nearest Garden	1.67
Nearest Milk Cow	—	Nearest Milk Cow	—
Nearest Milk Goat	—	Nearest Milk Goat	—
(W)		(NNW)	
Nearest Residence	0.97	Nearest Residence	1.03
Nearest Meat Animal	2.84	Nearest Meat Animal	2.27
Nearest Garden	1.15	Nearest Garden	1.87
Nearest Milk Cow	—	Nearest Milk Cow	—
Nearest Milk Goat	—	Nearest Milk Goat	—

SECTION 4

EVALUATION OF DOSE FROM ENVIRONMENTAL MEASUREMENTS VERSUS ESTIMATED DOSE FROM RELEASES

4.1 DOSE FROM ENVIRONMENTAL MEASUREMENTS

Annual doses to maximum exposed individuals were estimated based on measured concentrations of radionuclides in 1992 CNS REMP samples. The primary purpose of estimating doses based on REMP sample results was to compare them to effluent program dose estimates. Therefore, doses based on REMP sample results were conservatively calculated in a manner as equivalent as possible to effluent-based dose estimates, in order to allow for the most valid comparison.

Doses based on REMP sample results were calculated using the methodology and data presented in NRC Regulatory Guide 1.109. Measured radionuclide concentrations, averaged over the entire year (with nondetectable measurements averaged in as zero) for a specific nuclide, indicator location, and sample type, were used to calculate REMP-based doses, after subtracting the analogous average background concentration (as measured at the corresponding control location). 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.

Three radionuclides detected in 1992 REMP samples (Co-57, Ag-110m, and Sb-125), had no dose factors listed in Regulatory Guide 1.109. Dose factors for these radionuclides were taken from Appendix C of NUREG/CR-1276.

Dose contributions from detectable concentrations of naturally-occurring radionuclides other than tritium (K-40 and Be-7), were not included in REMP-based dose calculations. All other detected nuclides, including those not listed in Technical Specifications (see Section 3), were included in REMP-based dose calculations. Results for all 1992 REMP samples, required as well as supplemental, were included in the dose calculations.

Maximum dose estimates (Highest Annual Mean Concentration) based upon REMP drinking water, broadleaf vegetation, shoreline sediment, and fish sample results are reported in Tables 4-D.

Note that REMP-based dose estimates were not reported for the airborne radioiodine, airborne particulate, milk, ground water, or food product sample types, because no radionuclides other than naturally-occurring K-40 and Be-7 were detected in these samples. Note also that REMP-based dose estimates were not reported for the surface water or bottom sediment sample types, as these media are not directly connected to man, because sampled surface water is not considered to be a potable drinking water source and because sampled bottom sediment is permanently submerged. Dose estimates based upon REMP TLD results are discussed in Part 3.9.

The maximum dose to each organ from any single sample type (the "limiting" sample type) other than direct radiation from gaseous effluents, was determined and reported in Table 4-G. For skin dose, the limiting sample type was shoreline sediment collected at discharge canal Location 208-3S. For bone, liver, total body, thyroid gland, lung, kidney, and GI-LLI doses, the limiting sample type was forager fish collected at discharge canal Location 208. The maximum organ dose estimate for any single REMP sample type (other than direct radiation from gaseous effluents) collected during 1992 was 0.244 mrem/year to the maximum exposed adult's GI-LLI from consuming forager fish caught at discharge canal Location 208.

In order to generate REMP-based dose estimates which could be compared to reported effluent-based dose estimates, two additional evaluations were performed. These evaluations are discussed in the following two paragraphs.

Maximum 1992 REMP-based dose estimates for drinking water, shoreline sediment, and fish sample results were summed to determine the maximum total REMP-based doses for all sampled liquid effluent release pathways. This summation was performed individually for all 32 combinations of organ and age group. The dose contribution from shoreline sediment to each organ other than the skin was assumed to equal the total body contribution from shoreline sediment. The resulting maximum total organ dose estimates for the critical age groups have been reported in Table 4-H. The maximum total organ dose estimate for all liquid effluent release pathways sampled during 1992 was 0.285 mrem/year to the maximum exposed adult's GI-LLI. The critical pathway was forager fish, which accounted for 0.244 mrem/year (86%) of this total GI-LLI dose. Drinking water and shoreline sediment accounted for 13% and 1% of the total GI-LLI dose, respectively.

Maximum 1992 REMP-based dose estimates for airborne radioiodine (zero), airborne particulate (zero), milk (zero), and broadleaf vegetation sample results were summed to determine the maximum total REMP-based doses for all sampled gaseous effluent release pathways. This summation was performed individually for all 28 combinations of organ and age group. The resulting maximum total organ dose estimates for the critical age groups have been reported in Table 4-I.

The maximum total organ dose estimate for all gaseous effluent release pathways sampled during 1992 was 0.086 mrem/year to the maximum exposed child's kidney. The critical pathway was broadleaf vegetation, which accounted for 100% of the total kidney dose.

Excluding REMP TLD results (which are discussed in Part 3.9), all 1992 REMP-based annual organ dose estimates were less than 0.5 mrem/year, and were typically an order of magnitude below this level. All of these annual dose estimates were less than the corresponding calendar year (and even calendar quarter) dose limits applicable to effluent-based dose calculations (these limits are listed in CNS Technical Specifications 3.11.1.2 and 3.11.2.3).

4.2 ESTIMATED DOSE FROM RELEASES

Throughout the year, dose estimates were calculated based on actual 1992 liquid and gaseous effluent release data. These effluent-based dose estimates were calculated using the LADTAP and GASPAR computer programs, which employ the methodology and data presented in NRC Regulatory Guide 1.109. The 1992 CNS Annual Radioactive Effluent Release Report included such calendar year dose estimates for the maximum exposed individual from liquid and gaseous effluent releases. These reported doses are shown in Table 4-H (liquid releases) and Table 4-I (gaseous releases), along with the corresponding REMP-based dose estimates.

The effluent-based liquid release doses of Table 4-H are summations of dose contributions from the fish and shoreline sediment pathways (estimated for the discharge canal) as well as the drinking water pathway (estimated for the nearest downstream potable water intake).

The effluent-based gaseous release doses of Table 4-I are reported separately for noble gas exposure than for 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 1992 CNS Annual Radioactive Effluent Release Report listed the maximum total organ dose for the highest dose location (0.5 miles NNE), but did so only for the maximum organ (thyroid) for the critical age group (child). Therefore, effluent-based dose estimates for organs other than the thyroid are not given in the iodine, particulate, and tritium exposure summary of Table 4-I.

4.3 COMPARISON OF DOSES

Tables 4-H and 4-I allow for comparison of REMP-based versus effluent-based maximum dose estimates, critical ages, and critical pathways, for the liquid and gaseous release pathways respectively. As discussed in Part 4.1, the REMP-based estimates have been calculated in such a manner to be as analogous as possible to the corresponding effluent-based estimates. Therefore, the estimates can be compared directly with the following qualifications.

One difference between estimates is that all effluent-based dose estimates include pathway contributions from tritium contained in liquid and gaseous effluents. Although REMP-based dose estimates for drinking water pathways include dose contributions from tritium (as all REMP water samples are analyzed for tritium content), dose estimates for the fish, air, milk, and broadleaf vegetation pathways do not include tritium dose contributions; as tritium analysis is not performed on these samples. Similar differences hold true for certain other nuclides that are detected in effluent samples, but after dilution, transport, and radioactive decay, are normally too low to be detected in REMP samples (and their associated dose contributions are therefore not accounted for in REMP-based dose estimates). These differences result in REMP-based dose estimates that are biased somewhat low, in comparison to effluent-based estimates.

Another qualification is necessary considering that significant levels of tritium and Cs-137 are present throughout the environment and are not attributable to CNS effluents. REMP samples often contain these nuclides, sometimes at detectable levels much greater than the levels anticipated to result from station effluents. This situation compounded by the high variability in the frequency and level that tritium and Cs-137 are detected in REMP indicator and control location samples, introduces large uncertainties when estimated REMP-based dose contributions from net detectable concentrations of these nuclides. All 1992 REMP-based dose estimates, other than those for samples collected at the discharge canal, are entirely attributable to detection of tritium or Cs-137 in the corresponding REMP samples. It is probable that such doses are typically overestimates of the true contributions from tritium and Cs-137 released in CNS effluents.

Finally, airborne noble gas samples are not collected as part of the REMP, thus preventing an analogous comparison of effluent-based noble gas exposure estimates. Dose estimates based on REMP TLD results (which could be affected by noble gases in airborne effluents) are discussed in Part 3.9.

Comparison of the data in Table 4-F reveals good agreement between 1992 REMP and effluent-based maximum dose estimates for liquid effluent release pathways. Table 4-F gives environmental/effluent dose estimate ratios for each organ. REMP-based dose estimates ranged between 11% and 56% of the effluent based estimates. These were below the effluent-based estimates as would typically be expected. The 1992 effluent-based dose estimates for liquid effluent release pathways were 12% lower on average than their 1991 levels, reflecting similar decreases in the quantities of key radionuclides released in CNS liquid effluents. The above observations indicate a reasonable correlation between liquid effluents, REMP fish and shoreline sediment sample results and the associated dose estimates.

For iodine, particulate, and tritium exposure via gaseous effluent release pathways (Table 4-G), the maximum effluent-based dose estimate was 0.680 mrem/year to the maximum exposed child's thyroid gland (critical pathway was vegetation). The maximum REMP-based dose estimate was 0.276 mrem/year to the maximum exposed child's bone (critical pathway was broadleaf vegetation). This value was 40.6% of the maximum effluent-based dose estimate. The REMP-based dose estimates were entirely attributable to detection of Cs-137 in REMP broadleaf vegetation samples. These doses are probably overestimates of the true dose contribution from Cs-137 released in CNS gaseous effluents. Conversely, the REMP-based dose estimates do not include dose contributions from tritium (as tritium analysis is not performed on the corresponding REMP samples) which accounts for 84% of the effluent-based thyroid dose estimate. Although the REMP-based dose estimates for gaseous effluent release pathways compared favorably to the maximum effluent-based dose estimate, these estimates are not well suited for comparison.

Overall, 1992 annual dose estimates based upon REMP sample results compared very well with effluent program dose estimates. This is especially true considering the uncertainties inherent in comparing dose estimates based upon extremely low levels of environmental radioactivity. The REMP-based dose estimates were consistently comparable to, and comfortably less than, the corresponding effluent-based estimates for the liquid and gaseous release pathways. This evidence indicates that effluent program dose estimates are both valid and reasonably conservative and that doses to members of the public attributable to the operation of CNS are being maintained well within regulatory guidelines.

TABLE 4-A

DOSE ESTIMATES BASED ON LIMITING 1992 ENVIRONMENTAL SAMPLE RESULTS

ORGAN	DOSE RATE (mrem/year)	CRITICAL AGE	CRITICAL PATHWAY	CRITICAL LOCATION
Skin	1.63E-2	Teen	Shoreline Sediment	208-3S
Bone	4.01E-2	Teen	Fish (Forager)	208
Liver	9.92E-2	Child	Fish (Forager)	208
T. Body	9.07E-2	Adult	Drinking Water	214
Thyroid	5.50E-2	Child	Drinking Water	214
Kidney	6.61E-2	Child	Drinking Water	214
Lung	5.87E-2	Teen	Fish (Forager)	208
GI-LLI	2.85E-1	Adult	Fish (Forager)	208

TABLE 4-B

1992 ENVIRONMENTAL AND EFFLUENT DOSE COMPARISON
FOR LIQUID RELEASE PATHWAYS

ORGAN		DOSE RATE (mrem/year)	CRITICAL AGE	CRITICAL PATHWAY
Skin	(Env)	1.63E-2	Teen	Shoreline Sed.
Skin	(Eff)	7.32E-2	Teen	Shoreline Sed.
		Ratio = 0.22		
Bone	(Env)	4.01E-2	Teen	Fish (Forager)
Bone	(Eff)	7.30E-1	Child	Fish (Forager)
		Ratio = 0.055		
Liver	(Env)	9.92E-2	Child	Fish (Forager)
Liver	(Eff)	9.78E-1	Teen	Fish (Forager)
		Ratio = 0.10		
T. Body	(Env)	9.07E-2	Adult	Fish (Forager)
T. Body	(Eff)	6.66E-1	Adult	Drinking Water (214)
		Ratio = 0.14		
Thyroid	(Env)	5.50E-2	Child	Fish (Forager)
Thyroid	(Eff)	1.00E-1	Teen	Drinking Water (214)
		Ratio = 0.55		
Kidney	(Env)	6.61E-2	Child	Fish (Forager)
Kidney	(Eff)	3.80E-1	Teen	Drinking Water (214)
		Ratio = 0.17		
Lung	(Env)	5.87E-2	Teen	Fish (Forager)
Lung	(Eff)	2.08E-1	Teen	Fish (Forager)
		Ratio = 0.28		
GI LLI	(Env)	2.85E-1	Adult	Fish (Forager)
GI LLI	(Eff)	1.40E+0	Adult	Fish (Forager)
		Ratio = 0.20		

TABLE 4-C

1992 ENVIRONMENTAL AND EFFLUENT DOSE COMPARISON
FOR GASEOUS RELEASE PATHWAYS

NOBLE GAS EXPOSURE SUMMARY				
ORGAN		DOSE RATE (mrem/year)	CRITICAL AGE	CRITICAL PATHWAY
Skin	(Env)	N.G. not sampled	N/A	N/A
Skin	(Eff)	6.86E+0	N/A	Noble Gas Exposure
T. Body	(Env)	N.G. not sampled	N/A	N/A
T. Body	(Eff)	1.04E+0	N/A	Noble Gas Exposure

IODINE, PARTICULATE, AND TRITIUM EXPOSURE SUMMARY				
ORGAN		DOSE RATE (mrem/year)	CRITICAL AGE	CRITICAL PATHWAY
Bone	(Env)	2.76E-1	Child	Broadleaf Vegetation
Liver	(Env)	2.65E-1	Child	Broadleaf Vegetation
T. Body	(Env)	1.49E-1	Adult	Broadleaf Vegetation
Thyroid	(Env)	0	N/A	N/A
Thyroid		6.80E-1	Child	Vegetation
		Env/Eff = 0.00		
Kidney	(Env)	8.63E-2	Child	Broadleaf Vegetation
Lung	(Env)	3.10E-2	Child	Broadleaf Vegetation
GI-LLI	(Env)	4.39E-3	Adult	Broadleaf Vegetation

TABLE 4-D

Dose from Air Radioiodines Inhalation Pathway for 1992 Data
Maximum Exposed Adult

Usage (intake rate) = 8000.00 (m3/yr)

Highest Annual Mean Concentration

	Adult Inhalation dose factor (mrem per pCi ingested)								Air	Dose (mrem/yr)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Location	(pCi/m3)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	4.95E-06	7.87E-07	NO DATA	1.23E-06	1.74E-04	9.67E-06	ALL	0.00E+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	1.98E-07	2.59E-07	NO DATA	NO DATA	1.16E-04	1.33E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-59	1.47E-06	3.47E-06	1.32E-06	NO DATA	NO DATA	1.27E-04	2.35E-05	ALL	0.00E+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	1.44E-06	1.85E-06	NO DATA	NO DATA	7.46E-04	3.56E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zn-65	4.05E-06	1.29E-05	5.28E-06	NO DATA	8.62E-06	1.08E-04	6.68E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nb-95	1.76E-06	9.77E-07	5.26E-07	NO DATA	9.67E-07	6.31E-05	1.30E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zr-95	1.34E-05	4.30E-06	2.91E-06	NO DATA	6.77E-06	2.21E-04	1.88E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-131	3.15E-06	4.47E-06	2.56E-06	1.49E-03	7.66E-06	NO DATA	7.85E-07	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	4.66E-05	1.06E-04	9.10E-05	NO DATA	3.59E-05	1.22E-05	1.30E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	5.95E-05	7.76E-05	5.35E-05	NO DATA	2.78E-05	9.40E-06	1.05E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BaLa-140	4.88E-06	6.13E-09	3.20E-07	NO DATA	2.09E-09	1.59E-04	2.73E-05	ALL	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 DOSE EQUIVALENT(mrem/yr)=		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE 4-D

Dose from Air Radioiodines Inhalation Pathway for 1992 Data
Maximum Exposed Teen

Usage (Intake rate) = 8000 (m3/yr)

Highest Annual Mean Concentration

	TEEN Inhalation dose factor (mrem per pCi ingested)								Air	Dose (mrem/yr)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Location	(pCi/m3)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	6.39E-06	1.05E-06	NO DATA	1.59E-06	2.48E-04	8.35E-06	ALL	0.00E+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	2.59E-07	3.47E-07	NO DATA	NO DATA	1.68E-04	1.19E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-59	1.09E-06	4.62E-06	1.79E-06	NO DATA	NO DATA	1.91E-04	2.23E-05	ALL	0.00E+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	1.89E-06	2.48E-06	NO DATA	NO DATA	1.09E-03	3.24E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zn-65	4.82E-06	1.67E-05	7.80E-06	NO DATA	1.08E-05	1.55E-04	5.83E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nb-95	2.32E-06	1.29E-06	7.08E-07	NO DATA	1.25E-06	9.39E-05	1.21E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zr-95	1.82E-05	5.73E-06	3.94E-06	NO DATA	8.42E-06	3.36E-04	1.86E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-131	4.43E-06	6.14E-06	3.30E-06	1.83E-03	1.05E-05	NO DATA	8.11E-07	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	6.28E-05	1.41E-04	6.86E-05	NO DATA	4.69E-05	1.83E-05	1.22E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	8.38E-05	1.06E-04	3.89E-05	NO DATA	3.80E-05	1.51E-05	1.06E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba,La-140	8.84E-06	8.38E-09	4.40E-07	NO DATA	2.85E-09	2.54E-04	2.86E-05	ALL	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 Dose Equivalent (mrem/yr)=		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE 4-D

Dose from Inhalation Air Radioiodines for 1992 Data
Maximum Exposed Child

Breathing rate = 3700 m3 /yr

Highest Annual Mean Concentration

	CHILD Inhalation Dose Factor (mrem per pCi inhaled)									Dose (mrem/yr)							
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Air (pCi/m3)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	1.18E-05	2.57E-06	NO DATA	2.71E-06	4.26E-04	6.19E-06	ALL	0.00E+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	4.79E-07	8.55E-07	NO DATA	NO DATA	2.99E-04	9.29E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-59	5.59E-06	9.04E-06	4.51E-06	NO DATA	NO DATA	3.43E-04	1.91E-05	ALL	0.00E+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	3.55E-06	6.12E-06	NO DATA	NO DATA	1.91E-03	2.80E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zn-65	1.15E-05	3.06E-05	1.90E-05	NO DATA	1.93E-05	2.69E-04	4.41E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nb-95	6.35E-06	2.48E-06	1.77E-06	NO DATA	2.33E-06	1.66E-04	1.00E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zr-95	5.13E-05	1.13E-05	1.00E-05	NO DATA	1.61E-05	6.03E-04	1.85E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-131	1.30E-05	1.30E-05	7.37E-06	4.39E-03	2.13E-05	NO DATA	7.68E-07	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	1.76E-04	2.74E-04	6.07E-05	NO DATA	8.93E-05	3.27E-05	1.04E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	2.45E-04	2.23E-04	3.47E-05	NO DATA	7.83E-05	2.81E-05	9.78E-07	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BaLa-140	2.00E-05	1.75E-06	1.17E-06	NO DATA	5.71E-06	4.71E-04	2.75E-05	ALL	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 Dose Equivalent(mrem/yr)=				0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE 4-D

Dose from Air Particulate Inhalation Pathway for 1992 Data
Maximum Exposed Adult

Usage (intake rate) = 8000 (m3/yr)

Highest Annual Mean Concentration

	Adult Inhalation dose factor (mrem per pCi ingested)								Air	Dose (mrem/yr)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Location	(pCi/m3)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	4.95E-06	7.87E-07	NO DATA	1.23E-06	1.74E-04	9.67E-06	ALL	0.00E+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	1.98E-07	2.59E-07	NO DATA	NO DATA	1.16E-04	1.33E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-59	1.47E-06	3.47E-06	1.32E-06	NO DATA	NO DATA	1.27E-04	2.35E-05	ALL	0.00E+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	1.44E-06	1.85E-06	NO DATA	NO DATA	7.46E-04	3.56E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zn-65	4.05E-06	1.29E-05	5.28E-06	NO DATA	8.62E-06	1.08E-04	6.68E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nb-95	1.76E-06	9.77E-07	5.26E-07	NO DATA	9.67E-07	6.31E-05	1.30E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zr-95	1.34E-05	4.30E-06	2.91E-06	NO DATA	6.77E-06	2.21E-04	1.88E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-131	3.15E-06	4.47E-06	2.56E-06	1.49E-03	7.66E-06	NO DATA	7.85E-07	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	4.66E-05	1.06E-04	9.10E-05	NO DATA	3.59E-05	1.22E-05	1.30E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	5.95E-05	7.76E-05	5.35E-05	NO DATA	2.78E-05	9.40E-06	1.05E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BaLa-140	4.88E-06	6.13E-09	3.20E-07	NO DATA	2.09E-09	1.59E-04	2.73E-05	ALL	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 DOSE EQUIVALENT(mrem/yr)=		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE 4-D

Dose from Air Particulate Inhalation Pathway for 1992 Data
Maximum Exposed Teen

Usage (intake rate) = 8000 (m3/yr)

Highest Annual Mean Concentration

	TEEN Inhalation dose factor (mrem per pCi ingested)									Dose (mrem/yr)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Air (pCi/m3)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	6.39E-06	1.05E-06	NO DATA	1.59E-06	2.48E-04	6.35E-06	ALL	0.00E+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	2.59E-07	3.47E-07	NO DATA	NO DATA	1.68E-04	1.19E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-59	1.09E-06	4.62E-06	1.79E-06	NO DATA	NO DATA	1.81E-04	2.23E-05	ALL	0.00E+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	1.89E-06	2.48E-06	NO DATA	NO DATA	1.09E-03	3.24E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zn-65	4.82E-06	1.67E-05	7.80E-06	NO DATA	1.08E-05	1.55E-04	5.83E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nb-95	2.32E-06	1.29E-06	7.08E-07	NO DATA	1.25E-06	9.39E-05	1.21E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zr-95	1.82E-05	5.73E-06	3.94E-06	NO DATA	8.42E-06	3.36E-04	1.86E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-131	4.43E-06	6.14E-06	3.30E-06	1.83E-03	1.05E-05	NO DATA	8.11E-07	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	6.28E-05	1.41E-04	6.86E-05	NO DATA	4.69E-05	1.83E-05	1.22E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	8.38E-05	1.06E-04	3.89E-05	NO DATA	3.80E-05	1.51E-05	1.06E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BaLa-140	6.84E-06	8.38E-09	4.40E-07	NO DATA	2.85E-09	2.54E-04	2.86E-05	ALL	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 Dose Equivalent (mrem/yr)=		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE 4-D

Dose from Inhalation Air Particulate Pathway for 1992 Data
Maximum Exposed Child

Breathing rate = 3700 (m3/yr)

Highest Annual Mean Concentration

	CHILD Inhalation Dose Factor (mrem per pCi Inhaled)								Air	Dose (mrem/yr)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	(pCi/m3)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	1.16E-05	2.57E-06	NO DATA	2.71E-06	4.26E-04	6.19E-06	ALL	0.00E+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	4.79E-07	8.55E-07	NO DATA	NO DATA	2.99E-04	9.29E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-59	5.59E-06	9.04E-06	4.51E-06	NO DATA	NO DATA	3.43E-04	1.91E-05	ALL	0.00E+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	3.55E-06	2.12E-06	NO DATA	NO DATA	1.91E-03	2.80E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zn-65	1.15E-05	3.06E-05	1.00E-05	NO DATA	1.93E-05	2.89E-04	4.41E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nb-95	8.35E-06	2.48E-06	1.77E-06	NO DATA	2.33E-06	1.86E-04	1.00E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zr-95	5.13E-05	1.13E-05	1.00E-05	NO DATA	1.61E-05	8.03E-04	1.65E-05	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-131	1.30E-05	1.30E-05	7.37E-06	4.39E-03	2.13E-05	NO DATA	7.68E-07	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	1.78E-04	2.74E-04	6.07E-05	NO DATA	8.93E-05	3.27E-05	1.04E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	2.45E-04	2.23E-04	3.47E-05	NO DATA	7.63E-05	2.81E-05	9.78E-07	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-La-140	2.00E-05	1.75E-06	1.17E-06	NO DATA	5.71E-09	4.71E-04	2.75E-05	ALL	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 Dose Equivalent (mrem/yr) =		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE 4-D

Dose from Drinking Water Pathway for 1992 Data
Maximum Exposed Adult

Usage (intake rate) = 730 (l/yr)

Highest Annual Mean Concentration

	Adult Ingestion Dose Factor (mrem per pCi ingested)									Dose (mrem/yr)							
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	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	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	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	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	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	3.48E-09	1.86E-09	NO DATA	3.42E-09	NO DATA	2.10E-05	ALL	0	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	6.80E-09	NO DATA	1.53E-08	NO DATA	3.09E-05	ALL	0	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	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	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba,La-140	2.03E-05	2.55E-06	1.33E-06	NO DATA	8.67E-09	1.46E-06	4.18E-05	ALL	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	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	214	508	0.00E+00	3.88E-02	3.88E-02	3.88E-02	3.88E-02	3.88E-02	3.88E-02
						TOTAL DOSE EQUIVALENT(mrem/yr)=				0.00E+00	3.88E-02	3.88E-02	3.88E-02	3.88E-02	3.88E-02	3.88E-02

TABLE 4-D

Dose from Drinking Water Pathway for 1992 Data
Maximum Exposed Teen

Usage (intake rate) = 510 L/yr

Teen

Highest Annual Mean Concentration

Radionuclide	Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Drinking Water (pCi/L)	Dose (mrem/yr) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	5.90E-06	1.17E-06	NO DATA	1.78E-06	NO DATA	1.21E-05	ALL	0.0	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	0.0	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	0.0	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	3.86E-05	ALL	0.0	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	0.0	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	4.58E-09	2.51E-09	NO DATA	4.42E-09	NO DATA	1.95E-05	ALL	0.0	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	1.01E-08	NO DATA	3.00E-05	ALL	0.0	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	0.0	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	8.26E-05	2.39E-05	2.45E-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
Cs-137	1.12E-04	1.49E-04	5.19E-05	NO DATA	5.07E-05	1.97E-05	2.12E-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
Ba-La-140	2.84E-05	3.48E-08	1.83E-06	NO DATA	1.18E-08	2.34E-08	4.38E-05	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	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07	214	506	0.00E+00	2.74E-02	2.74E-02	2.74E-02	2.74E-02	2.74E-02	2.74E-02
								Total Dose Equivalent (mrem/yr)=		0.00E+00	2.74E-02	2.74E-02	2.74E-02	2.74E-02	2.74E-02	2.74E-02

TABLE 4-D

Dose from Drinking Water Pathway for 1992 Data
Maximum Exposed Child

Usage (intake rate) = 510 (l/yr)

CHILD *Highest Annual Mean Concentration*

Radionuclide	Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Water (pCi/l)	Dose (mrem/yr) 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
Co-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	3.85E-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
Ba,La-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	214	506	0.00E+00	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02
								Total Dose Equivalent(mrem/yr) =		0.00E+00	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02

TABLE 4-D

Dose from Drinking Water Pathway for 1992 Data
Maximum Exposed Infant

Usage (intake rate) = 330 L/yr

Highest Annual Mean Concentration

	INFANT Ingestion Dose Factor (mrem per pCi ingested)									Dose (mrem/yr)						
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
Ba,La-140	1.71E-04	1.71E-07	8.81E-06	NO DATA	4.06E-06	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	214	506	0.00E+00	5.14E-02	5.14E-02	5.14E-02	5.14E-02	5.14E-02	5.14E-02
						Total Dose Equivalent (mrem/yr) =				0.00E+00	5.14E-02	5.14E-02	5.14E-02	5.14E-02	5.14E-02	5.14E-02

TABLE 4-D

Dose from Milk Pathway for 1992 Data
Maximum Exposed Adult

Usage (Intake rate) = 310 L/yr

Highest Annual Mean Concentration

Adult

Radionuclide	Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Milk (pCi/L)	Dose (mrem/yr) 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	0.0	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	0.0	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	0.0	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	0.0	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	0.0	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	0.0	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	0.0	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	0.0	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	0.0	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	0.0	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-06	1.33E-06	NO DATA	8.67E-09	1.46E-06	9.25E-05	ALL	0.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Total Dose Equivalent (mrem/yr)= 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00

TABLE 4-D

Dose from Milk Pathway for 1992 Data
Maximum Exposed Child

Usage (intake rate) = 330.00 (l/yr)

Highest Annual Mean Concentration

CHILD

Radionuclide	Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Milk (pCi/l)	Dose (mrem/yr) 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
Co-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	3.85E-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
Ba,La-140	8.31E-05	7.28E-06	4.85E-06	NO DATA	2.37E-06	4.34E-06	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
								Total Dose (mrem/yr) =		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE 4-D

Dose from Milk Pathway for 1992 Data
Maximum Exposed Teen

Usage (Intake rate) = 400 L/yr

Highest Annual Mean Concentration

Teen

Radionuclide	Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Milk (pCi/L)	Dose (mrem/yr) 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	0.0	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	0.0	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	0.0	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	0.0	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	0.0	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	4.58E-09	2.51E-09	NO DATA	4.42E-09	NO DATA	1.95E-05	ALL	0.0	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	1.01E-08	NO DATA	3.00E-05	ALL	0.0	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	0.0	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	6.28E-05	2.39E-05	2.45E-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
Cs-137	1.12E-04	1.49E-04	5.19E-05	NO DATA	5.07E-05	1.97E-05	2.12E-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
BaLa-140	2.84E-05	3.48E-08	1.83E-06	NO DATA	1.18E-08	2.34E-08	4.38E-05	ALL	0.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Total Dose Equivalent (mrem/yr)= 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00

TABLE 4-D

Dose from Milk Pathway for 1992 Data
Maximum Exposed Infant

Usage (intake rate) = 330 L/yr

Highest Annual Mean Concentration

	INFANT Ingestion Dose Factor (mrem per pCi ingested)								Dose (mrem/yr)							
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Milk (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	8.11E-04	4.33E-05	NO DATA	1.84E-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	4.66E-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
						Total Dose Equivalent (mrem/yr) =				0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE 4-D

Dose from Broadleaf Vegetation Pathway for 1992 Data
Maximum Exposed Adult

Usage (intake rate) = 64 kg/yr

Highest Annual Mean Concentration

	Adult Ingestion Dose Factor (mrem per pCi ingested)							Indicator	Food	Dose (mrem/yr)						
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	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	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	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	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	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	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	6.80E-09	NO DATA	1.53E-08	NO DATA	3.09E-05	ALL	0	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	8.22E-05	1.48E-04	1.21E-04	NO DATA	4.79E-05	1.59E-05	2.59E-06	ALL	0	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	226	32.5	1.66E-01	2.27E-01	1.49E-01	0.00E+00	7.70E-02	2.56E-02	4.39E-03
Ba-La-140	2.03E-05	2.55E-06	1.33E-06	NO DATA	8.67E-09	1.46E-06	4.18E-05	ALL	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
								Total Dose Equivalent(mrem/yr)=		1.66E-01	2.27E-01	1.49E-01	0.00E+00	7.70E-02	2.56E-02	4.39E-03

TABLE 4-D

Dose from Broadleaf Vegetation Pathway for 1992 Data
Maximum Exposed Teen

Usage (intake rate) = 42 (kg/yr)

Highest Annual Mean Concentration

	Teen															
	Ingestion Dose Factor (mrem per pCi ingested)									Dose (mrem/yr)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Food (kg/yr)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	5.90E-06	1.17E-06	NO DATA	1.78E-06	NO DATA	1.21E-05	ALL	0.0	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	0.0	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	0.0	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	0.0	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	0.0	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	0.0	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	1.01E-08	NO DATA	3.00E-05	ALL	0.0	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	0.0	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	8.28E-05	2.39E-05	2.45E-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
Cs-137	1.12E-04	1.49E-04	5.19E-05	NO DATA	5.07E-05	1.97E-05	2.12E-06	226	32.5	1.53E-01	2.03E-01	7.08E-02	0.00E+00	6.92E-02	2.69E-02	2.89E-03
BaLa-140	2.84E-05	3.48E-06	1.83E-06	NO DATA	1.18E-06	2.34E-06	4.38E-05	ALL	0.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						Total Dose Equivalent (mrem/yr)=				1.53E-01	2.03E-01	7.08E-02	0.00E+00	6.92E-02	2.69E-02	2.89E-03

TABLE 4-D

Dose from Broadleaf Vegetation Pathway for 1992 Data
Maximum Exposed Child

Usage (intake rate) = 26 kg/yr

Highest Annual Mean Concentration

CHILD

Radionuclide	Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Food (pCi/kg)	Dose (mrem/yr) 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
Co-60	NO DATA	5.29E-06	1.56E-05	NO DATA	NO DATA	NO DATA	2.83E-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	6.10E-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	226	32.50	2.76E-01	2.64E-01	3.90E-02	0.00E+00	8.62E-02	3.10E-02	1.66E-03
Ba,La-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
								Total Dose (mrem/yr) =		2.76E-01	2.64E-01	3.90E-02	0.00E+00	8.62E-02	3.10E-02	1.66E-03

CNS REMP - SHORELINE RECREATION PATHWAY DOSE CALCULATION SPREADSHEET
(Regulatory Guide 1.109 Methodology)

PERIOD: 1992 LOCATION: 208-1S (CNS Discharge Canal)

0.2 = W = Shore-Width Factor (River Shore)

40.0 kg/square meter = M = Mass Factor

Dose Rate (mrem/hour) = W x M x EDF x Concentration

NUCLIDE		EXTERNAL DOSE FACTOR (mrem/hour per pCi/m2) T-Body	EXTERNAL DOSE FACTOR (mrem/hour per pCi/m2) Skin	SHORELINE SEDIMENT NUCLIDE CONCENTRATION (pCi/dry kg)	DOSE RATE (mrem/hour) T-Body	DOSE RATE (mrem/hour) Skin
Na-24		2.50E-08	2.90E-08	0.00	0.00E+00	0.00E+00
Cr-51		2.20E-10	2.60E-10	0.00	0.00E+00	0.00E+00
Mn-54		5.80E-09	6.80E-09	35.00	1.62E-06	1.90E-06
Co-58		7.00E-09	8.20E-09	445.30	2.49E-05	2.92E-05
Fe-59		8.00E-09	9.40E-09	0.00	0.00E+00	0.00E+00
Co-60		1.70E-08	2.00E-08	201.30	2.74E-05	3.22E-05
Zn-65		4.00E-09	4.60E-09	0.00	0.00E+00	0.00E+00
Nb-95		5.10E-09	6.00E-09	0.00	0.00E+00	0.00E+00
Zr-95		5.00E-09	5.80E-09	0.00	0.00E+00	0.00E+00
I-131		2.80E-09	3.40E-09	0.00	0.00E+00	0.00E+00
Cs-134		1.20E-08	1.40E-08	0.00	0.00E+00	0.00E+00
Cs-137		4.20E-09	4.90E-09	59.20	1.99E-06	2.32E-06
Ba-140		2.10E-09	2.40E-09	0.00	0.00E+00	0.00E+00
La-140		1.50E-08	1.70E-08	0.00	0.00E+00	0.00E+00
Ru-103		3.60E-09	4.20E-09	0.00	0.00E+00	0.00E+00
Nuclides not listed in Regulatory Guide 1.109 (EDFs Taken or Derived from data in Appendix C of NUREG/CR-1276):						
Co-57	T	9.10E-10	1.00E-09	0.00	0.00E+00	0.00E+00
Sn-113	D	1.90E-09	2.20E-09	0.00	0.00E+00	0.00E+00
Sb-122	D	3.00E-09	3.50E-09	0.00	0.00E+00	0.00E+00
Sb-125	T	3.10E-09	3.50E-09	0.00	0.00E+00	0.00E+00
TOTAL				740.80	5.59E-05	6.56E-05

AGE GROUP	SHORELINE RECREATION (hours/year)	DOSE RATE (mrem/year) T-Body	DOSE RATE (mrem/year) Skin
Adult	12.0	6.71E-04	7.88E-04
Teen	67.0	3.75E-03	4.40E-03
Child	14.0	7.81E-04	9.19E-04

CNS REMP - SHORELINE RECREATION PATHWAY DOSE CALCULATION SPREADSHEET
(Regulatory Guide 1.109 Methodology)

PERIOD: 1992 LOCATION: 208-2S (CNS Discharge Canal)

0.2 = W = Shore-Width Factor (River Shore)

40.0 kg/square meter = M = Mass Factor

Dose Rate (mrem/hour) = W x M x EDF x Concentration

NUCLIDE	EXTERNAL DOSE FACTOR (mrem/hour per pCi/m2) T-Body	Skin	SHORELINE SEDIMENT NUCLIDE CONCENTRATION (pCi/dry kg)	DOSE RATE (mrem/hour) T-Body	Skin
Na-24	2.50E-08	2.90E-08	0.00	0.00E+00	0.00E+00
Cr-51	2.20E-10	2.60E-10	0.00	0.00E+00	0.00E+00
Mn-54	5.80E-09	6.80E-09	142.20	6.60E-06	7.74E-06
Co-58	7.00E-09	8.20E-09	1339.70	7.50E-05	8.79E-05
Fe-59	8.00E-09	9.40E-09	0.00	0.00E+00	0.00E+00
Co-60	1.70E-08	2.00E-08	775.00	1.05E-04	1.24E-04
Zn-65	4.00E-09	4.60E-09	0.00	0.00E+00	0.00E+00
Nb-95	5.10E-09	6.00E-09	10.60	4.32E-07	5.09E-07
Zr-95	5.00E-09	5.80E-09	0.00	0.00E+00	0.00E+00
I-131	2.80E-09	3.40E-09	0.00	0.00E+00	0.00E+00
Cs-134	1.20E-08	1.40E-08	38.00	3.65E-06	4.26E-06
Cs-137	4.20E-09	4.90E-09	139.70	4.69E-06	5.48E-06
Ba-140	2.10E-09	2.40E-09	0.00	0.00E+00	0.00E+00
La-140	1.50E-08	1.70E-08	0.00	0.00E+00	0.00E+00
Ru-103	3.60E-09	4.20E-09	0.00	0.00E+00	0.00E+00

Nuclides not listed in Regulatory Guide 1.109
(EDFs Taken or Derived from data in Appendix C of NUREG/CR-1276):

Co-57	T	9.10E-10	1.00E-09	0.00	0.00E+00	0.00E+00
Sn-113	D	1.90E-09	2.20E-09	0.00	0.00E+00	0.00E+00
Sb-122	D	3.00E-09	3.50E-09	0.00	0.00E+00	0.00E+00
Sb-125	T	3.10E-09	3.50E-09	51.20	1.27E-06	1.43E-06
TOTAL				2496.40	1.97E-04	2.31E-04

AGE GROUP	SHORELINE RECREATION (hours/year)	DOSE RATE (mrem/year) T-Body	Skin
Adult	12.0	2.36E-03	2.78E-03
Teen	67.0	1.32E-02	1.55E-02
Child	14.0	2.76E-03	3.24E-03

CNS REMP - SHORELINE RECREATION PATHWAY DOSE CALCULATION SPREADSHEET
(Regulatory Guide 1.109 Methodology)

PERIOD: 1992 LOCATION: 208-3S (CNS Discharge Canal)

0.2 = W = Shore-Width Factor (River Shore)

40.0 kg/square meter = M = Mass Factor

Dose Rate (mrem/hour) = W x M x EDF x Concentration

NUCLIDE		EXTERNAL DOSE FACTOR (mrem/hour per pCi/m2) T-Body	EXTERNAL DOSE FACTOR (mrem/hour per pCi/m2) Skin	SHORELINE SEDIMENT NUCLIDE CONCENTRATION (pCi/dry kg)	DOSE RATE (mrem/hour) T-Body	DOSE RATE (mrem/hour) Skin
Na-24		2.50E-08	2.90E-08	0.00	0.00E+00	0.00E+00
Cr-51		2.20E-10	2.60E-10	0.00	0.00E+00	0.00E+00
Mn-54		5.80E-09	6.80E-09	172.00	7.98E-06	9.36E-06
Co-58		7.00E-09	8.20E-09	1590.00	8.90E-05	1.04E-04
Fe-59		8.00E-09	9.40E-09	0.00	0.00E+00	0.00E+00
Co-60		1.70E-08	2.00E-08	764.00	1.04E-04	1.22E-04
Zn-65		4.00E-09	4.60E-09	0.00	0.00E+00	0.00E+00
Nb-95		5.10E-09	6.00E-09	0.00	0.00E+00	0.00E+00
Zr-95		5.00E-09	5.80E-09	0.00	0.00E+00	0.00E+00
I-131		2.80E-09	3.40E-09	0.00	0.00E+00	0.00E+00
Cs-134		1.20E-08	1.40E-08	12.50	1.20E-06	1.40E-06
Cs-137		4.20E-09	4.90E-09	121.10	4.07E-06	4.75E-06
Ba-140		2.10E-09	2.40E-09	0.00	0.00E+00	0.00E+00
La-140		1.50E-08	1.70E-08	0.00	0.00E+00	0.00E+00
Ru-103		3.60E-09	4.20E-09	0.00	0.00E+00	0.00E+00
Nuclides not listed in Regulatory Guide 1.109 (EDFs Taken or Derived from data in Appendix C of NUREG/CR-1276):						
Co-57	T	9.10E-10	1.00E-09	9.10	6.62E-08	7.28E-08
Sn-113	D	1.90E-09	2.20E-09	0.00	0.00E+00	0.00E+00
Sb-122	D	3.00E-09	3.50E-09	0.00	0.00E+00	0.00E+00
Sb-125	T	3.10E-09	3.50E-09	29.50	7.32E-07	8.26E-07
TOTAL				2698.20	2.07E-04	2.43E-04

AGE GROUP	SHORELINE RECREATION (hours/year)	DOSE RATE (mrem/year) T-Body	DOSE RATE (mrem/year) Skin
Adult	12.0	2.48E-03	2.92E-03
Teen	67.0	1.39E-02	1.63E-02
Child	14.0	2.90E-03	3.40E-03

TABLE 4-D

Dose from Fish Pathway for 1992 Data
Maximum Exposed Adult

Usage (intake rate) = 21 kg/yr

Highest Annual Mean Concentration

	Adult Ingestion Dose Factor (mrem per pCi ingested)									Dose (mrem/yr)						
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	4.57E-06	8.72E-07	NO DATA	1.38E-06	NO DATA	1.40E-05	208	40.3	0.00E+00	3.87E-03	7.38E-04	0.00E+00	1.15E-03	0.00E+00	1.18E-02
Co-58	NO DATA	7.45E-07	1.67E-06	NO DATA	NO DATA	NO DATA	1.51E-05	208	238	0.00E+00	3.69E-03	8.28E-03	0.00E+00	0.00E+00	0.00E+00	7.48E-02
Fe-59	4.34E-06	1.02E-05	3.91E-06	NO DATA	NO DATA	2.85E-06	3.40E-05	ALL	0	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	208	188	0.00E+00	8.36E-03	1.84E-02	0.00E+00	0.00E+00	0.00E+00	1.57E-01
Zn-65	4.84E-06	1.54E-05	6.98E-06	NO DATA	1.03E-05	NO DATA	9.70E-06	ALL	0	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	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	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	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	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	208	14.6	2.44E-02	3.34E-02	2.19E-02	0.00E+00	1.13E-02	3.77E-03	6.47E-04
BaLa-140	2.03E-05	2.55E-06	1.33E-06	NO DATA	8.67E-09	1.48E-08	4.18E-05	ALL	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ag-110m	1.60E-07	1.48E-07	8.79E-08	NO DATA	2.91E-07	NO DATA	6.04E-05	208	5.8	1.95E-05	1.80E-05	1.07E-05	0.00E+00	3.54E-05	1.78E-06	7.36E-03
						TOTAL DOSE EQUIVALENT(mrem/yr)=				2.44E-02	4.93E-02	4.93E-02	0.00E+00	1.25E-02	3.77E-03	2.44E-01

TABLE 4-D

Dose from Fish Pathway for 1992 Data
Maximum Exposed Teen

Usage (intake rate) = 16 (kg/yr)

TEEN — Highest Annual Mean Concentration

Radionuclide	Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Fish (kg/yr)	Dose (mrem/yr) 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	208	40.3	0.00E+00	3.80E-03	7.54E-04	0.00E+00	1.13E-03	0.00E+00	7.80E-03
Co-58	NO DATA	9.72E-07	2.24E-06	NO DATA	NO DATA	NO DATA	1.34E-05	208	236.0	0.00E+00	3.67E-03	8.48E-03	0.00E+00	0.00E+00	0.00E+00	5.06E-02
Fe-59	5.87E-06	1.37E-05	5.29E-06	NO DATA	NO DATA	4.32E-06	3.24E-05	ALL	0.0	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	208	186.0	0.00E+00	8.36E-03	1.88E-02	0.00E+00	0.00E+00	0.00E+00	1.09E-01
Zn-65	5.76E-06	2.00E-05	9.33E-06	NO DATA	1.28E-05	NO DATA	8.47E-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
Nb-95	8.22E-09	4.56E-09	2.51E-09	NO DATA	4.42E-09	NO DATA	1.95E-05	ALL	0.0	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	1.01E-08	NO DATA	3.00E-05	ALL	0.0	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	0.0	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	0.0	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	208	14.6	2.62E-02	3.48E-02	1.21E-02	0.00E+00	1.18E-02	4.60E-03	4.95E-04
Ba,La-140	2.84E-05	3.48E-06	1.83E-06	NO DATA	1.18E-08	2.34E-08	4.38E-05	ALL	0.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ag-110m	2.05E-07	1.94E-07	1.18E-07	NO DATA	3.70E-07	NO DATA	5.45E-05	208	5.8	1.90E-05	1.80E-05	1.10E-05	0.00E+00	3.43E-05	0.00E+00	5.06E-03
							Total Dose Equivalent (mrem/yr)=			2.82E-02	5.07E-02	4.02E-02	0.00E+00	1.30E-02	4.60E-03	1.78E-01

TABLE 4-D

Dose from Fish Pathway for 1992 Data
Maximum Exposed Child

Usage (Intake rate) = 6.9 kg/yr

CHILD *Highest Annual Mean Concentration*

Radionuclide	Ingestion Dose Factor (mrem per pCi Ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Fish (pCi/kg)	Dose (mrem/yr) 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	208	40.30	0.00E+00	2.98E-03	7.92E-04	0.00E+00	8.34E-04	0.00E+00	2.50E-03
Co-58	NO DATA	1.80E-06	5.51E-06	NO DATA	NO DATA	NO DATA	1.65E-05	208	236.00	0.00E+00	2.93E-03	8.97E-03	0.00E+00	0.00E+00	0.00E+00	1.71E-02
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
Co-60	NO DATA	5.29E-06	1.56E-05	NO DATA	NO DATA	NO DATA	2.93E-05	208	186.00	0.00E+00	6.79E-03	2.00E-02	0.00E+00	0.00E+00	0.00E+00	3.76E-02
Zn-65	1.37E-05	3.85E-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	8.78E-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	208	14.80	3.29E-02	3.15E-02	4.65E-03	0.00E+00	1.03E-02	3.70E-03	1.97E-04
Ba,La-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
Ag-110m	5.39E-07	3.64E-07	2.91E-07	NO DATA	6.78E-07	NO DATA	4.33E-05	208	5.8	2.16E-05	1.46E-05	1.16E-05	0.00E+00	2.71E-05	0.00E+00	1.73E-03
								Total Dose (mrem/yr) =		3.30E-02	4.42E-02	3.45E-02	0.00E+00	1.11E-02	3.70E-03	5.91E-02

TABLE 4-D

Dose from Food Products (Crops) Pathway for 1992 Data
Maximum Exposed Adult

Usage (intake rate) = 520 kg/yr

Highest Annual Mean Concentration

Radionuclide	Adult Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Food (pCi/kg)	Dose (mrem/yr) 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	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	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	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	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	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	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	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	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	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	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-06	1.33E-06	NO DATA	8.67E-09	1.46E-06	4.18E-05	ALL	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
								TOTAL DOSE EQUIVALENT(mrem/yr)=		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE 4-D

Dose from Food Products Pathway (Crops) for 1992 Data
Maximum Exposed Teen

Usage (intake rate) = 630 (kg/yr)

Highest Annual Mean Concentration

Teen

Radionuclide	Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Food (pCi/wkg)	Dose (mrem/yr) 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	0.0	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	0.0	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	0.0	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	0.0	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	0.0	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	0.0	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	1.01E-08	NO DATA	3.00E-05	ALL	0.0	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	0.0	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	0.0	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	3.07E-05	1.97E-05	2.12E-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
BaLa-140	2.84E-05	3.48E-08	1.83E-06	NO DATA	1.18E-08	2.34E-08	4.38E-05	ALL	0.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
					Total Dose Equivalent (mrem/yr)=					0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE 4-D

Dose from Food Pathway (Crops) for 1992 Data
Maximum Exposed Child

Usage (intake rate) = 520 kg/yr

Highest Annual Mean Concentration

	CHILD Ingestion Dose Factor (mrem per pCi ingested)									Dose (mrem/yr)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Indicator Location	Food (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
Co-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
Ba,La-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
								Total Dose Equivalent(mrem/yr)=		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

SECTION 5
QUALITY ASSURANCE

5.1 DUKE POWER COMPANY'S RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

5.1.1 SAMPLE COLLECTION

The Radiological and Environmental Services Group and the Fisheries work group perform the environmental sample collections as specified by approved sample collection procedures.

5.1.2 SAMPLE ANALYSIS

The Radiological and Environmental Services Group performed the environmental sample analyses as specified by approved analysis procedures.

In 1989, reviewed data indicated detection of Cs-137 in airborne radioiodine cartridges, but not in associated airborne filters for the same sampling period and location. An extensive investigation was conducted in 1990 to determine reasons why low level Cs-137 activity, approximately 1 to 8 picocuries per total cartridge, was being detected on a low percentage basis of all cartridges counted by the Duke Power Radiological and Environmental Services Group. The possibility of detecting low-level activity was increased due to the installation of low background shields for gamma spectroscopy. In addition to the new shields employed, analysis techniques in some instances used extended count times. Experimental results determined that the Cs-137 activity was due to the activated carbon media and was present prior to placement into field sampling units.

Various airborne radioiodine cartridges were obtained from different vendors nationwide which had similar characteristics as the cartridges that were in current use by the Duke Power Environmental Collection Team. Findings support that low-level Cs-137 is a fallout product that is incorporated into the carbon media.

It is anticipated that continual observance of low activity Cs-137 will be detected on a random basis in airborne radioiodine cartridges and any trending of this data will be reported by the Radiological and Environmental Services Group to appropriate nuclear station personnel for consideration.

5.1.3 DOSIMETRY ANALYSIS

The Dosimetry Laboratory performed environmental dosimetry measurements as specified by approved dosimetry analysis procedures.

5.1.4 INTRALABORATORY QUALITY ASSURANCE

Radiological and Environmental Services 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.

Additionally, 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.

5.1.5 INTERLABORATORY QUALITY ASSURANCE

5.1.5.1 DUKE POWER'S AUDIT DIVISION

The Radiological and Environmental Services Group participated in a Quality Assurance audit which was performed by Duke Power Company's Audit Division on April 8, 1992. The Environmental Collection Team was accompanied by a Quality Assurance Inspector for the purpose of auditing the Radiological Environmental Monitoring Program. The collection practices were in accordance with Radiological and Environmental Services procedures and no findings, suggestions, or recommendations were submitted.

5.1.5.2 DUKE POWER'S NUCLEAR PRODUCTION INTERCOMPARISON PROGRAM

The Radiological and Environmental Services Group participated in the Duke Power Nuclear Production Intercomparison Program during 1992.

Interlaboratory cross-check body burden standards, marinelli beakers, air filters, air cartridges, gross alpha/beta on smears, and tritium in water samples were analyzed at various times of the year by the four counting laboratories in Duke Power Company for this program.

5.1.5.3 U.S. NUCLEAR REGULATORY COMMISSION INSPECTIONS

Radiological and Environmental Services was not audited by the NRC in 1992.

5.1.5.4 UNITED STATES ENVIRONMENTAL PROTECTION AGENCY INTERCOMPARISON PROGRAM

The Radiological and Environmental Services Group participated in the Environmental Protection Agency (EPA) Environmental Monitoring Systems Laboratory Intercomparison Program. The EPA sample types included mixed gamma in water (3 times per year), mixed gamma in milk (2 times per year), gamma in air filters (2 times per year), iodine in milk (2 times per year), tritium in water (3 times per year), iodine in water (2 times per year), gross alpha/beta in air filters (2 times per year), and gross alpha/beta in water (2 times per year).

Radiological and Environmental Services prepared and analyzed each sample as quickly as possible. Should the data obtained be out of EPA limits, Radiological and Environmental Services would have performed and documented follow-up investigations. The Radiological and Environmental Services EPA Intercomparison Report code is "CP". A summary of the EPA Intercomparison Reports for 1932 is documented in Table 5.A. Of the thirty-four (34) analyses performed in 1992, one analysis Gross Beta in water reference date (1/31/92) was out of acceptance limits.

An investigation was performed to find out why the results for the EPA Drinking Water were not within statistical limits.

The following areas were investigated in an effort to resolve these poor results:

1. Geometry of the sample
2. Gas flow
3. Efficiency calibration files
4. Errors in the activity calculation
5. X-checks and calibration checks counted at about the same time of the analysis
6. Trends of past EPA Alpha/Beta X-checks
7. Recounting the EPA Drinking Water X-Check
8. Reanalyzing the EPA Drinking Water X-Check (preparation and counting)
9. Reagents used in sample preparation

The geometry of this sample is a 2 inch concentric ring stainless steel planchet. The planchets were visually inspected and no abnormalities were discovered.

From the review of the logbooks, the gas flow on the system was normal at the time the x-checks were analyzed.

The efficiency calibration files were checked and verified to be correct.

The activity calculations were reviewed very thoroughly and no errors were found.

There were no other EPA x-checks analyzed at the time of this x-check, but a G.O. swipe x-check was analyzed on February 13, 1992. The results of this x-check were within statistical limits. Calibration checks, using EPA waters and filters, were also performed on March 27-29, 1992, and the results were also within statistical limits. This part of the investigation determined the system was operating properly at the time of the x-check analysis.

Analyzed results of past EPA x-checks Drinking Waters, since 1984, were gathered and plotted to verify trends in the results. Other than one beta x-check result which exceeded the statistical limits (i.e., from 1/22/88), there were no "significant trends" shown by this data over this time period. There was a slight bias high trend in the beta activities, which may have been caused by the difference in the background levels between the EPA water and the ASC water (i.e., water used by the EPA to prepare the x-check may have less natural activity than the ultra pure demineralized water that we use to prepare the x-check sample here at the laboratory).

The original EPA Drinking Water samples were analyzed again to see if the initial results could be duplicated. The results were not duplicated in the recounts, in that the beta results were almost half of the original activities. These findings would indicate the instrument was not operating properly, but this was found not be the case in previous investigation steps.

The EPA Drinking Water samples were prepared and analyzed again to see if there was a problem in the preparation of the original samples. The results produced were within statistical limits, therefore indicating there might have been a preparational error in the original samples or the background levels of the ultra-pure demineralized water was higher than the water used by the EPA.

The reagents used in the two sample preparations were compared, and the only difference was that the second preparation was performed using fresh reagents (i.e., prepared at the time the sample preparation was performed).

To conclude this investigation, it appears the only possible reasons for obtaining poor results may have been due to the reagents and demineralized water used in the preparation of the samples. The only way to determine this would be for the EPA to send a container of their water used in the preparation of the x-check along with the x-check sample.

This would remove the chances of error which could be caused by the differences in background levels of water sources. There will be no major changes in the preparation of future samples since this has not shown a significant problem over the past 7-8 years.

Additional documentation of this investigation is available from Radiological and Environmental Services.

5.1.5.5 NRC/STATE OF S.C. ENVIRONMENTAL MONITORING PROGRAM

The ONS Chemistry Section and Radiological and Environmental Services routinely participates with the State of South Carolina in their NRC/State Contract Environmental Monitoring Program. The Laboratory splits water, milk, vegetation, sediment, and fish samples with the Bureau of Radiological Health of the State's Department of Health and Environmental Control (DEHC) for analysis. DHEC collects air samples from two of the locations sampled for air by CNS. Results of the analyses performed on split and duplicate samples by the Radiological and Environmental Services Group and DHEC Laboratory are compiled by DHEC and provided to the NRC. TLDs are also co-located with the State and NRC at various environmental sites.

5.1.5.6 NRC/STATE OF N.C. INTERCOMPARISON PROGRAM

Radiological and Environmental Services, and the Dosimetry Laboratory routinely participate with the State of North Carolina Department of Environmental Health and Natural Resources (DEHNR) in an intercomparison program. Health and Radiological Projects sends air, water, milk, vegetation, sediment, and fish samples to the State of North Carolina Radiation Protection Section for intercomparison analysis. TLDs are also co-located with the State and NRC at various environmental sites. Also every six to eight months the State of North Carolina Radiation Protection Section irradiates environmental dosimeters and sends them to the Dosimetry Laboratory for analysis of the unknown estimated delivered exposure. A summary of the State of North Carolina Environmental Dosimetry Intercomparison Report for 1992 is documented in Table 5.B.

The Dosimetry Laboratory results were within 2.78% for the December 1992 cross-check of the State of North Carolina results (excluding Standard Deviation values).

5.1.5.7 U.S. DEPARTMENT OF ENERGY INTERCOMPARISON PROGRAM

There was no DOE intercomparison program during calendar year 1992.

5.2 CONTRACTOR LABORATORY

No contractor laboratories were used during 1992.

TABLE 5-A (Page 1 of 3)

U.S. ENVIRONMENTAL PROTECTION AGENCY INTERLABORATORY COMPARISON PROGRAM
1992 CROSS-CHECK RESULTS FOR THE RADIOLOGICAL AND ENVIRONMENTAL SERVICES LABORATORY

ANALYSIS	DATE	NUCLIDE(S)	KNOWN VALUE	CONTROL LIMITS 3 SIGMA; N=3	REPORTED VALUE
Gamma in Water	2/14/92	Ba-133	76 pCi/l	62.1 - 89.9 pCi/L	80.00 pCi/L
		Co-60	40 pCi/L	31.1 - 48.7 pCi/L	42.00 pCi/L
		Zn-65	148 pCi/L	122.0 - 174.0 pCi/L	156.00 pCi/L
		Ru-106	203 pCi/L	168.3 - 237.7 pCi/L	207.00 pCi/L
		Cs-134	31 pCi/L	22.3 - 39.7 pCi/L	31.00 pCi/L
		Cs-137	49 pCi/L	40.3 - 57.7 pCi/L	51.00 pCi/L
	6/05/92	Ba-133	98 pCi/L	80.7 - 115.3 pCi/L	101.33 pCi/L
		Co-60	20 pCi/L	11.3 - 28.7 pCi/L	21.00 pCi/L
		Zn-65	99 pCi/L	81.7 - 116.3 pCi/L	106.67 pCi/L
		Ru-106	141 pCi/L	116.7 - 165.3 pCi/L	148.33 pCi/L
		Cs-134	15 pCi/L	6.3 - 23.7 pCi/L	15.33 pCi/L
		Cs-137	15 pCi/L	6.3 - 23.7 pCi/L	15.00 pCi/L
	10/09/92	Ba-133	74 pCi/L	61.9 - 86.1 pCi/L	76.33 pCi/L
		Co-60	10 pCi/L	1.3 - 18.7 pCi/L	11.00 pCi/L
		Zn-65	148 pCi/L	122.0 - 174.0 pCi/L	161.67 pCi/L

TABLE 5-A (Page 2 of 3)
U.S. ENVIRONMENTAL PROTECTION AGENCY INTERLABORATORY COMPARISON PROGRAM
1992 CROSS-CHECK RESULTS FOR THE RADIOLOGICAL AND ENVIRONMENTAL SERVICES LABORATORY

ANALYSIS	DATE	NUCLIDE(S)	KNOWN VALUE	CONTROL LIMITS (3 SIGMA; N=3)	REPORTED VALUE
Gamma in Water	10/09/92	Ru-106	175 pCi/L	143.8 - 206.2 pCi/L	154.00 pCi/L
		Cs-134	8 pCi/L	0.0 - 16.7 pCi/L	8.00 pCi/L
		Cs-137	8 pCi/L	0.0 - 16.7 pCi/L	8.67 pCi/L
	2/07/92	I-131	59 pCi/L	48.6 - 69.4 pCi/L	53.00 pCi/L
	8/07/92	I-131	45 pCi/L	34.6 - 55.4 pCi/L	50.30 pCi/L
Air Filter	3/27/92	Cs-137	10 pCi/Filter	1.3 - 18.7 pCi/Filter	12.00 pCi/Filter
		Gross Beta	41 pCi/Filter	32.3 - 49.7 pCi/Filter	40.67 pCi/Filter
	8/28/92	Cs-137	18 pCi/Filter	9.3 - 26.7 pCi/Filter	20.00 pCi/Filter
		Gross Beta	69 pCi/Filter	51.7 - 86.3 pCi/Filter	68.70 pCi/Filter
Tritium in Water	2/21/92	H-3	7904 pCi/L	6533.4 - 9274.6 pCi/L	7961.67 pCi/L
	6/19/92	H-3	2125 pCi/L	1523.0 - 2727.0 pCi/L	2014.00 pCi/L
	10/23/92	H-3	5962 pCi/L	4928.0 - 6996.0 pCi/L	6033.00 pCi/L

TABLE 5-A (Page 3 of 3)
U.S. ENVIRONMENTAL PROTECTION AGENCY INTERLABORATORY COMPARISON PROGRAM
1992 CROSS-CHECK RESULTS FOR THE RADIOLOGICAL AND ENVIRONMENTAL SERVICES LABORATORY

ANALYSIS	DATE	NUCLIDE(S)	KNOWN VALUE	CONTROL LIMITS (3 SIGMA; N=3)	REPORTED VALUE
Gamma in Milk	4/24/92	I-131	78 pCi/L	64.1 - 91.9 pCi/L	80.00 pCi/L
		Cs-137	39 pCi/L	0.3 - 47.7 pCi/L	39.00 pCi/L
	9/25/92	I-131	100 pCi/L	82.7 - 117.3 pCi/L	103.00 pCi/L
		Cs-137	15 pCi/L	6.3 - 23.7 pCi/L	16.00 pCi/L
Beta in Water	1/31/92	Gross Beta	30 pCi/L	21.3 - 38.7 pCi/L	43.30 pCi/L
	5/15/92	Gross Beta	44 pCi/L	35.3 - 52.7 pCi/L	45.67 pCi/L
	9/18/92	Gross Beta	45 pCi/L	25.9 - 64.1 pCi/L	43.00 pCi/L

TABLE 5-B

STATE OF NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL HEALTH AND NATURAL RESOURCES

ENVIRONMENTAL DOSIMETER CROSS-CHECK - 1992

STATE OF N.C. ESTIMATED VALUE			RADIATION DOSIMETRY & RECORDS ESTIMATED VALUE	
Date of Cross-check	Exposure (mR)	Estimated Uncertainty (1 S.D. mR)	Exposure (mR)	Estimated Uncertainty (1S.D. mR)
12/92	49.0	± 2.46	48.6	± 3.96

SECTION 6
REFERENCES

6.1 Catawba Nuclear Station Units 1 and 2 Technical Specifications.

6.2 Duke Power Company Offsite Dose Calculation Manual.

6.3 Catawba Nuclear Station Final Safety Analysis Report.

6.4 Title 10, Code of Federal Regulations.

6.5 Regulatory Guide 1.109, Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I, Revision 1, October 1977.

6.6 NUREG/CR-1276, User's Manual for LADTAP II - A Computer Program for Calculating Radiation Exposure to Man from Routine Release of Nuclear Reactor Liquid Effluents, May 1980.

6.7 Kocher, D.C., Radioactive Decay Data Tables, 1981.

6.8 Catawba Nuclear Station Annual Radiological Environmental Operating Reports, 1985 - 1989.

6.9 Catawba Nuclear Station Annual Radioactive Effluent Release Reports, 1985 - 1992.

APPENDIX A

ENVIRONMENTAL SAMPLING AND ANALYSIS PROCEDURES

Adherence to established procedures for sampling and analysis of all environmental media at Catawba was required to ensure compliance with Station Technical Specifications. Analytical procedures were employed to ensure that Technical Specification detection capabilities were achieved.

Environmental sampling and analyses were performed by the Duke Power Radiological and Environmental Services Laboratory, Radiation Dosimetry and Records group and Fisheries subunit.

Parts I and II of this Appendix describe pertinent changes made during 1992 to the sampling and analysis procedures, respectively. Part III summarizes the environmental sampling and analysis procedures, by media type.

I. CHANGE OF SAMPLING PROCEDURES

The Fort Mill municipality has decided to close the water treatment plant. On 12/9/92, the plant ceased to produce drinking water. The plant was closed because it is an old facility and becoming obsolete. Fort Mill decided it was more economically feasible to construct and connect a supply line to the Rock Hill drinking water supply than to repair and modernize the Fort Mill facility. The final sample from this location was collected on 12/9/92.

Technical Specification 3/4.12 Table 3.12-1 requires one sample of each of one to three of the nearest water supplies that could be affected by the plants discharge and one sample from a control location. With the loss of this sample location, Rock Hill becomes the only drinking water supply that could be affected by CNS discharge and is already part of the sampling program (site #214). Belmont Water Treatment Plant (site #218) is the control site. An attempt was made by Radiological and Environmental Services to find a suitable replacement for this location. Tega Cay, York, and Clover, South Carolina were contacted. Tega Cay is downstream of CNS on Lake Wylie (3.3 miles west) but obtains their drinking water from a community well water system operated by a private company. Clover (9.8 miles WNW) is also supplied by a ground water system. York (10.3 miles WSW) makes drinking water from raw water out of Caldwell Lake, a reservoir on Turkey Creek which is not part of the Catawba River system and therefore could not be affected by CNS discharge. Ground water is already sampled from two locations near CNS and therefore no gains would be made by sampling either the Tega Cay or Clover water supplies.

II. CHANGE OF ANALYSIS PROCEDURES

No significant changes were made to analysis procedures in 1992.

III. SAMPLING AND ANALYSIS PROCEDURES

A.1 AIRBORNE RADIOIODINES AND PARTICULATES

Airborne particulate and radioiodine samples at each of five locations were composited continuously by means of continuous air samplers. Airborne particulates were collected on a particulate filter and radioiodines were collected in a charcoal cartridge situated behind the filter in the sampler. Filters and cartridges were collected weekly. A gamma analysis and gross beta analysis were performed on each filter, and a gamma analysis was performed on each charcoal cartridge.

A.2 GROUND WATER

Ground water grab samples were collected quarterly from residential wells at two locations. A gamma analysis, low-level I-131 analysis, and tritium analysis were performed on each sample.

A.3 DRINKING WATER

Drinking water composite samples were collected biweekly from each of three Drinking Water Treatment Plants, except for Fort Mill Drinking Water Treatment Plant, which ceased operation on 12/9/92 (see Section I of this Appendix). Each biweekly sample was composited to form a monthly composite for each location, and a gamma analysis and gross beta analysis were performed on each monthly composite. Biweekly samples were composited quarterly for tritium analysis.

A.4 SURFACE WATER

Surface water composite samples were collected biweekly from each of three locations. A low-level I-131 analysis was performed on each biweekly sample. Two biweekly samples were composited to form a monthly composite for each location, and a gamma analysis was performed on each monthly composite. Biweekly samples were composited quarterly for tritium analysis.

A.5 MILK

Milk grab samples were collected biweekly from three dairies. A low-level I-131 analysis and a gamma analysis were performed on each sample.

A.6 BROADLEAF VEGETATION

Broadleaf vegetation samples were collected monthly from each of four locations. A gamma analysis was performed on each sample.

A.7 SHORELINE SEDIMENT

Shoreline sediment samples were collected semiannually from three locations. A gamma analysis was performed on each sample after drying and removal of rocks and clams.

A.8 FISH

Three types of fish samples were collected semiannually from two locations. The types of fish collected represented predatory fish, foraging fish, and bottom feeding fish. A gamma analysis was performed on the edible portions of each sample. Boney fish, such as shad, are prepared whole minus the head and tail.

A.9 DIRECT GAMMA RADIATION (TLD)

Thermoluminescent dosimeters (TLDs) were collected quarterly from each of forty locations. The TLDs were placed surrounding the CNS site as follows: Sixteen TLDs were located in an inner ring, one TLD in each of the meteorological sectors, in the general area of the site boundary. Sixteen TLDs were located in an outer ring, one TLD in each of the meteorological sectors, at approximately six to eight kilometers from the site boundary. The remaining eight TLDs were placed in five special interest areas (schools, recreation areas), and at three control locations. A gamma dose and dose rate were reported quarterly for each location.

A.10 FOOD PRODUCTS

Samples were collected monthly when available, during the harvest season, from an irrigated garden at a residence located downstream from CNS. A gamma analysis was performed on each sample.

A.11 ANNUAL LAND USE CENSUS

The 1992 CNS Annual Land Use Census was conducted by the station during June. The census identified the location, within eight kilometers (five miles) of the station in each of the sixteen meteorological sectors, of the nearest residence, meat animal, milk cow, milk goat, and garden producing broadleaf vegetation over an area greater than 50 square meters.

IV. SAMPLING AND ANALYSIS PROGRAM

A number of significant problems were prevalent in the sampling program during 1992 for Catawba. Focus was centered on: 1) air sampler repeat failures and 2) surface water sampling site service pumps being out of service. Both areas were addressed during the year with plans made for complete air sampler replacement completed during 1993 and with the ultimate replacement and modification of the surface water site pump equipment. Over the past few years, Lake Wylie has exhibited extremely high levels of turbidity as well as other matter which have severely clogged sampling lines and forced the pumps to operate under conditions that they were not originally designed. The current proposal for the surface water sites will incorporate submersible pumps and modifications to the sampling systems.

With these two major system changes/improvements during 1993, the overall efficiency of the Catawba Sampling and Analysis Program should return to the level that is expected by our program personnel.

In addition to these two areas, a definite improvement and enhancement to the REMP program in 1992 was the implementation of the Global Positioning System (GPS) Project. Utilization of this system enables more accurate determination of distance and sector for each of the programs' sampling locations/sites. GPS is a satellite based radio navigation system which provides precise positioning data.

APPENDIX B

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
SUMMARY OF ANALYSIS RESULTS INDEX

TABLE B.1.1 AIRBORNE RADIOIODINES

Name of Facility : CATAWBA NUCLEAR STATION
Location of Facility : YORK COUNTY, S.C.
Time Report Generated : 16-FEB-1993 11:49:32
Docket Number : 50-413,414
Reporting Period : 1-JAN-1992 through 31-DEC-1992
Database Name : $DISK1:[USER.ASC]CNS92.SAF;10

Medium or Pathway Sampled (Units)	Type & Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Mean Name, Distance and Direction Location Code	Location with Highest Mean Name, Distance and Direction Mean (Fraction) Range	Control Locations Mean (Fraction) Range	No. of Non-Routine Report Meas.
AIR RADIOIODINES (PCI/M3)						217(10.0Mi SSE)	
5 Locations	MN-54 257	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	CO-58 257	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	FE-59 257	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	CO-60 257	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	ZN-65 257	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	NB-95 257	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	ZR-95 257	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	I-131 257	7.00E-02	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	CS-134 257	5.00E-02	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	CS-137 257	6.00E-02	8.30E-03(2/ 208) 4.74E-03-- 1.19E-02	201(0.5MiNE)	1.19E-02(1/ 52) 1.19E-02-- 1.19E-02	3.53E-02(1/ 49) 3.53E-02-- 3.53E-02	0
	BALA-140 257	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	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
If LLD is equal to 0, then LLD is not required by Technical Specifications
Location 200 = Site Boundary (0.6Mi NNE)
Location 201 = Site Boundary (0.5Mi NE)
Location 205 = Site Boundary (0.3Mi SW)
Location 212 = Tega Cay, S.C. (3.3Mi E)
Location 217 = Rock Hill, S.C. (10.0Mi SSE)

TABLE B.1.2 AIRBORNE PARTICULATES

Environmental Radiological Monitoring Program Summary

Name of Facility : CATAWBA NUCLEAR STATION
Location of Facility : YORK COUNTY, S.C.
Time Report Generated : 16-FEB-1993 11:49:32

Docket Number : 50-413,414
Reporting Period : 1-JAN-1992 through 31-DEC-1992
Database Name : $DISK1:[USER.ASC]CNS92.SAF;10

Medium or Pathway Sampled (Units)	Type & Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Mean Name, Distance and Direction Location Code	Location with Highest Mean Name, Distance and Direction Mean (Fraction) Range	Control Locations Mean (Fraction) Range	No. of Non-Routine Report Meas.
AIR PARTICULATE (PCI/M3)						217(10.0Mi SSE)	
5 locations	MN-54 257	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	CO-58 257	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	FE-59 257	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	CO-60 257	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	ZN-65 257	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	NB-95 257	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	ZR-95 257	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	I-131 257	7.00E-02	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	CS-134 257	5.00E-02	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	CS-137 257	6.00E-02	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	BALA-140 257	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 49) 0.00E+00-- 0.00E+00	0
	BETA 257	1.00E-02	1.84E-02(208/ 208) 7.63E-03-- 5.44E-02	212(3.3Mi E)	1.90E-02(52/ 52) 8.38E-03-- 4.44E-02	2.01E-02(49/ 49) 6.86E-03-- 3.16E-02	

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, then LLD is not required by Technical Specifications
Location 200 = Site Boundary (0.6Mi NNE)
Location 201 = Site Boundary (0.5Mi NE)
Location 205 = Site Boundary (0.3Mi SW)
Location 212 = Tega Cay, SC (3.3Mi E)
Location 217 = Rock Hill Substation (10.0Mi SSE)

TABLE B.2 GROUND WATER

Name of Facility : CATAWBA NUCLEAR STATION
Location of Facility : YORK COUNTY, S.C.
Time Report Generated : 16-FEB-1993 11:49:32
Docket Number : 50-413,414
Reporting Period : 1-JAN-1992 through 31-DEC-1992
Database Name : $DISK1:[USER.ASC]CNS92.SAF;10

Medium or Pathway Sampled (Units)	Type & Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Mean: Name, Distance and Direction — Location Code	Location with Highest Mean: Name, Distance and Direction — Mean (Fraction) Range	Control Locations Mean (Fraction) Range	No. of Non-Routine Report Meas.
GROUND WATER (PCI/LITER)						No Control Location	
2 Locations	ANAL1-LL B	1.0	0.00E+00(0/ 8) 0.00E+00-- 0.00E+00		0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	H-3 B	2.00E+03	0.00E+00(0/ 8) 0.00E+00-- 0.00E+00		0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	MN-54 B	15.	0.00E+00(0/ 8) 0.00E+00-- 0.00E+00		0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	CO-58 B	15.	0.00E+00(0/ 8) 0.00E+00-- 0.00E+00		0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	FE-59 B	30.	0.00E+00(0/ 8) 0.00E+00-- 0.00E+00		0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	CO-60 B	15.	0.00E+00(0/ 8) 0.00E+00-- 0.00E+00		0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	ZN-65 B	30.	0.00E+00(0/ 8) 0.00E+00-- 0.00E+00		0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	NB-95 B	15.	0.00E+00(0/ 8) 0.00E+00-- 0.00E+00		0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	ZR-95 B	15.	0.00E+00(0/ 8) 0.00E+00-- 0.00E+00		0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	I-131 B	15.	0.00E+00(0/ 8) 0.00E+00-- 0.00E+00		0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	CS-134 B	15.	0.00E+00(0/ 8) 0.00E+00-- 0.00E+00		0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	CS-137 B	18.	0.00E+00(0/ 8) 0.00E+00-- 0.00E+00		0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	BALA-140 B	15.	0.00E+00(0/ 8) 0.00E+00-- 0.00E+00		0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	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
If LLD is equal to 0, then LLD is not required by Technical Specifications
Location 252 = Residence (0.7Mi SW)
Location 253 = Residence (0.8Mi N)

TABLE B.3 DRINKING WATER (Page 1 of 2)

Environmental Radiological Monitoring Program Summary

Name of Facility : CATAWBA NUCLEAR STATION
Location of Facility : YORK COUNTY, S.C.
Time Report Generated : 16-FEB-1993 11:49:32

Docket Number : 50-413,414
Reporting Period : 1-JAN-1992 through 31-DEC-1992
Database Name : $DISK1:[USER.ASCII]CNS92.SAF;10

Medium or Pathway Sampled (Units)	Type & Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Mean: Name, Distance and Direction; Location Code	Location with Highest Mean: Mean (Fraction) Range	Control Locations Mean (Fraction) Range	No. of Non-Routine Report Meas.
DRINKING WATER (PCI/LITER)						218(13.5Mi N)	
3 Locations	ANAL1-LL 39	1.0	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	ANAL2-LL 38	1.0	0.00E+00(0/ 25) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	MN-54 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	CO-58 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	FE-59 39	30.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	CO-60 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	ZN-65 39	30.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	NB-95 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	ZR-95 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	I-131 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	CS-134 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	CS-137 39	18.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	BALA-140 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	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
If LLD is equal to 0, then LLD is not required by Technical Specifications
Location 213 = Fort Mill Water Supply (7.5Mi ESE)
Location 214 = Rock Hill Water Supply (7.3Mi SSE)
Location 218 = Belmont Water Supply (13.5Mi N)

TABLE B.3 DRINKING WATER (Page 2 of 2)

Environmental Radiological Monitoring Program Summary

Name of Facility : CATAWBA NUCLEAR STATION
Location of Facility : YORK COUNTY, S.C.
Time Report Generated : 16-FEB-1993 11:49:32

Docket Number : 50-413,414
Reporting Period : 1-JAN-1992 through 31-DEC-1992
Database Name : $DISK1:[USER.ASC]CNS92.SAF;10

Medium or Pathway Sampled (Units)	Type & Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Mean Name, Distance and Direction Location Code	Location with Highest Mean Mean (Fraction) Range	Control Locations Mean (Fraction) Range	No. of Non-Routine Report Meas.
DRINKING WATER (PCI/LITER) 3 Locations	BETA 39	1.00E+03	2.9 (22/ 26) 0.89 -- 5.8		3.2 (11/ 13) 1.7 -- 5.4	218(13.5Mi N) 2.4 (9/ 13) 1.9 -- 2.9	0
DW TRITIUM (PCI/LITER) 3 Locations	H-3 12	2.00E+03	7.11E+02(5/ 8) 5.15E+02-- 9.36E+02	213(7.5Mi ESE)	7.65E+02(2/ 4) 5.94E+02-- 9.36E+02	5.38E+02(1/ 4) 5.38E+02-- 5.38E+02	0

Mean and range base upon detectable measurements only
Fraction of detectable measurements at specifies locations is indicated in parentheses, (Fraction)
Zero range indicates no detectable activity measurements
if LLD is equal to 0, then LLD is not required by Technical Specifications
Location 213 = Fort Mill Water Supply (7.5Mi ESE)
Location 214 = Rock Hill Water Supply (7.3Mi SSE)
Location 218 = Belmont Water Supply (13.5Mi N)

TABLE B.4 SURFACE WATER (Page 1 of 2)

Environmental Radiological Monitoring Program Summary

Name of Facility : CATAWBA NUCLEAR STATION
Location of Facility : YORK COUNTY, S.C.
Time Report Generated : 16-FEB-1993 11:49:32

Docket Number : 50-413,414
Reporting Period : 1-JAN-1992 through 31-DEC-1992
Database Name : $DISK1:[USER.ASC]CNS92.SAF;10

Medium or Pathway Sampled (Units)	Type & Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Mean: Name, Distance and Direction; Location Code	Location with Highest Mean: Mean (Fraction) Range	Control Locations Mean (Fraction) Range	No. of Non-Routine Report Meas.
SURFACE WATER (PCI/LITER)						208(0.5Mi S)	
3 Locations	ANAL1-LL 39	1.0	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.41 (1/ 13) 0.41 -- 0.41	0
	ANAL2-LL 39	1.0	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	MN-54 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	CO-58 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	FE-59 39	30.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	CO-60 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	ZN-65 39	30.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	NB-95 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	ZR-95 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	I-131 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	CS-134 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	CS-137 39	18.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	BALA-140 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	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
If LLD is equal to 0, then LLD is not required by Technical Specifications
Location 208 = Discharge Canal (0.5Mi S)
Location 210 = Ebenezer Access (2.4Mi SE)
Location 215 = River Pointe (4.1Mi NNE)

TABLE B.4 SURFACE WATER (Page 2 of 2)

Name of Facility : CATAWBA NUCLEAR STATION
Location of Facility : YORK COUNTY, S.C.
Time Report Generated : 16-FEB-1993 11:49:32

Docket Number : 50-413,414
Reporting Period : 1-JAN-1992 through 31-DEC-1992
Database Name : $DISK1:[USER.ASC]CNS92.SAF;10

Medium or Pathway Sampled (Units)	Type & Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Mean: Name, Distance and Direction — Location Code	Location with Highest Mean: Name, Distance and Direction — Mean (Fraction) Range	Control Locations Mean (Fraction) Range	No. of Non-Routine Report Meas.
SW TRITIUM (PCI/LITER)				208(0.5Mi S)		215(4.1Mi NNE)	
3 Locations	H-3 12	2.00E+03	4.28E+03(7/ 8) 5.10E+02-- 9.03E+03		6.91E+03(4/ 4) 4.66E+03-- 9.03E+03	6.64E+02(2/ 4) 5.13E+02-- 8.16E+02	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
If LLD is equal to 0, then LLD is not required by Technical Specifications
Location 208 = Discharge Canal (0.5Mi S)
Location 211 = Lake Wylie Dam (4.0Mi ESE)
Location 215 = River Pointe (4.1Mi NNE)

TABLE B.5 MILK

Environmental Radiological Monitoring Program Summary

Name of Facility : CATAWBA NUCLEAR STATION
Location of Facility : YORK COUNTY, S.C.
Time Report Generated : 16-FEB-1993 11:49:32

Docket Number : 50-413,414
Reporting Period : 1-JAN-1992 through 31-DEC-1992
Database Name : $DISK1:[USER.ASC]CNS92.SAF;10

Medium or Pathway Sampled (Units)	Type & Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Mean: Name, Distance and Direction; Location Code; Mean (Fraction) Range	Control Locations Mean (Fraction) Range	No. of Non-Routine Report Meas.
MILK (PCI/LITER)					221(13.0Mi NW)	
3 Locations	MN-54 78	0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	CO-58 78	0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	FE-59 78	0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	CO-60 78	0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	ZN-65 78	0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	NB-95 78	0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	ZR-95 78	0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	I-131 78	15.	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	LLI-131 78	1.0	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	CS-134 78	15.	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	CS-137 78	18.	3.4 (2/ 52) 1.5 -- 5.2	209(7.0Mi SSW) 3.4 (2/ 26) 1.5 -- 5.2	5.0 (1/ 26) 5.0 -- 5.0	0
	BALA-140 78	15.	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	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
If LLD is equal to 0, then LLD is not required by Technical Specifications
Location 209 = Woods Dairy (7.0Mi SSW)
Location 219 = Pursley Dairy (6.0Mi SW)
Location 221 = Oates Dairy (13.0Mi NW)

TABLE B.6 BROADLEAF VEGETATION

Name of Facility : CATAWBA NUCLEAR STATION
Location of Facility : YORK COUNTY, S.C.
Time Report Generated : 16-FEB-1993 11:49:32
Docket Number : 50-413,414
Reporting Period : 1-JAN-1992 through 31-DEC-1992
Database Name : $DISK1:[USER.ASC]CNS92.SAF;10

Medium or Pathway Sampled (Units)	Type & Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Mean Name, Distance and Direction Location Code	Location with Highest Mean Name, Distance and Direction Mean (Fraction) Range	Control Locations Mean (Fraction) Range	No. of Non-Routine Report Meas.
BROAD LEAF VEGET (PCI/WET/KG)						217(10.0Mi SSE)	
4 Locations	MN-54 48	0.00E+00	0.00E+00(0/ 36) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0
	CO-58 48	0.00E+00	0.00E+00(0/ 36) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0
	FE-59 48	0.00E+00	0.00E+00(0/ 36) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0
	CO-60 48	0.00E+00	0.00E+00(0/ 36) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0
	ZN-65 48	0.00E+00	0.00E+00(0/ 36) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0
	NB-95 48	0.00E+00	0.00E+00(0/ 36) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0
	ZR-95 48	0.00E+00	0.00E+00(0/ 36) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0
	I-131 48	60.	0.00E+00(0/ 36) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0
	CS-134 48	60.	0.00E+00(0/ 36) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0
	CS-137 48	80.	81. (8/ 36) 37. -- 1.83E+02	226(0.5Mi S)	97. (4/ 12) 39. -- 1.83E+02	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0
	BALA-140 48	0.00E+00	0.00E+00(0/ 36) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	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
If LLD is equal to 0, then LLD is not required by Technical Specifications
Location 200 = Site Boundary (0.6Mi NNE)
Location 201 = Site Boundary (0.5Mi NE)
Location 217 = Rock Hill Substation (10.0Mi SSE)
Location 226 = Site Boundary (0.5Mi S)

TABLE B.7 SHORELINE SEDIMENT

Name of Facility : CATAWBA NUCLEAR STATION
Location of Facility : YORK COUNTY, S.C.
Time Report Generated : 16-FEB-1993 11:49:32
Docket Number : 50-413,414
Reporting Period : 1-JAN-1992 through 31-DEC-1992
Database Name : $DISK1:[USER.ASC]CNS92.SAF;10

Medium or Pathway Sampled (Units)	Type & Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Mean Name, Distance and Direction Location Code	Mean (Fraction) Range	Control Locations Mean (Fraction) Range	No. of Non-Routine Report Meas.
SEDIMENT (PCI/DRY/KG)						215(4.1Mi NNE)	
				208(0.5Mi S)			
3 Locations	MN-54 6	0.00E+00	49. (2/ 4) 41. -- 58.		49. (2/ 2) 41. -- 58.	0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	0
				208			
	CO-58 6	0.00E+00	2.25E+02(2/ 4) 1.85E+02-- 2.65E+02		2.25E+02(2/ 2) 1.85E+02-- 2.65E+02	0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	0
	FE-59 6	0.00E+00	0.00E+00(0/ 4) 0.00E+00-- 0.00E+00		0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	0
				208			
	CO-60 6	0.00E+00	2.61E+02(2/ 4) 1.90E+02-- 3.32E+02		2.61E+02(2/ 2) 1.90E+02-- 3.32E+02	0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	0
	ZN-65 6	0.00E+00	0.00E+00(0/ 4) 0.00E+00-- 0.00E+00		0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	0
	NB-95 6	0.00E+00	0.00E+00(0/ 4) 0.00E+00-- 0.00E+00		0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	0
	ZR-95 6	0.00E+00	0.00E+00(0/ 4) 0.00E+00-- 0.00E+00		0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	0
	I-131 6	0.00E+00	0.00E+00(0/ 4) 0.00E+00-- 0.00E+00		0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	0
	CS-134 6	1.50E+02	0.00E+00(0/ 4) 0.00E+00-- 0.00E+00		0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	0
				208			
	CS-137 6	1.80E+02	43. (2/ 4) 41. -- 45.		43. (2/ 2) 41. -- 45.	0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	0
	BALA-140 6	0.00E+00	0.00E+00(0/ 4) 0.00E+00-- 0.00E+00		0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	0.00E+00(0/ 2) 0.00E+00-- 0.00E+00	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
If LLD is equal to 0, then LLD is not required by Technical Specifications
Location 208 = Discharge Canal (0.5Mi S)
Location 210 = Ebenezer Access (2.4Mi SE)
Location 215 = River Pointe (4.1Mi NNE)

TABLE B.8 FISH

Name of Facility : CATAWBA NUCLEAR STATION
Location of Facility : YORK COUNTY, S.C.
Time Report Generated : 16-FEB-1993 11:49:32
Docket Number : 50-413,414
Reporting Period : 1-JAN-1992 through 31-DEC-1992
Database Name : $DISK1:[USER.ASC]CNS92.SAF;10

Medium or Pathway Sampled (Units)	Type & Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Mean Name, Distance and Direction Location Code	Location with Highest Mean Mean (Fraction) Range	Control Locations Mean (Fraction) Range	No. of Non-Routine Report Meas.
FISH (PCI/WET/KG)						216(4.0Mi NNE)	
				208(0.5Mi S)			
2 locations	MN-54 12	1.30E+02	1.21E+02(1/ 6)		1.21E+02(1/ 6)	30. (1/ 6)	0
			1.21E+02-- 1.21E+02		1.21E+02-- 1.21E+02	30. -- 30.	
				208			
	CO-58 12	1.30E+02	2.71E+02(3/ 6)		2.71E+02(3/ 6)	83. (4/ 6)	0
			48. -- 6.60E+02		48. -- 6.60E+02	9.0 -- 2.53E+02	
	FE-59 12	2.60E+02	0.00E+00(0/ 6)		0.00E+00(0/ 6)	0.00E+00(0/ 6)	0
			0.00E+00-- 0.00E+00		0.00E+00-- 0.00E+00	0.00E+00-- 0.00E+00	
				208			
	CO-60 12	1.30E+02	5.57E+02(1/ 6)		5.57E+02(1/ 6)	1.53E+02(1/ 6)	0
			5.57E+02-- 5.57E+02		5.57E+02-- 5.57E+02	1.53E+02-- 1.53E+02	
	ZN-65 12	2.60E+02	0.00E+00(0/ 6)		0.00E+00(0/ 6)	0.00E+00(0/ 6)	0
			0.00E+00-- 0.00E+00		0.00E+00-- 0.00E+00	0.00E+00-- 0.00E+00	
	NB-95 12	0.00E+00	0.00E+00(0/ 6)		0.00E+00(0/ 6)	0.00E+00(0/ 6)	0
			0.00E+00-- 0.00E+00		0.00E+00-- 0.00E+00	0.00E+00-- 0.00E+00	
	ZR-95 12	0.00E+00	0.00E+00(0/ 6)		0.00E+00(0/ 6)	0.00E+00(0/ 6)	0
			0.00E+00-- 0.00E+00		0.00E+00-- 0.00E+00	0.00E+00-- 0.00E+00	
	I-131 12	0.00E+00	0.00E+00(0/ 6)		0.00E+00(0/ 6)	0.00E+00(0/ 6)	0
			0.00E+00-- 0.00E+00		0.00E+00-- 0.00E+00	0.00E+00-- 0.00E+00	
				208			
	CS-134 12	1.30E+02	45. (3/ 6)		45. (3/ 6)	16. (1/ 6)	0
			19. -- 93.		19. -- 93.	16. -- 16.	
				208			
	CS-137 12	1.50E+02	59. (6/ 6)		59. (6/ 6)	25. (3/ 6)	0
			13. -- 1.72E+02		13. -- 1.72E+02	16. -- 41.	
	BALA-140 12	0.00E+00	0.00E+00(0/ 6)		0.00E+00(0/ 6)	0.00E+00(0/ 6)	0
			0.00E+00-- 0.00E+00		0.00E+00-- 0.00E+00	0.00E+00-- 0.00E+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, then LLD is not required by Technical Specifications
Location 208 = Discharge Canal (0.5Mi S)
Location 216 = Highway 49 bridge (4.0Mi NNE)

TABLE B.9 DIRECT GAMMA RADIATION (TLD)

Environmental Radiological Monitoring Program Summary

Name of Facility : CATAWBA NUCLEAR STATION
Location of Facility : YORK COUNTY, S.C.
Time Report Generated : 16-FEB-1993 11:48:20

Docket Number : 50-413,414
Reporting Period : 1-JAN-1992 through 31-DEC-1992
Database Name : $DISK1:[USER.ASC]CNS92.SAF;10

Medium or Pathway Sampled (Units)	Type & Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Mean: Name, Distance and Direction; Location Code	Location with Highest Mean: Mean (Fraction) Range	Control Locations Mean (Fraction) Range	No. of Non-Routine Report Meas.
DIRECT RAD-TLD (mR/QTR)						* See Below	
40 Locations	mR/QTR 158	0.00E+00	19. (147/ 147) 7.4 -- 31.	204(0.5Mi SSW)	23. (4/ 4) 17. -- 31.	16. (11/ 11) 9.6 -- 25.	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
If LLD is equal to 0, then LLD is not required by Technical Specifications

LOCATIONS:

200 Site Boundary (0.6Mi NNE)
201 Site Boundary (0.5Mi NE)
203 Site Boundary (0.4Mi ESE)
204 Site Boundary (0.5Mi SSW)
205 Site Boundary (0.3Mi SW)
206 Site Boundary (0.7Mi WNW)
207 Site Boundary (0.9Mi WNW)
212 Site Boundary (0.9Mi NNW)
*217 CONTROL (10.0Mi SSE)
222 Site Boundary (0.7Mi W)
223 Site Boundary (0.6Mi E)
225 Site Boundary (0.7Mi SE)
226 Site Boundary (0.5Mi S)
227 Site Boundary (0.5Mi WSW)
228 Site Boundary (0.6Mi W)
229 Site Boundary (0.8Mi NW)
230 4-5Mi radius (4.4Mi W)
231 4-5Mi radius (4.2Mi NNE)
255 Site Boundary (0.6Mi ENE)
256 Site Boundary (0.6Mi SSE)
232 4-5Mi radius (4.1Mi NE)
233 4-5Mi radius (4.0Mi ENE)
234 4-5Mi radius (4.5Mi E)
235 4-5Mi radius (4.0Mi ESE)
236 4-5Mi radius (4.2Mi SE)
237 4-5Mi radius (4.8Mi SSE)
238 4-5Mi radius (4.2Mi S)
239 4-5Mi radius (4.6Mi SSW)
240 4-5Mi radius (4.1Mi WSW)
241 4-5Mi radius (4.7Mi WSW)
242 4-5Mi radius (4.6Mi W)
243 4-5Mi radius (4.6Mi WNW)
244 4-5mi radius (4.1Mi NW)
245 4-5Mi radius (4.2Mi WNW)
246 SPECIAL INTEREST (8.1Mi ENE)
*247 CONTROL (7.5Mi ESE)
248 SPECIAL INTEREST (7.0Mi SSE)
249 SPECIAL INTEREST (8.1Mi S)
250 SPECIAL INTEREST (10.3Mi WSW)
*251 CONTROL (9.8 Mi WNW)

TABLE B.10 FOOD PRODUCTS (CROPS)

Name of Facility : CATAWBA NUCLEAR STATION
Location of Facility : YORK COUNTY, S.C.
Time Report Generated : 16-FEB-1993 11:49:32
Docket Number : 50-413,414
Reporting Period : 1-JAN-1992 through 31-DEC-1992
Database Name : $DISK1:[USER.ASC]CNS92.SAF;10

Medium or Pathway Sampled (Units)	Type & Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Fraction) Range	Location with Highest Mean: Name, Distance and Direction; Location Code	Location with Highest Mean: Mean (Fraction) Range	Control Locations Mean (Fraction) Range	No. of Non-Routine Report Meas.
CROPS (PCI/WET/KG)						No Control Location	
1 Location	MN-54 12	0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	CO-58 12	0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	FE-59 12	0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	CO-60 12	0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	ZN-65 12	0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	NB-95 12	0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	ZR-95 12	0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	I-131 12	60.	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	CS-134 12	60.	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	CS-137 12	80.	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0
	BALA-140 12	0.00E+00	0.00E+00(0/ 12) 0.00E+00-- 0.00E+00		0.00E+00(0/ 12) 0.00E+00-- 0.00E+00	0.00E+00(0/ 0) 0.00E+00-- 0.00E+00	0

lean and range based upon detectable measurements only
raction of detectable measurements at specified locations is indicated in parentheses, (Fraction)
ero range indicates no detectable activity measurements
f LLD is equal to 0, then LLD is not required by Technical Specifications
ocation 253 = irrigated garden at Cloninger Residence (2.1Mi SSE)

APPENDIX C

CATAWBA NUCLEAR STATION
SAMPLING DEVIATIONS AND UNAVAILABLE ANALYSES

I. SAMPLING DEVIATIONS

The following deviations from sampling requirements occurred during 1992:

Sample Type	Location	Scheduled Collection Dates	Actual Collection Dates	Deviation	Reason	Action
Air Particulates & Air Radioiodines	200	1/15-1/22/92	1/15-1/22/92	Sample not collected for entire collection period	Replacement of transformer caused power to be cut for 24 minutes	Voltage verified following power restoration
		4/1-4/8/92	4/1-4/4/92	Sample not collected for entire collection period	Blown fuse	Replaced sampler
		4/8-4/15/92	4/8-4/14/92	Sample not collected for entire collection period	Blown fuse	Replaced fuse
		6/10-6/17/92	6/10-6/11/92	Sample not collected for entire collection period	Blown fuse	Replaced fuse
		7/8-7/15/92	7/8-7/10/92	Sample not collected for entire collection period	Blown fuse	Replaced sampler
	212	4/22-4/29/92	4/22-4/26/92	Sample not collected for entire collection period	Blown fuse	Replaced fuse
	217	4/1-4/8/92	4/1-4/4/92	Sample not collected for entire collection period	Blown fuse	Replaced fuse
		4/15-4/22/92	4/15-4/16/92	Sample not collected for entire collection period	Blown fuse	Replaced fuse
		6/24-7/1/92	6/24-6/28/92	Sample not collected for entire collection period	Blown fuse	Replaced sampler
		9/23-9/30/92	9/23-9/24/92	Sample not collected for entire collection period	Blown fuse	Replaced sampler
		11/25-12/2/92	11/25/92	Sample not collected for entire collection period	Blown fuse	Replaced fuse
		12/23-12/30/92	12/23-12/28/92	Sample not collected for entire collection period	Blown fuse	Replaced fuse, and verified voltage

Sample Type	Location	Scheduled Collection Dates	Actual Collection Dates	Deviation	Reason	Action
Surface Water	208	4/15-4/29/92	4/29/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken Informed CNS to initiate work request for repair
		4/29-5/13/92	5/13/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken Work request initiated by CNS
		5/13-5/27/92	5/27/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken Work request written by CNS
		5/27-6/10/92	6/10/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken Work request on order
		6/10-6/24/92	6/24/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken Work request on order
		6/24-7/8/92	7/8/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken Work request on order
		7/8-7/22/92	7/22/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken Work request on order
		7/22-8/5/92	8/5/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken Work request on order
		8/5-8/19/92	8/19/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken Work request on order
		8/19-9/2/92	8/25-9/2/92	Sample not collected for entire collection period	Power off due to repair work	Abbreviated sample taken
		10/28-11/11/92	11/2-11/11/92	Sample not collected for entire collection period	Power off due to repair work	Abbreviated sample taken
	211	2/19-3/4/92	3/4/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken; CNS notified to initiate repairs
		3/4-3/18/92	3/18/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken; CNS notified to initiate repairs
		3/18-4/1/92	4/1/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken; CNS notified to initiate repairs
		4/1-4/15/92	4/15/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken; CNS notified to initiate repairs

Sample Type	Location	Scheduled Collection Dates	Actual Collection Dates	Deviation	Reason	Action
Surface Water	211	4/15-4/29/92	4/21-4/29/92	Sample not collected for entire collection period	Pump malfunction	Abbreviated sample collected
	215	2/19-3/4/92	3/4/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken; notified CNS for repairs
		3/4-3/18/92	3/18/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken; notified CNS for repairs
		3/18-4/1/92	4/1/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken; notified CNS for repairs
		4/1-4/15/92	4/15/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken; notified CNS for repairs
		4/15-4/29/92	4/29/92	Sample not collected for entire collection period	Pump malfunction	Grab sample taken; notified CNS for repairs
		4/29-5/13/92	5/4-5/13/92	Sample not collected for entire collection period	Pump malfunction; sampler replaced on 5/4/92	Abbreviated sample taken
		9/30-10/14/92	9/30-10/14/92	Sample not collected for entire collection period	Voltage supply too low to run sampler; voltage verified	Abbreviated sample taken;CNS work request initiated
		10/14-10/28/92	10/19-10/28/92	Sample not collected for entire collection period	Bad feeder cable	Abbreviated sample taken; power supply switched to panel box
Drinking Water	214	9/2-9/16/92	9/3-9/16/92	Sample not collected for entire collection period	Power supply cut off for repairs	Abbreviated sample collected
Crops	253	1/8/92	1/29/92	Sample not collected within the allowable time period	Inadvertently left off of sampling schedule . Historically, crops were not available this early in the year.	Crops collection added to sampling schedule and was collected as soon as practicable
Ground Water	252	9/30/92	11/18/92	Sample not collected during third quarter	GW Collection inadvertenly left off of sampling schedule	GW added to sampling schedule and was collected as soon as practicable
	254	9/30/92	11/18/92	Sample not collected during third quarter	GW Collection inadvertenly left off of sampling schedule	GW added to sampling schedule and was collected as soon as practicable

II. UNAVAILABLE ANALYSES

The following unavailable analyses occurred during the sampling year 1992:

Sample Type	Location	Scheduled Collection Dates	Deviation	Reason	Action
Thermoluminescent Dosimeter (TLD)	247	12/12/91 - 3/12/92	TLD not collected	TLD missing	New TLD placed in field
	234	6/29 - 9/29/92	TLD not ollected	Badge case found near proper location; phospor missing	New TLD placed in filed
Air Particulates & Air Radioiodines	217	4/8 - 4/15/92	Insufficient volume of sample collected to meet LLD's	Sampler ran for only six minutes before blowing a fuse	Replaced fuse; sampler tagged
	217	6/17-6/24/92	Insufficient volume of sample collected to meet LLD's	Sampler ran for only twelve minutes before blowing a fuse	Replace fuse; sampler tagged
	217	9/23/92	Insufficient volume of sample collected to meet LLD's	Sampler ran for only 1.7 hours before blowing a fuse	Replace fuse; sampler tagged

APPENDIX D

ANALYTICAL DEVIATIONS

There were no analytical deviations for Catawba Nuclear Station for the calendar year 1992.

APPENDIX E

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANALYSIS RESULTS

This appendix includes all of the sample analysis reports generated from each sample medium for 1992.

Appendix E is located separately from this report and is archived at Duke Power's Applied Science Center environmental data master file.

DUKE POWER