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April 28, 1992

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Subject: Oconee Nuclear Site
Docket Nos. 50-269, -270, -287
Annual Radiological Environmental Operating Report

Dear Sir:

Pursuant to Technical Specification 6.6.1.5, please find enclosed the Oconee Nuclear Site Annual Radiological Environmental Operating Report for the calendar year 1991.

Very truly yours,

/s/ W. Dance for

J. W. Hampton

cc: Mr. S. D. Ebneter, Regional Administrator
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Oconee Nuclear Station
Units 1, 2, and 3

Annual Radiological Environmental Operating Report

1991

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM

ANNUAL OPERATING REPORT

January 1, 1991 - December 31, 1991

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SECTION 1.

EXECUTIVE SUMMARY

This Annual Radiological Environmental Operating Report describes the Oconee Nuclear Station Radiological Environmental Program and the results of the program for the calendar year 1991.

Included in the report are identification of sampling locations, descriptions of environmental sampling and analysis procedures, comparisons of doses calculated from environmental measurements and doses calculated from effluent data, a summary of the results of the 1991 program, discussion of the results, and discussion of the quality assurance activities associated with the program. Deviations from program requirements and changes made to the program are also included.

Sampling activities were conducted as prescribed by Selected Licensee Commitments (SLC). Required analyses were performed and detection capabilities met SLC. In addition, supplemental samples were taken and additional analyses performed to better assess radioactivity in the environment.

Concentrations observed in the environment in 1991 for station related radionuclides were generally within the ranges of concentrations observed in the past. Compared to 1990, there was very little difference in the radionuclides detected and their concentrations. All positive indications of radioactivity due to plant operations were well below the reporting levels specified by the Nuclear Regulatory Commission (NRC) as given in Selected Licensee Commitments. Visual inspection of data indicated that radionuclide concentrations in drinking water, surface water, shoreline sediment, and fish have increased since the operation of Oconee Nuclear Station began. Statistical analysis of the historical data showed the existence of any continuing increase to have moderate to no probability.

Comparisons of doses calculated from environmental measurements and doses calculated from effluent data demonstrated that levels of radioactivity were not higher than expected and were within the Selected Licensee Commitments limits. In conclusion, Oconee Nuclear Station's contribution to environmental radioactivity is small and 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

Oconee Nuclear Station (ONS) is located in Oconee County, South Carolina, approximately 8 miles northeast of Seneca, South Carolina, on the shore of Lake Keowee. This lake was formed by damming the Keowee and Little Rivers in that location. Immediately to the south is the U.S. Government Hartwell Project. The Keowee Hydro-electric Plant near the station joins Lake Keowee and the upper reaches of Lake Hartwell. To the north the Jocassee Hydro-electric Plant joins Lake Jocassee and Lake Keowee. Jocassee is a pumped storage plant.

ONS consists of three pressurized water reactor units with a combined generating capacity of 2658 megawatts. Unit 1 began commercial operation 07/15/73. Unit 2 began commercial operation 09/09/74, and Unit 3 began on 12/16/74.

Site specific locations for the Radiological Environmental Monitoring Program are defined in the Duke Power Company Offsite Dose Calculation Manual (ODCM). Figure 2.1-1 is a map depicting the Thermoluminescent Dosimeter (TLD) monitoring locations and the sampling locations. The samples obtained from the locations include Airborne Radioiodine and Particulates, Drinking Water, Surface Water, Milk, Broadleaf Vegetation, Shoreline Sediment and Fish. Table 2.1-1 lists the specific samples required for each location. Figure 2.1-2 is a map showing the TLD locations within a 1 mile radius of the site. Table 2.1-2 lists the locations of all the TLDs.

2.2 SCOPE AND REQUIREMENTS OF ENVIRONMENTAL MONITORING PROGRAM

An environmental surveillance program has been continuously conducted at ONS since 1969, four years prior to operation of Unit 1. The

purpose of the preoperational program was to document the existing environmental radioactivity levels and their variability during sampling in order to develop a baseline to which operational levels may be compared. The current operational program was established to detect changes in radioactivity levels in the environs of the plant and to supplement the radiological effluent monitoring program by verifying that the measurable activity and radiation levels are not higher than those expected based on effluent measurements and modeling of the environmental exposure pathways. In addition, measured concentrations and dose rates are compared to the levels and limits specified in Selected Licensee Commitments. Trends are identified so that corrective actions may be taken prior to levels and limits being exceeded.

The sample media used, the sampling locations, and the sampling frequencies are selected to monitor significant dose pathways as well as the anticipated types and quantities of radionuclides released from the plant. Locations and media are utilized that would demonstrate physical and biological sites of activity accumulation. Control locations are utilized to distinguish between activity of plant origin and environmental background levels. Frequencies of sampling and sample quantities utilized are based on the release rate of plant effluents, the half lives of the radionuclides, and the required detection capabilities of the analyses. In turn, the concentrations specified for the detection capabilities correspond to environmental concentrations that could result in doses that are fractions of the allowable dose limits.

The specific locations and sample frequencies given in Table 2.1-1 and 2.1-2 meet the program conditions of ONS Selected Licensee Commitments 16.11-6. The Selected Licensee Commitments also defines the analysis type, frequency and detection capabilities for each sample. These are repeated in Tables 2.2-1 and 2.2-2. Non-routine reporting levels for activity found in environmental samples are listed in Table 2.2-3.

These reporting levels are based on the activity in the pathway resulting in potential doses corresponding to the 10CFR50 Appendix I calendar year dose objectives for effluents for one reactor.

An additional surveillance requirement is that an annual Land Use Census be conducted. The census assures that changes in the use of the plant environs are identified. The census results are used to make appropriate modifications to the monitoring program and the parameters utilized to calculate doses from plant effluents.

2.3 STATISTICAL AND CALCULATIONAL METHODOLOGY

2.3.1 ESTIMATION OF THE MEAN VALUE

There was one (1) basic statistical calculation performed on the raw data resulting from the environmental sample analysis program. The calculation involved the determination of the mean value for the indicator and the control samples for each sample medium. The mean ($\bar{x}$) 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 Environmental Monitoring Program. The following equation was used to estimate the mean:

$$\bar{x} = \frac{\sum_{i=1}^{N} x_i}{N} \qquad \text{(eq. 2-1)}$$

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. Prior to 1987 Minimum Detectable Activities (MDA) were included in the calculation of the mean when no detectable activity was found. Both positive and negative MDA values were used in the mean calculations.

2.3.2 LOWER LEVEL OF DETECTION AND MINIMUM DETECTABLE ACTIVITY

The Lower Level of Detection (LLD) and Minimum Detectable Activity (MDA) are used throughout the Environmental Monitoring Program, both in the Selected Licensee Commitments and in the implementation of the commitment.

The LLD, as defined in the Selected Licensee Commitment, 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's for each sample medium and selected radionuclides are given in the Selected Licensee Commitments and are listed in Table 2.2-2.

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 gammas 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 a batch background count. This 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.

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. This is traditionally done by looking at historical data (including preoperational data) and determining if a trend exists. Trends, if they exist, may be either positive or negative. Since nuclear reactor operations do not normally remove radioactivity from the surrounding environment, a negative trend in a particular radionuclide's concentration in an environmental medium does not indicate that reactor operations are removing radioactivity from the environment but that reactor operations are not adding that radionuclide

to the environment in quantities exceeding the preoperational level and that the normal removal processes (radioactive decay, deposition, resuspension, etc.) are influencing the concentration.

In some cases, visual inspection of tabular or graphical presentations of data may be sufficient to determine if a trend exists. In other cases, it may not be so obvious. Therefore, it is desirable to obtain a single numerical value from the data which will permit a meaningful interpretation of the relationship existing between the variations in the data. If it is assumed that a linear relationship exists between the time after startup of the reactor and the amount of radionuclides in a particular environmental medium, the least squares regression method may be used to define the linear relationship. To determine if the data actually correlate to the straight line assumption, the theoretical variance is compared to the actual variance. The numerical value that summarizes this comparison is known as the correlation coefficient. This correlation coefficient, symbolized by "r", is a determination of how closely the data fit a straight line and may be calculated from the following equation:

$$r = \frac{N\Sigma XY - \Sigma X\Sigma Y}{\left[(N\Sigma X^2 - (\Sigma X)^2) (N\Sigma Y^2 - (\Sigma Y)^2) \right]} \qquad \text{(eq.2-2)}$$

where, r = correlation coefficient for the data set of X and Y,
X = the year or point in time,
Y = the radionuclide concentration associated with X,
N = number of observations.

The range of values as calculated by the correlation coefficient lies between positive one (+1) and negative one (-1). The absolute value of the correlation coefficient represents the probability of a trend. Zero (0) represents no indication of either a positive or negative trend. A positive (+) correlation coefficient indicates an increasing

trend, and, conversely, a negative (-) correlation coefficient indicates a decreasing trend. The ranges of a correlation coefficient are summarized below:

$1 \geq \|r\| > 0.7$	High to moderate probability of a trend.
$0.7 \geq \|r\| > 0.3$	Moderate to poor probability of a trend.
$0.3 \geq \|r\| \geq 0$	Poor to no probability of a trend.

Identifying a trend by using the correlation coefficient is only useful for the time periods where the discharge from the nuclear plant is relatively stable and no other sources of radioactivity are present. Substantial increases or decreases in the amount of a particular radionuclide's release from the nuclear plant will greatly affect the resulting environmental levels; therefore, a knowledge of the release of a radionuclide from the nuclear plant is necessary to completely interpret the trends, or lack of trends, determined from the environmental data. Other factors that may affect environmental levels of radionuclides include prevailing weather conditions (periods of drought or heavier than normal precipitation), construction in or around either the nuclear plant or the sampling location, addition or deletion of other sources of radioactive materials (such as the Chernobyl accident), etc.. Some of these factors may be obvious while others are sometimes unknown to the plant personnel.

The change in 1987 in the method of calculating the mean (using only net positive results) will also affect the apparent trends.

Because of these considerations, how trends are identified will depend not only on the least squares regression method, but will include some judgement by plant personnel on the factors affecting environmental levels.

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. In this case, the correlation coefficient is not a sufficient indicator of whether reactor discharges are having an impact on the environment, since there is no bioaccumulation. Another test is needed to give us a meaningful interpretation of the data. If we assume that the naturally occurring radiation levels around the plant are normally distributed, and that the reactor discharges 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. The comparison involves one when we are certain no effect is occurring and one when an effect may be occurring and 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:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{s_p \sqrt{1/n_1 + 1/n_2}}$$

where,

$\bar{x}_1$ = the mean value of the first set of measurements

$\bar{x}_2$ = the mean value of the second set of measurements

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

$$s_p = \sqrt{s_p^2}$$

where,

$$s_p^2 = \frac{(n_1 - 1)\, s_1 + (n_2 - 1)\, s_2}{n_1 + n_2 - 2}$$

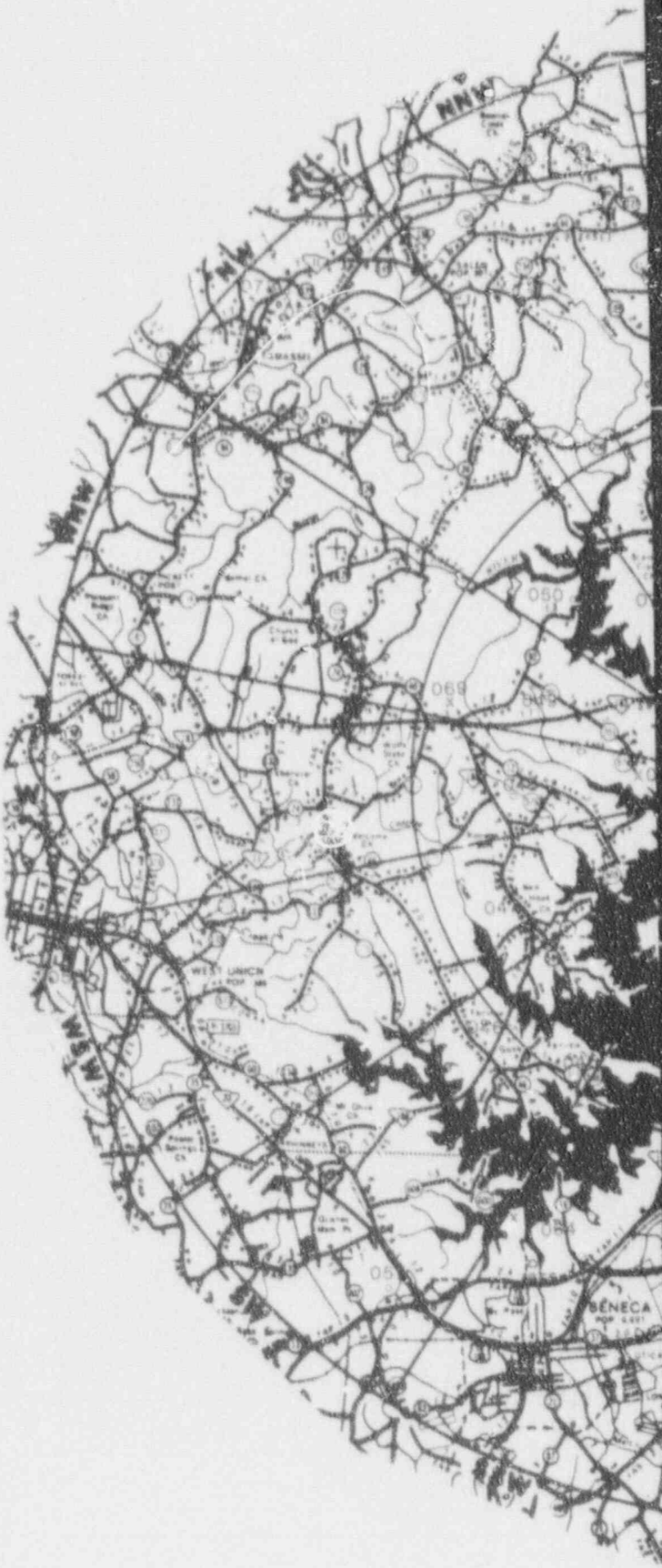
n_1 = the number of measurements in the first set

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 us 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.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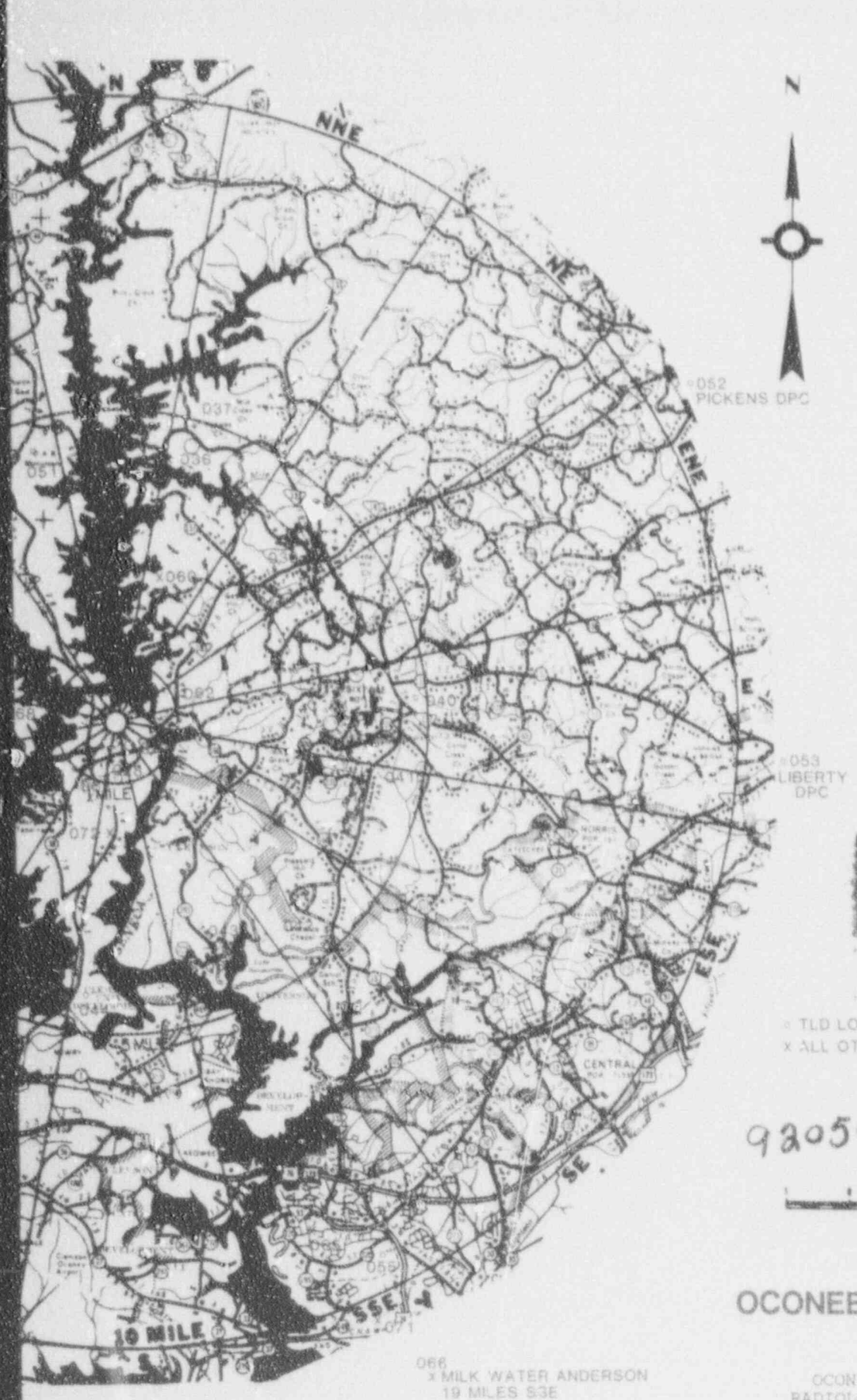
SENECA



052
PICKENS DPC

053
LIBERTY
DPC

066
x MILK WATER ANDERSON
19 MILES S3E

LEGEND

51
APERTURE
CARD

Also Available on
Aperture Card

o TLD LOCATIONS
x ALL OTHER LOCATIONS

9205040271 - 01

SCALE OF MILES

FIGURE A5.0-1
(1 OF 2)
OCONEE NUCLEAR STATION

Figure 2.1-1
OCONEE NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL
MONITORING PROGRAM LOCATIONS

FIGURE 2.1-2

TLD MONITORING LOCATIONS AT THE SITE BOUNDARY

TABLE 2.1-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLING LOCATIONS

CODE:

W - Weekly (≤ 7 days)
SM - Semimonthly (≤ 15 days)
M - Monthly (≤ 31 days)
SA - Semiannually (≤ 184 days)

	SAMPLING LOCATION DESCRIPTION	Air Radioiodines and Particulates	Surface Water	Drinking Water	Shoreline Sediment	Milk	Fish	Broadleaf Vegetation
028	Site Boundary (0.5 miles S)							M
060	New Greenville Water Intake Rd. (2.5 miles NNE)*	W		M			SA	M
061	Old Hwy. 183 (1.5 miles SSW)	W						
062	Lake Keowee/Hydro Intake (0.7 mile ENE) (CONTROL)		M					
063	Lake Hartwell - Hwy. 183 Bridge (0.8 mile ESE) [000.7]		M		SA		SA	
064	Seneca (6.7 miles SW) [004.1] (CONTROL)			M				
066	Anderson (19.0 miles SSE) [012]#			M		SM		
067	Lawrence Ramsey Bridge, Hwy. 27 (4.2 miles SSE) [005.2]				SA		SA	
068	High Falls County Park (2.0 miles W) (CONTROL)				SA			
069	Powell Residence (4.5 miles WNW) [002.1]					SM		
071	Clemson Dairy (10.3 miles SSE) [006.3]					SM		
072	Hwy. 130 (1.7 miles S)	W						
073	Tamassee DAR School (9.0 miles NW) (CONTROL)	W						M
074	Keowee Key Resort (1.7 miles NNW)	W						

*Control for Fish only
#Control for Milk only
[ ] Location Numbers prior to 1984

TABLE 2.1-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

TLD LOCATIONS

LOCATION DESCRIPTION			LOCATION DESCRIPTION		
020	0.2 MILES N	SITE BOUNDARY	040	4.5 MILES E	MICROWAVE TOWER, SIX MILE
021	0.2 MILES NNE	SITE BOUNDARY	041	4.0 MILES ESE	JCT. HWY. 101 & 133
022	0.5 MILES NE	SITE BOUNDARY	042	5.0 MILES SE	LAWRENCE CHAPEL CHURCH, HWY.133
023	0.9 MILES ENE	SITE BOUNDARY	043	4.0 MILES SSE	HWY. 291 AT ISAQUEENA PARK ENTRANCE
024	0.8 MILES E	SITE BOUNDARY	044	4.0 MILES S	HWY. 130 AT LITTLE RIVER DAM
025	0.6 MILES ESE	SITE BOUNDARY	045	5.0 MILES SSW	TERMINUS OF HWY. 588 AT CROOKED CREED
026	0.3 MILES SE	SITE BOUNDARY	046	4.5 MILES SW	HWY. 188 AT CROOKED CREEK BRIDGE
027	0.3 MILES SSE	SITE BOUNDARY	047	4.0 MILES WSW	NEW HOPE CHURCH, HWY. 188
028	0.5 MILES S	SITE BOUNDARY	048	4.0 MILES W	JCT. HWY. 175 & 188
029	0.6 MILES SSW	SITE BOUNDARY	049	4.0 MILES WNW	JCT. HWY. 201 & 92
030	0.4 MILES SW	SITE BOUNDARY	050	4.0 MILES NW	STAMP CREEK LANDING-END OF HWY. 92
031	0.2 MILES WSW	SITE BOUNDARY	051	4.5 MILES NNW	HWY. 128, 1 MILE N OF HWY. 130
032	0.2 MILES W	SITE BOUNDARY	052	12.0 MILES ENE	DPC BRANCH OFFICE-PICKENS
033	0.2 MILES WNW	SITE BOUNDARY	053	11.0 MILES E	DPC BRANCH OFFICE-LIBERTY
034	0.2 MILES NW	SITE BOUNDARY	054	9.5 MILES ESE	POST OFFICE-HWY.93 NORRIS
035	0.1 MILES NNW	SITE BOUNDARY	055	9.5 MILES SSE	CLEMSON METEOROLOGY PLOT
036	4.0 MILES N	MILE CREEK LANDING	056	8.4 MILES SSW	WATER TOWER-SENECA
037	4.5 MILES NNE	KEOWEE CHURCH, HWY. 327	057	9.0 MILES SW	OCONEE MEMORIAL HOSPITAL
038	4.0 MILES NE	DURHAM CONVENIENCE MART, JCT. HWY. 183 & 133	058	10.0 MILES WSW	BRANCH ROAD SUBSTATION-WALHALLA (CONTROL)
039	4.0 MILES ENE	HWY. 133, 1 MILE EAST OF JCT. HWY. 183 & 133	059	9.0 MILES NW	TAMASSEE DAR SCHOOL

TABLE 2.2-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANALYSES

	SAMPLE MEDIUM	ANALYSIS SCHEDULE	ANALYSES				
			GAMMA ISOTOPIC	TRITIUM	LOW LEVEL I-131	GROSS BETA	TLD
1.	Air Radioiodine and Particulates	Weekly	X				
2.	Direct Radiation	Quarterly					X
3.	Surface Water	Monthly	X				
		Quarterly Composite		X			
4.	Drinking Water	Monthly	X				
		Quarterly Composite		X		X	
5.	Shoreline Sediment	Semiannually	X				
6.	Milk	Semimonthly	X		X		
7.	Fish	Semiannually	X				
8.	Broadleaf Vegetation	Monthly	X				

TABLE 2.2-2

MAXIMUM VALUES FOR THE LOWER LIMITS OF DETECTION (LLD)

Analysis	Water (pci/l)	Airborne Particulate or Gas (pci/m^3)	Fish (pci/kg,wet)	Milk (pci/l)	Broadleaf Vegetation (pci/kg,wet)	Sediment (pci/kg,dry)
gross beta	4					
H-3	2000					
Mn-54	15		130			
Fe-59	30		260			
Co-58,60	15		130			
Zn-65	30		260			
Zr-95	30					
Nb-95	15					
I-131	15	7×10^{-2}		1	60	
Cs-134,137	15,18	$5,6 \times 10^{-2}$	130,150	15,18	60,80	150,180
Ba-140	60			60		
La-140	15			15		

TABLE 2.2-3

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Analysis	Water (pci/l)	Air Particulates or Gases (pci/m^3)	Fish (pci/Kg,wet)	Milk (pci/l)	Vegetation (pci/Kg,wet)
H-3	$2 \times 10^{4*}$				
Mn-54	1×10^{3}		3×10^{4}		
Fe-59	4×10^{2}		1×10^{4}		
Co-58	1×10^{3}		3×10^{4}		
Co-60	3×10^{2}		1×10^{4}		
Zn-65	3×10^{2}		2×10^{4}		
Zr-Nb-95	4×10^{2}				
I-131	2**	1		3	1×10^{2}
Cs-134	30	10	1×10^{3}	60	1×10^{3}
Cs-137	50	20	2×10^{3}	70	2×10^{3}
Ba-La-140	2×10^{2}			3×10^{2}	

*For drinking water samples. This is 40CFR Part 141 value.

**If low level I-131 analyses are performed.

SECTION 3.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM DISCUSSION, INTERPRETATION AND TRENDING OF RESULTS

Data from the 1991 environmental monitoring program was compared to preoperational and historical data whenever comparable. Comparisons from preoperational through the present were possible for fish samples and direct gamma radiation as measured by TLD. Analysis results for other sample media were not directly comparable to preoperational and earlier operational sample results because of either significant changes in the analysis methods or changes in the reporting of the results.

Trend analysis was performed for the radionuclides listed in Selected Licensee Commitment 16.11-6. These radionuclides are collectively referred to as "Selected Licensee Commitments radionuclides" and include H-3, Mn-54, Fe-59, Co-58, Co-60, Zn-65, Zr-95, Nb-95, I-131, Cs-134, Cs-137, Ba-140, La-140, and gross beta for drinking water. In addition to these, trending was performed for other radionuclides that were detected and could have been the result of station effluents. For 1991, this included Ag-110m and Sb-125 in shoreline sediment and Ag-110m in surface water.

Trending was performed using visual inspection and statistical analysis of data. Trend methods included comparing annual mean concentrations of any plant related detected radionuclide to the previous year's concentration. Factors evaluated included the frequency of detection and the concentration in terms of the percent of the radionuclide's reporting level. The highest annual mean concentration of each Selected Licensee Commitments radionuclide and any other detected effluent related radionuclide was used for the estimation of the linear regression correlation coefficient. Any negative annual mean values given as a result of previous reporting practices (described in Section 2.3.3) were replaced with zero to properly represent environmental conditions.

Graphs of individual sample results were plotted for any detected radionuclide that was a major dose contributor for the sample media's pathway according to dose calculations based on effluents. A radionuclide is considered a major dose contributor when 5% or more of the pathway dose is due to the radionuclide. Graphs are also drawn for a radionuclide whenever linear regression analysis shows high probability of a positive trend. There were no high positive trends in 1991.

Data presented in Sections 3.1 - 3.8 support the conclusion that there was no significant increase in radionuclides in the environment around ONS due to station operations in 1991. Similarly, there was no significant increase in ambient background radiation levels in the surrounding areas.

Section 2 and Appendix A provide additional information regarding sampling locations, sampling and analysis requirements, trend identification methods, and a description of the sampling and analysis procedures. Appendix B contains tables summarizing sample results. These tables include detectable results of Selected Licensee Commitments radionuclides only. Other radionuclides that were detected, as well as Selected Licensee Commitments radionuclides, are summarized in this section. Section 4 contains dose calculations based on the radionuclides and concentrations observed during 1991. Section 5 summarizes the quality assurance activities for the year associated with radiological environmental monitoring. Appendices C and D list deviations from Selected Licensee Commitments sampling and analysis requirements for environmental monitoring.

3.1 AIRBORNE RADIOIODINE AND PARTICULATES

Gamma spectroscopy was performed on 258 fiber filters and 258 charcoal cartridges collected during 1991. Tables 3.1-1 and 3.1-2 summarize the radionuclides that were detected. Comparison of the data in the tables shows that no radionuclides were detected at the indicator or control locations. No increases in radioactivity have occurred at the indicator locations.

TABLE 3.1-1
AIRBORNE PARTICULATES FILTERS
MEAN ANNUAL CONCENTRATIONS (Pci/m^3)

Isotope	1990 Highest Mean	1991 Highest Mean	1991 %Reporting Level	1991 Control Mean	1991 %Reporting Level
None Detected					

TABLE 3.1-2
AIRBORNE RADIOIODINE CARTRIDGES
MEAN ANNUAL CONCENTRATIONS (pCi/m³)

Isotope	1990 Highest Mean	1991 Highest Mean	1991 %Reporting Level	1991 Control Mean	1991 %Reporting Level
None Detected					

As reported in the 1989 and 1990 Annual Radiological Environmental Operating Report, Cs-137 was observed as being present in air cartridges but not the corresponding particulate filter. However, this did not occur in 1991. An extensive investigation, performed by the Radioanalysis Laboratory, lead to the conclusion that the Cs-137 activity detected was not attributed by station effluents but is an active constituent of the charcoal.

Visual inspection of tabular data taken from previous environmental report summaries and the 1991 summary did not reveal any increasing trends. Linear regression analysis results give a low probability of a trend for the majority of the radionuclides. None of the radionuclides that had indications of increasing trends (positive correlation coefficient) were detected in any of the indicator location samples taken during 1991. Table 3.1-3 and 3.1-4 summarizes the data used and the results of the linear regression analysis.

K-40 and Be-7 were observed in air samples in addition to the radionuclides listed in the tables.

TABLE 3.1-3
AIRBORNE PARTICULATES
TREND ANALYSIS OF MEAN ANNUAL CONCENTRAITONS
CONCENTRATION (pCi/m3)

YEAR	Mn-54 INDICATOR	Co-58 INDICATOR	Fe-59 INDICATOR	Co-60 INDICATOR	Zn-65 INDICATOR	Nb-95 INDICATOR	Zr-95 INDICATOR	I-131 INDICATOR	Cs-134 INDICATOR	Cs-137 INDICATOR	BaLa-140 INDICATOR
1979	5.52E-04	5.76E-04	1.85E-03	7.22E-04	0.00E+00	7.57E-04	7.57E-04	7.54E-03	5.66E-04	5.69E-03	1.56E-04
1980	3.83E-04	4.41E-04	1.92E-03	6.48E-04	1.70E-04	3.18E-03	3.18E-03	3.07E-03	0.00E+00	2.96E-03	1.42E-03
1981	7.14E-04	2.76E-04	1.83E-03	1.11E-03	0.00E+00	6.39E-02	3.93E-02	6.31E-03	2.47E-04	5.36E-03	1.41E-03
1982	9.06E-04	9.91E-04	1.70E-03	1.60E-03	1.30E-03	2.31E-03	9.31E-04	2.87E-03	1.66E-04	4.24E-03	3.07E-04
1983	2.64E-04	5.03E-04	1.91E-03	1.35E-03	0.00E+00	4.50E-04	4.92E-04	1.48E-03	0.00E+00	2.53E-03	4.36E-04
1984	4.30E-04	1.38E-04	6.66E-04	2.80E-04	2.34E-04	5.89E-04	1.50E-03	9.35E-04	7.18E-05	6.63E-04	5.34E-04
1985	4.74E-04	2.93E-04	6.50E-04	6.99E-04	0.00E+00	5.52E-04	9.88E-04	3.94E-04	5.93E-04	5.90E-04	4.42E-04
1986	2.77E-04	2.31E-04	6.59E-04	4.72E-04	0.00E+00	1.19E-03	9.40E-04	8.21E-04	6.57E-04	9.01E-04	5.67E-04
1987	2.52E-03	3.44E-03	6.60E-03	2.65E-03	6.11E-03	9.55E-03	6.58E-03	5.94E-03	3.43E-02	3.21E-03	6.23E-03
1988	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1989	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1990	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1991	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Correlation Coefficient	-2.05E-01	-8.48E-02	-2.87E-01	-3.83E-01	9.14E-02	-3.23E-01	-3.38E-01	-6.80E-01	1.45E-01	-8.25E-01	-4.96E-02
Trend Probability	Poor	Poor	Poor	Moderate	Poor	Moderate	Moderate	Moderate	Poor	High	Poor
Type Trend	Decreasing	Decreasing	Decreasing	Decreasing	Increasing	Decreasing	Decreasing	Decreasing	Increasing	Decreasing	Decreasing

Note: All negative mean values were replaced with "zeros" for calculational purposes.

TABLE 3.1-4
AIRBORNE RADIOIODINE
TREND ANALYSIS OF MEAN ANNUAL CONCENTRATIONS
CONCENTRATION (pCi/m3)

YEAR	Mn-54 INDICATOR	Co-58 INDICATOR	Fe-59 INDICATOR	Co-60 INDICATOR	Zn-65 INDICATOR	Nb-95 INDICATOR	Zr-95 INDICATOR	I-131 INDICATOR	Cs-134 INDICATOR	Cs-137 INDICATOR	[illegible]
1979	5.52E-04	5.56E-04	1.85E-03	7.22E-04	0.00E+00	7.57E-04	7.57E-04	7.54E-03	5.66E-04	5.69E-03	1.5[illegible]
1980	3.83E-04	4.41E-04	1.92E-03	6.48E-04	1.70E-04	3.18E-03	3.18E-03	3.07E-03	0.00E+00	2.96E-03	1.4[illegible]
1981	7.14E-04	2.76E-04	1.83E-03	1.11E-03	0.00E+00	6.39E-02	3.33E-02	6.31E-03	2.47E-04	5.36E-03	1.41E-0[illegible]
1982	9.06E-04	9.91E-04	1.70E-03	1.60E-03	1.30E-03	2.31E-03	9.31E-04	2.87E-03	1.66E-04	4.24E-03	6.07E-04
1983	2.[illegible]4E-04	5.03E-04	1.91E-03	1.35E-03	0.00E+00	4.50E-04	4.92E-04	1.48E-03	0.00E+00	2.53E-03	4.36E-04
1984	5.57E-04	5.66E-04	1.55E-03	6.7[illegible]E-04	5.47E-04	5.66E-04	1.10E-03	8.11E-04	6.47E-04	2.86E-03	7.96E-03
1985	3.72E-04	1.13E-04	2.11E-03	9.48E-04	0.00E+00	9.78E-04	1.05E-03	7.71E-04	5.66E-04	1.86E-03	3.89E-04
1986	5.00E-04	1.53E-04	5.14E-04	5.44E-04	0.00E+00	1.30E-03	9.60E-04	9.33E-04	6.10E-04	2.15E-03	5.44E-04
1987	4.29E-03	3.47E-03	7.56E-03	4.95E-03	0.00E+00	4.24E-03	7.46E-03	4.29E-03	5.04E-03	4.79E-03	7.30E-03
1988	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.94E-03	0.00E+00
1989	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.99E-04	0.00E+00	3.95E-03	0.00E+00
1990	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.22E-03	0.00E+00
1991	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Correlation Coefficient	-5.87E-02	-9.43E-02	-2.46E-01	-1.59E-01	-3.01E-01	-3.37E-01	-3.32E-01	-7.45E-01	8.12E-02	-5.33E-01	-7.17E-02
Trend Probability	Poor	Poor	Poor	Poor	Moderate	Moderate	Moderate	High	Poor	Moderate	Poor
Type Trend	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Increasing	Decreasing	Decreasing

Note: All negative mean values were replaced with "zeros" for calculational purposes.

3.2 DRINKING WATER

Gross beta analysis and gamma spectroscopy were performed on 39 monthly drinking water samples. These samples were composited to form 15 quarterly period samples for Tritium analysis.

Radioactivity was detected in the gross beta analyses. Table 3.2-1 summarizes the results. The detection frequency increased in 1991 but the mean concentration decreased. The frequency of detection may have been affected by the change in determining the critical level described in Appendix A. There is also little difference between the indicator and control concentrations for 1991. Tritium was detected in one of the quarterly composites. Table 3.2-1 and 3.2-2 summarizes the results. All concentrations were well below any reporting levels.

TABLE 3.2-1
DRINKING WATER MEAN ANNUAL CONCENTRATIONS (pCi/liter)

Isotope	1990 Highest Mean	1991 Highest Mean	%Reporting Level	1991 Control Mean	%Reporting Level
H-3	---(0/5)---	5.58E2(1/5)	2.79%	--- (0/5) ---	
Gross Beta	3.0E0(3/13)	1.81E0(10/13)	NS	1.41(10/13)	NS

Value in parenthesis is the fraction of detectable measurements. NS = none specified by Selected Licensee Commitments.

Visual inspection of tabular data summarizing activity observed from the preoperational period through 1991 did not show any siginificant increasing trends. Only one of the radionuclides evaluated by linear regression analysis had a high probablity of a trend. That radionuclide was I-131 with a high probability of a decreasing trend.

Total Beta results had moderate probability of an increasing trend. Linear regression analysis data and results are contained in Table 3.2-2.

A previous drinking water location, Clemson Water Plant, location number 065, is still monitored though not required by Selected Licensee Commitments. The plant was closed 7/01/89. The raw water that supplied the plant continues to be sampled and results trended. Only H-3 and K-40 have been detected in the raw water samples since the plant closure. The H-3 concentration averages to 7.96E2 pCi/liter for the 1991 period, and is similar to the finished drinking water H-3 levels that had been obtained from the plant. Figure 3.2-1 shows the H-3 levels at the Clemson site and drinking water sites. Sample analysis results from location 065 raw water are not included in the tables summarizing drinking water results.

K-40 was observed in drinking water samples in addition to the Total Beta and tritium radioactivity listed in the tables.

TABLE 3.2-2
DRINKING WATER
TREND ANALYSIS OF MEAN ANNUAL CONCENTRATIONS
CONCENTRATION (pCi/liter)

YEAR	Mn-54 INDICATOR	Co-58 INDICATOR	Fe-59 INDICATOR	Co-60 INDICATOR	Zn-65 INDICATOR	Nb-95 INDICATOR	Zr-95 INDICATOR	I-131 INDICATOR	Cs-134 INDICATOR	Cs-137 INDICATOR	BaLa-140 INDICATOR	Gross Beta INDICATOR
1979	1.24E+00	6.04E-01	1.42E+00	1.13E+00	6.35E-01	1.64E+00	1.64E+00	8.28E-01	0.00E+00	3.55E-01	3.73E-01	1.83E+00
1980	9.17E-01	9.39E-01	2.05E+00	1.77E+00	0.00E+00	1.54E+00	1.54E+00	1.72E+00	0.00E+00	9.43E-01	4.90E-01	1.86E+00
1981	1.42E+00	0.00E+00	5.85E+	1.44E+00	7.30E-01	4.92E-01	9.21E 91	1.52E+00	5.54E-01	1.34E+00	1.71E-01	1.98E+00
1982	1.29E-01	7.28E-01	0.00E+00	2.25E+00	1.12E-01	1.21E+00	1.79E+00	9.71E-01	1.92E+00	4.61E-01	3.29E-01	2.04E+00
1983	5.83E-04	0.00E+00	2.21E+00	6.26E+00	0.00E+00	0.00E+00	2.41E+00	6.27E-01	3.70E-01	8.14E-01	2.21E+00	1.85E+00
1984	5.41E-01	1.74E-01	3.59E+00	2.51E+00	1.01E+00	1.66E+00	1.29E+00	9.45E-01	6.13E-01	1.81E-01	4.45E-01	1.87E+00
1985	0.00E+00	9.94E-01	0.00E+00	5.50E-01	6.81E-01	8.72E-01	1.72E+00	8.39E-01	1.08E+00	5.77E-01	1.68E+00	2.14E+00
1986	4.30E-01	2.18E-01	9.73E-01	1.18E-01	0.00E+00	1.05E+00	1.43E+00	1.81E+00	1.20E+00	1.09E+00	4.36E-01	1.93E+00
1987	4.30E+00	3.20E+00	1.30E+01	5.10E+00	8.10E+0	5.50E+00	1.40E+01	0.00E+00	6.20E+00	5.50E+00	0.00E+00	2.00E+00
1988	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.90E+00	0.00E+00	2.79E+00
1989	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.30E+00
1990	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.00E+00
1991	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.81E+00
Correlation Coefficient	-1.72E-01	-9.78E-02	-1.35E-01	-3.49E-01	7.89E-02	-1.83E-01	-1.90E-02	-7.21E-01	5.38E-02	7.49E-02	-3.34E-01	4.78E-01
Trend Probability	Poor	Poor	Poor	Moderate	Poor	Poor	Poor	High	Poor	Poor	Moderate	Moderate
Type Trend	Decreasing	Decreasing	Decreasing	Decreasing	Increasing	Decreasing	Decreasing	Decreasing	Increasing	Increasing	Decreasing	Increasing

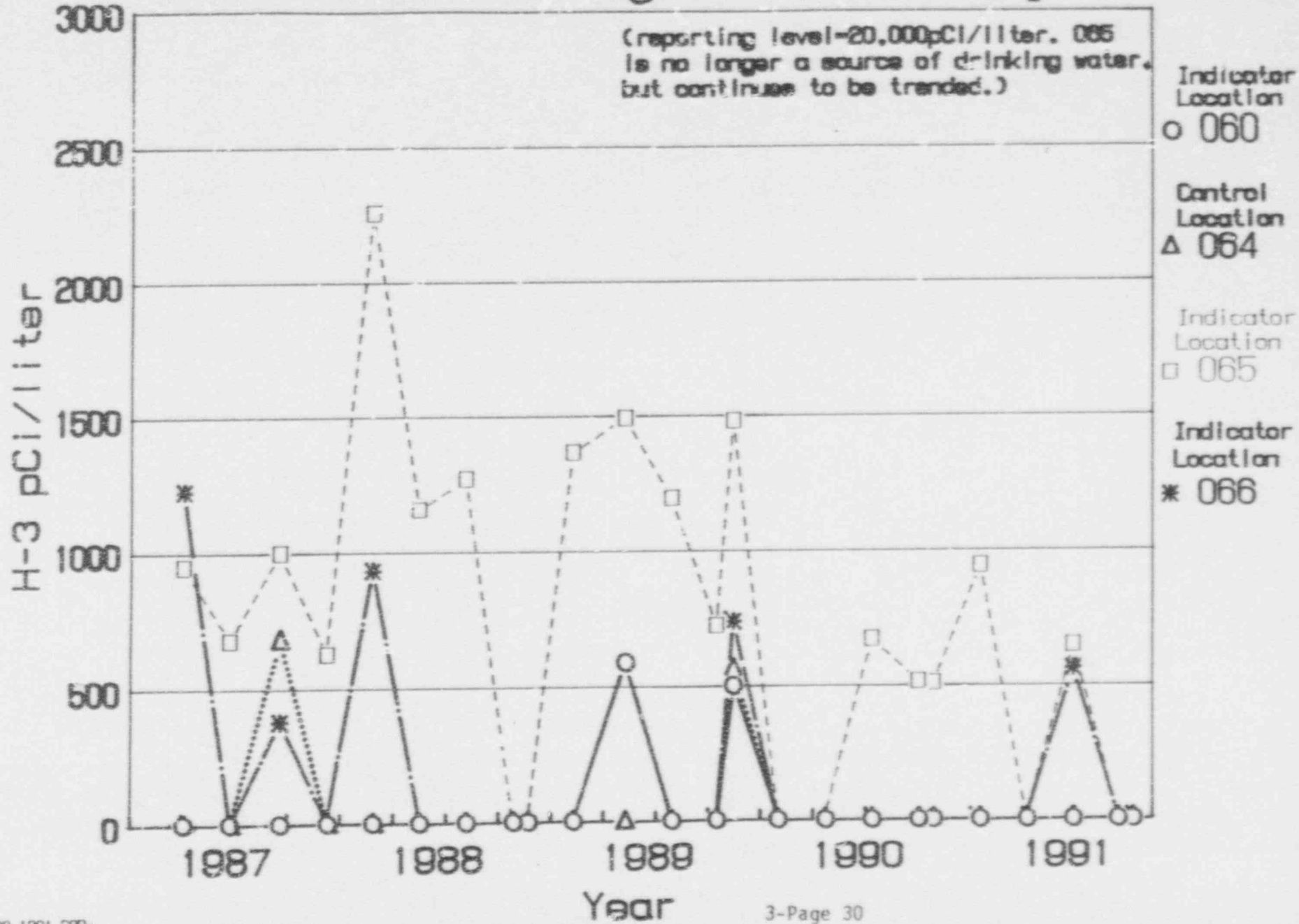
Note: All negative mean values were replaced with "zeros" for calculational purposes.

TABLE 3.2-2
DRINKING WATER
TREND ANALYSIS OF MEAN ANNUAL CONCENTRATIONS
CONCENTRATION (pCi/liter)

YEAR	H-3 INDICATOR
1974	4.40E+02
1975	1.80E+03
1976	2.20E+03
1977	1.20E+03
1978	1.05E+03
1979	5.78E+02
1980	6.60E+02
1981	8.30E+02
1982	6.43E+02
1983	9.37E+02
1984	7.65E+02
1985	8.56E+02
1986	1.[illegible]E+03
1987	8.15E+02
1989	1.57E+03
1989	1.35E+03
1990	0.00E+00
1991	5.58E+02
Correlation Coefficient	-2.97E-01
Trend Probability	Poor
Type Trend	Decreasing

Figure 3.2-1

H-3 in Drinking Water Samples



3.3 SURFACE WATER

Gamma spectroscopy was performed on 26 monthly surface water samples. These samples were composited to form 10 quarterly samples for Tritium analysis.

Table 3.3-1 summarizes the radionuclides that were detected. The indicator location is near the liquid effluent release point and differences between the indicator and control samples are expected. Comparison of 1990 and 1991 highest mean annual concentrations show there is no significant change in concentrations. For the majority of the radionuclides, the concentrations are low and the number of samples with detectable activity is small (with the exception of Tritium). Observed surface water concentrations were below any reporting levels.

Visual inspection of tabular data covering the preoperational period through 1991 did not reveal any significant increasing trends. Linear regression analysis was applied to the highest indicator location mean for Tritium from the preoperational period through 1991, and for the past thirteen years for the remaining radionuclides. The data used and the results are in Table 3.3-2. Co-58, Co-60, Ag-110m, and Sb-125 had positive correlation coefficients, which indicates an increasing trend. However, none of the radionuclides show a high probability of a trend. Only Co-58, Ag-110m and H-3 were detected in 1991 samples.

K-40 was observed in surface water samples in addition to the radionuclides listed in the tables.

TABLE 3.3-1
SURFACE WATER
MEAN ANNUAL CONCENTRATIONS (pCi/liter)

Isotope	1990 Highest Mean	1991 Highest Mean	1991 %Reporting Level	1991 Control Mean	1991 %Reporting Level
Co-58	1.7E0(1/13)	5.37E0(1/13)	0.54%	---(0/13)	---
Ag-110m	3.04E0(1/13)	7.04E0(1/13)	NS	---(0/13)	---
H-3	1.03E4(5/5)	5.76E3(4/5)	28.9%*	---(0/5)	---

Value in parenthesis is the fraction of detectable measurements. NS = none specified by Selecteed Licensee Commitments.

* Reporting Level used is for Drinking Water. None specified for Surface Water.

TABLE 3.3-2
SURFACE WATER
TREND ANALYSIS OF MEAN ANNUAL CONCENTRATIONS
CONCENTRATION (pCi/liter)

YEAR	Mn-54 INDICATOR	Co-58 INDICATOR	Fe-59 INDICATOR	Co-60 INDICATOR	Zn-65 INDICATOR	Nb-95 INDICATOR	Zr-95 INDICATOR	I-131 INDICATOR	Cs-134 INDICATOR	Cs-137 INDICATOR	BaLa-140 INDICATOR	Ag-110m INDICATOR	Sb-125 INDICATOR
1979	1.37E+00	1.33E+00	3.71E+00	2.60E+00	3.24E-01	1.78E+00	1.78E+00	2.03E+00	2.92E-01	2.82E+00	2.26E-03	0.00E+00	0.00E+00
1980	2.08E-01	1.56E+00	2.57E+00	2.30E+00	3.05E-01	1.22E+00	1.22E+00	1.53E+00	2.11E-01	5.40E+00	5.01E-01	0.00E+00	0.00E+00
1981	4.28E-01	1.10E+00	2.66E+00	6.10E-01	1.58E+00	1.70E+00	2.39E+00	2.65E+00	3.26E+00	3.90E+00	8.56E-01	0.00E+00	0.00E+00
1982	5.63E-01	6.14E-01	2.29E+00	1.99E+00	1.17E+00	2.29E+00	2.27E+00	3.88E+00	1.93E+00	4.85E+00	1.25E+00	0.00E+00	0.00E+00
1983	9.97E-01	6.39E-01	2.86E+00	3.02E+00	9.61E-01	3.91E-01	1.91E+00	2.48E+00	5.67E-01	6.83E-01	1.30E+00	0.00E+00	0.00E+00
1984	7.51E-01	9.40E-01	2.54E+00	6.30E-01	5.40E-01	7.90E-01	1.70E+00	2.26E+00	3.03E-01	4.83E-01	0.00E+00	0.00E+00	0.00E+00
1985	9.34E-02	2.15E-01	2.83E+00	6.27E-01	1.40E-01	4.95E-01	[illegible]E+00	1.44E-01	1.00E+00	9.90E-01	0.00E+00	0.00E+00	0.00E+00
1986	1.12E+00	2.85E+00	0.00E+00	9.21E-01	0.00E+00	1.22E+00	1.46E-01	9.10E-01	8.00E-01	5.49E-01	4.47E-01	0.00E+00	7.89E+01
1987	0.00E+00	5.10E+01	0.00E+00	3.40E+00	0.00E+00	4.00E+00	0.00E+00	0.00E+00	4.10E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1988	0.00E+00	6.20E+00	0.00E+00	5.00E+00	0.00E+00	2.50E+00	0.00E+00	0.00E+00	0.00E+00	3.50E+00	0.00E+00	2.71E+01	3.70E+01
1989	0.00E+00	5.30E+00	0.00E+00	3.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.40E+00	0.00E+00	7.60E+00	2.22E-01
1990	0.00E+00	1.70E+00	0.00E+00	1.60E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.04E+00	0.00E+00
1991	0.00E+00	5.37E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.04E+00	0.00E+00
Correla Coeffic	-6.23E-01	2.52E-01	-8.82E-01	8.11E-03	-6.37E-01	-2.76E-01	-8.52E-01	-7.78E-01	-2.26E-01	-5.53E-01	-5.07E-01	4.75E-01	1.82E-01
Trend Prob.	Moderate	Poor	High	Poor	Moderate	Poor	High	High	Poor	Moderate	Moderate	Moderate	Poor
Type Trend	Decrease	Increase	Decrease	Increase	Decrease	Decrease	Decrease	Decrease	Decrease	Decrease	Decrease	Increase	Increase

Note: All negative mean values were replaced with "zeros" for calculational purposes.

TABLE 3.3-2
SURFACE WATER
TREND ANALYSIS OF MEAN ANNUAL CONCENTRATIONS
CONCENTRATION (pCi/liter)

YEAR	Mn-54 INDICATOR	Co-58 INDICATOR	Fe-59 INDICATOR	Co-60 INDICATOR	Zn-65 INDICATOR	Nb-95 INDICATOR	Zr-95 INDICATOR	I-131 INDICATOR	Cs-134 INDICATOR	Cs-137 INDICATOR	BaLa-140 INDICATOR	Ag-110m INDICATOR	Sb-125 INDICATOR
1979	1.37E+00	1.33E+00	3.71E+00	2.60E+00	3.24E-01	1.78E+00	1.78E+00	2.03E+00	2.92E-01	2.82E+00	2.26E-03	0.00E+00	0.00E+00
1980	2.08E-01	1.56E+00	2.57E+00	2.30E+00	3.05E-01	1.22E+00	1.22E+00	1.53E+00	2.11E-01	5.40E+00	5.01E-01	0.00E+00	0.00E+00
1981	4.28E-01	1.10E+00	2.66E+00	6.10E-01	1.58E+00	1.70E+00	2.39E+00	2.65E+00	3.26E+00	3.90E+00	8.36E-01	0.00E+00	0.00E+00
1982	5.63E-01	6.14E-01	2.29E+00	1.99E+00	1.17E+00	2.29E+00	2.27E+00	2.88E+00	1.93E+00	4.85E+00	1.25E+00	0.00E+00	0.00E+00
1983	9.97E-01	6.99E-01	2.36E+00	3.02E+00	9.61E-01	3.91E-01	1.91E+00	2.48E+00	5.67E-01	6.83E-01	1.30E+00	0.00E+00	0.00E+00
1984	7.51E-01	9.40E-01	2.54E+00	2.30E-01	5.40E-01	7.90E-01	1.70E+00	2.26E+00	3.03E-01	4.83E-01	0.00E+00	0.00E+00	0.00E+00
1985	9.34E-02	2.15E-01	2.83E+00	6.27E-01	1.40E-01	4.95E-01	1.03E+00	1.44E-01	1.09E+00	9.90E-01	0.00E+00	0.00E+00	7.89E+01
198.	1.12E+00	2.85E+00	0.00E+00	9.21E-01	0.00E+00	1.22E+00	1.46E-01	9.10E-01	8.00E-01	5.49E-01	4.47E-01	0.00E+00	0.00E+00
1987	0.00E+00	5.10E+01	0.00E+00	3.40E+00	0.00E+00	5.00E+00	0.00E+00	0.00E+00	4.10E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1988	0.00E+00	6.20E+00	0.00E+00	5.00E+00	0.00E+00	2.50E+00	0.00E+00	0.00E+00	0.00E+00	3.50E+00	0.00E+00	2.71E+01	3.70E+01
1989	0.00E+00	5.30E+00	0.00E+00	3.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.40E+00	0.00E+00	7.60E+00	2.22E+01
1990	0.00E+00	1.70E+00	0.00E+00	1.60E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.04E+00	0.00E+00
1991	0.00E+00	5.37E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.04E+00	0.00E+00
Correla Coeffic	-6.23E-01	2.52E-01	-8.82E-01	8.11E-03	-6.37E-01	-2.76E-01	-8.52E-01	-7.78E-01	-2.26E-01	-5.53E-01	-5.07E-01	4.75E-01	1.82E-01
Trend Prob.	Moderate	Poor	High	Poor	Moderate	Poor	High	High	Poor	Moderate	Moderate	Moderate	Poor
Type Trend	Decrease	Increase	Decrease	Increase	Decrease	Decrease	Decrease	Decrease	Decrease	Decrease	Decrease	Increase	Increase

Note: All negative mean values were replaced with "zeros" for calculational purposes.

TABLE 3.3-2
SURFACE WATER
TREND ANALYSIS OF MEAN ANNUAL CONCENTRATIONS
CONCENTRATION (pCi/liter)

YEAR	H-3 INDICATOR
1972	4.80E+02
1974	1.55E+03
1975	2.90E+04
1976	2.95E+04
1977	2.90E+03
1978	8.00E+02
1979	4.67E+03
1980	4.93E+03
1981	7.21E+03
1982	6.13E+03
1983	8.40E+03
1984	9.93E+03
1985	1.05E+04
1986	1.26E+04
1987	7.08E+03
1988	1.10E+04
1989	1.02E+04
1990	1.03E+04
1991	5.76E+03
Correlation Coefficient	-2.40E-02
Trend Probability	Poor
Type Trend	Decreasing

3.4 MILK

Gamma spectroscopy and low level iodine analysis was performed on 78 milk samples collected in 1991. Table 3.4-1 summarizes the radionuclides that were detected. Cs-137 was the only radionuclide observed in indicator location milk samples (besides naturally occurring ones). Although the detection frequency for Cs-137 increased in 1991, the mean concentration decreased. Cs-137 had a poor probability of an increasing trend. No concentrations above reporting levels were identified.

TABLE 3.4-1

MILK
MEAN ANNUAL CONCENTRATIONS (pCi/liter)

Isotope	1990 Highest Mean	1991 Highest Mean	1991 %Reporting Level	1991 Control Mean	1991 %Reporting Level
Cs-137	6.4E0(1/26)	4.99E0(4/26)	7.13%	---(0/26)	---

Value in parenthesis is the fraction of detectable measurements.

Visual inspections of tabular data taken from previous environmental report summaries and the 1991 summary did not reveal any significant increasing trends. Linear regression analysis data and results are found in Table 3.4-2. None of the radionuclides had a high probability of a positive trend. Trend analysis for I-131, which is the main contributor to doses calculated from gaseous particulate and iodine effluent data, indicates with moderate probability that iodine concentrations are decreasing.

K-40 was observed in milk samples in addition to the radionuclides listed in the tables.

TABLE 3.4-2
MILK
TREND ANALYSIS OF MEAN ANNUAL CONCENTRATIONS
CONCENTRATION (pCi/liter)

YEAR	Mn-54 INDICATOR	Co-58 INDICATOR	Fe-59 INDICATOR	Co-60 INDICATOR	Zn-65 INDICATOR	Nb-95 INDICATOR	Zr-95 INDICATOR	I-131(LL) INDICATOR	Cs-134 INDICATOR	Cs-137 INDICATOR	BaLa-140 INDICATOR
1979	2.83E+00	6.67E-01	5.60E+00	8.39E-01	2.11E+00	2.32E+00	2.32E+00	1.48E-01	0.00E+00	7.25E+00	0.00E+00
1980	8.41E-02	3.99E-01	2.94E+00	1.88E+00	1.37E-01	1.16E+00	1.16E+00	7.46E-01	0.00E+00	3.58E+00	1.58E-01
1981	8.54E-02	1.40E+00	4.53E-01	5.20E-01	0.00E+00	4.29E-01	1.38E+00	4.70E-02	6.53E-01	5.52E+00	9.51E-02
1982	9.83E-01	2.94E-01	3.39E+00	1.12E+00	8.47E-01	5.63E-01	2.55E+00	7.38E-03	1.25E+00	2.71E+00	1.64E+00
1983	1.02E+00	1.95E+00	3.75E+00	1.41E+00	0.00E+00	0.00E+00	1.90E+00	2.76E-03	2.19E+00	5.04E+00	6.03E-01
1984	0.00E+00	5.94E-01	2.30E+00	1.02E+00	3.30E-01	1.37E+00	2.43E-01	9.62E-04	0.00E+00	2.30E+00	1.27E+00
1985	9.25E-01	9.80E-01	0.00E+00	6.70E-01	1.17E+00	5.61E-01	1.88E+00	0.00E+00	1.01E+00	2.38E+00	5.90E-01
1986	1.16E+00	0.00E+00	2.22E+00	4.43E-01	0.00E+00	1.08E+00	8.34E-01	3.72E-02	1.16E+00	2.79E+00	2.96E-01
1987	7.90E+00	5.60E+00	0.00E+00	8.30E+00	9.90E+00	6.80E+00	9.30E+00	0.00E+00	6.60E+00	4.90E+00	4.20E+00
1988	0.00E+00	0.00E+00	0.00E+00	4.30E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.90E+00	0.00E+00
1989	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.70E+00	0.00E+00
1990	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.40E+00	0.00E+00
1991	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.90E+00	0.00E+00
Correlation Coefficient	-5.65E-02	-8.05E-02	-7.66E-01	5.77E-02	2.82E-02	-1.13E-01	-1.51E-01	-5.00E-01	4.24E-02	1.42E-02	-2.46E-03
Trend Probability	Poor	Poor	High	Poor	Poor	Poor	Poor	Moderate	Poor	Poor	Poor
Type Trend	Decreasing	Decreasing	Decreasing	Increasing	Increasing	Decreasing	Decreasing	Decreasing	Increasing	Increasing	Decreasing

Note: All negative mean values were replaced with "zeros" for calculational purposes.

3.5 BROADLEAF VEGETATION

Gamma spectroscopy was performed on 39 broadleaf vegetation samples during 1991. Cs-137 was detected one time and was the only radionuclide, other than those occurring naturally, that was observed in indicator location samples. Cs-137 was also detected in control location samples and at a higher frequency. The sample results are summarized in Table 3.5-1. Concentrations that were detected are below reporting levels.

TABLE 3.5-1
BROADLEAF VEGETATION
MEAN ANNUAL CONCENTRATIONS (pCi/kg, wet)

Isotope	1990 Highest Mean	1991 Highest Mean	%Reporting Level	1991 Control Mean	%Reporting Level
Cs-137	7.73E2(1/13)	2.22E1(1/13)	1.11%	1.45E2(7/13)	7.3%

Value in parenthesis is the fraction of detectable measurements.

Visual inspection of tabular data taken from previous environmental report summaries and the 1991 summary did not reveal any increasing trends. Linear regression analysis data and results are given in Table 3.5-2. Only one radionuclide, Cs-137, had a probability of an increasing trend and it was a moderate probability.

K-40 and Be-7 were observed in broadleaf vegetation samples in addition to those listed in the table.

TABLE 3.5-2
BROADLEAF VEGETATION
TREND ANALYSIS OF MEAN ANNUAL CONCENTRATIONS
CONCENTRATION (pCi/kg)

YEAR	Mn-54 INDICATOR	Co-58 INDICATOR	Fe-59 INDICATOR	Co-60 INDICATOR	Zn-65 INDICATOR	Zr-95 INDICATOR	Zr-95 INDICATOR	I-131 INDICATOR	Cs-134 INDICATOR	Cs-137 INDICATOR	Ba-La 140 INDICATOR
1979	1.54E+01	7.22E+00	1.62E+01	1.87E+01	1.36E+01	2.01E+01	2.01E+01	2.45E+01	0.00E+00	5.04E+01	1.14E+01
1980	1.14E+01	1.40E+01	4.15E+01	1.48E+01	3.21E+00	1.45E+01	1.43E+02	3.59E+00	9.40E+00	2.80E+01	1.10E+00
1981	1.89E+01	4.67E+00	7.96E+00	2.84E+00	6.41E+00	4.55E+02	2.35E+02	1.74E+01	2.30E+00	2.79E+01	8.95E+00
1982	1.16E+01	1.38E+01	2.98E+01	7.32E+00	2.78E+00	1.86E+01	1.10E+01	9.30E-01	6.65E+00	2.42E+01	9.16E+00
1983	8.36E+00	4.91E+00	3.94E+01	0.00E+00	0.00E+00	8.00E+00	5.54E+00	5.47E+00	1.73E+01	7.44E+00	5.39E+00
1984	4.37E-01	1.24E+00	2.56E+00	1.38E+00	1.54E+00	4.06E-01	3.79E+00	4.55E+00	1.01E+01	1.37E+01	4.47E+00
1985	2.85E+00	5.40E-01	7.49E+00	1.13E+01	0.00E+00	0.00E+00	2.87E+00	3.15E+00	1.15E+01	1.62E+01	2.05E+00
1986	4.76E+00	0.00E+00	3.46E+00	3.99E+00	0.00E+00	4.64E+00	7.07E-01	0.00E+00	1.34E+01	2.90E+01	4.00E+00
1987	2.20E+01	0.00E+00	3.30E+01	1.70E+01	0.00E+00	2.10E+01	5.40E+01	4.80E+01	1.80E+01	2.70E+01	4.30E+01
1988	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.40E+01	0.00E+00
1989	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1990	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.73E+02	0.00E+00
1991	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.22E+01	0.00E+00
Correlation Coefficient	-6.22E-01	-7.63E-01	-5.81E-01	-5.51E-01	-7.20E-01	-3.50E-01	-3.57E-01	-2.38E-01	-4.72E-02	3.01E-01	-1.15E-01
Trend Probability	Moderate	High	Moderate	Moderate	High	Moderate	Moderate	Poor	Poor	Moderate	Poor
Type Trend	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Increasing	Decreasing

Note: All negative mean values were replaced with "zeros" for calculational purposes.

3.6 SHORELINE SEDIMENT

Gamma spectroscopy was performed on twelve sediment samples. Selected Licensee Commitments requires samples to be collected from two locations semiannually. Three locations are sampled quarterly in order to better assess the concentrations being observed in sediment samples. The results of the additional samples are included in the shoreline sediment tables and graphs.

Table 3.6-1 summarizes the radionuclides that were detected. The 1990 and 1991 highest annual means are very similar in the radionuclides detected and their concentrations.

Visual inspection of tabular data from previous environmental report summaries and the 1991 summary indicated some increases in shoreline sediment concentrations. Linear regression analysis data and results are found in Table 3.6-2. Moderate positive trends resulted for Mn-54, Co-60, Cs-137, Ag-110m, and Sb-125.

Graphs of individual sample results can be found in Figures 3.6-1 through 3.6-3. The period plotted begins when shoreline sediment sampling was initiated in 1984. Cs-137, Co-60, Ag-110m, and Sb-125 were graphed because of the moderate probability of increasing trend and because they are major dose contributors in effluent calculations. The graphs show an increasing trend is possible, but fluctuations in the results are large. The 1991 doses from shoreline sediments were low and well within any dose limits.

K-40 and Be-7 were observed in shoreline sediment samples in addition to the radionuclides listed in the tables.

TABLE 3.6-1
SHORELINE SEDIMENT
MEAN ANNUAL CONCENTRATIONS (pCi/kg, dry)

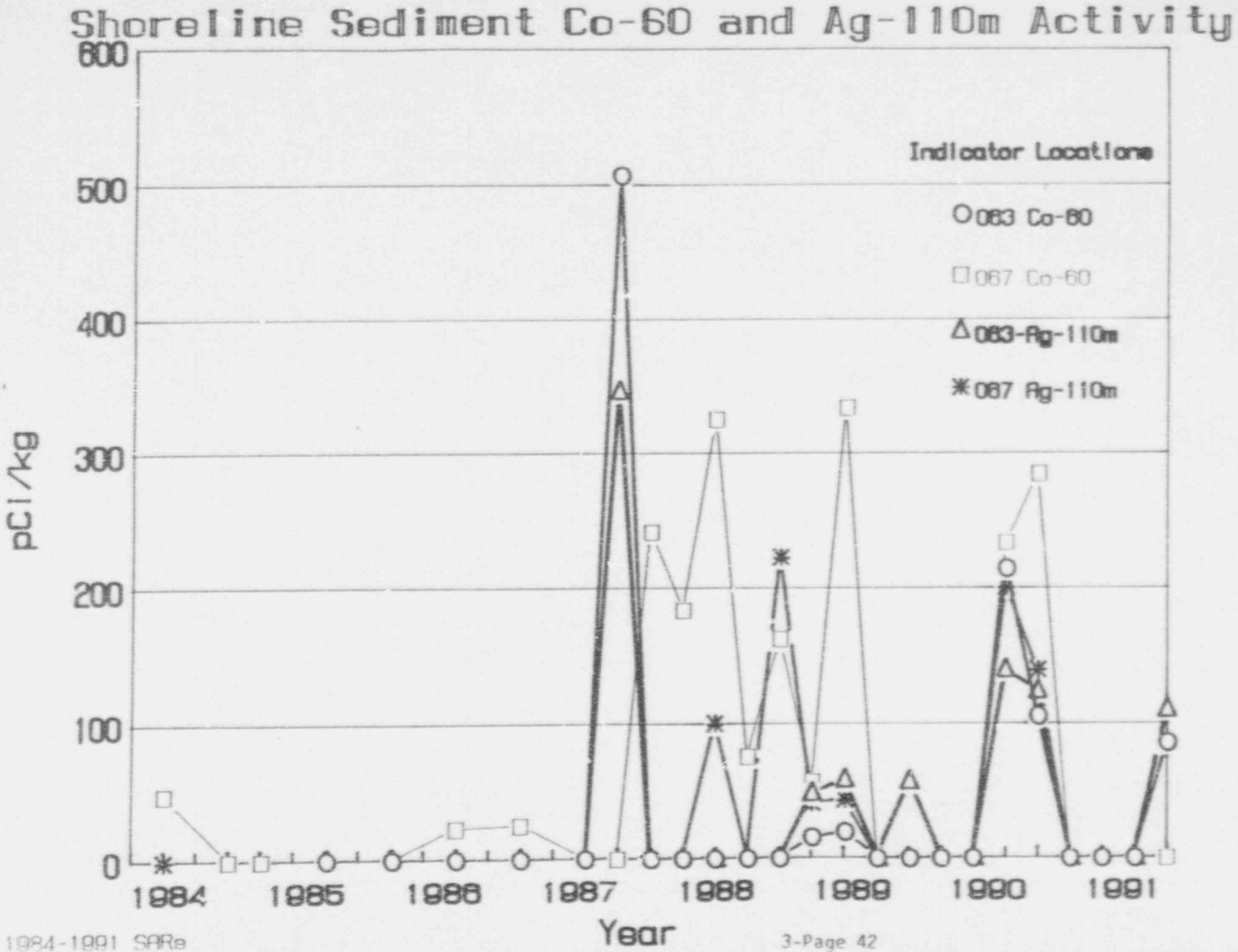
Isotope	1990 Highest Mean	1991 Highest Mean	1991 %Reporting Level	1991 Control Mean	1991 %Reporting Level
Mn-54	3.40E1(3/4)	3.26E1(1/4)	NS	---(0/4)---	
Co-58	8.00E1(2/4)	5.60E1(1/4)	NS	---(0/4)---	
Co-60	2.59E2(2/4)	8.57E1(1/4)	NS	---(0/4)---	
Cs-134	4.50E1(2/4)	6.91E1(1/4)	NS	---(0/4)---	
Cs-137	5.36E2(3/4)	1.24E2(3/4)	NS	---(0/4)---	
Ag-110m	1.71E2(2/4)	1.10E2(1/4)	NS	---(0/4)---	
Sb-125	9.00E1(1/4)	1.78E2(1/4)	NS	---(0/4)---	

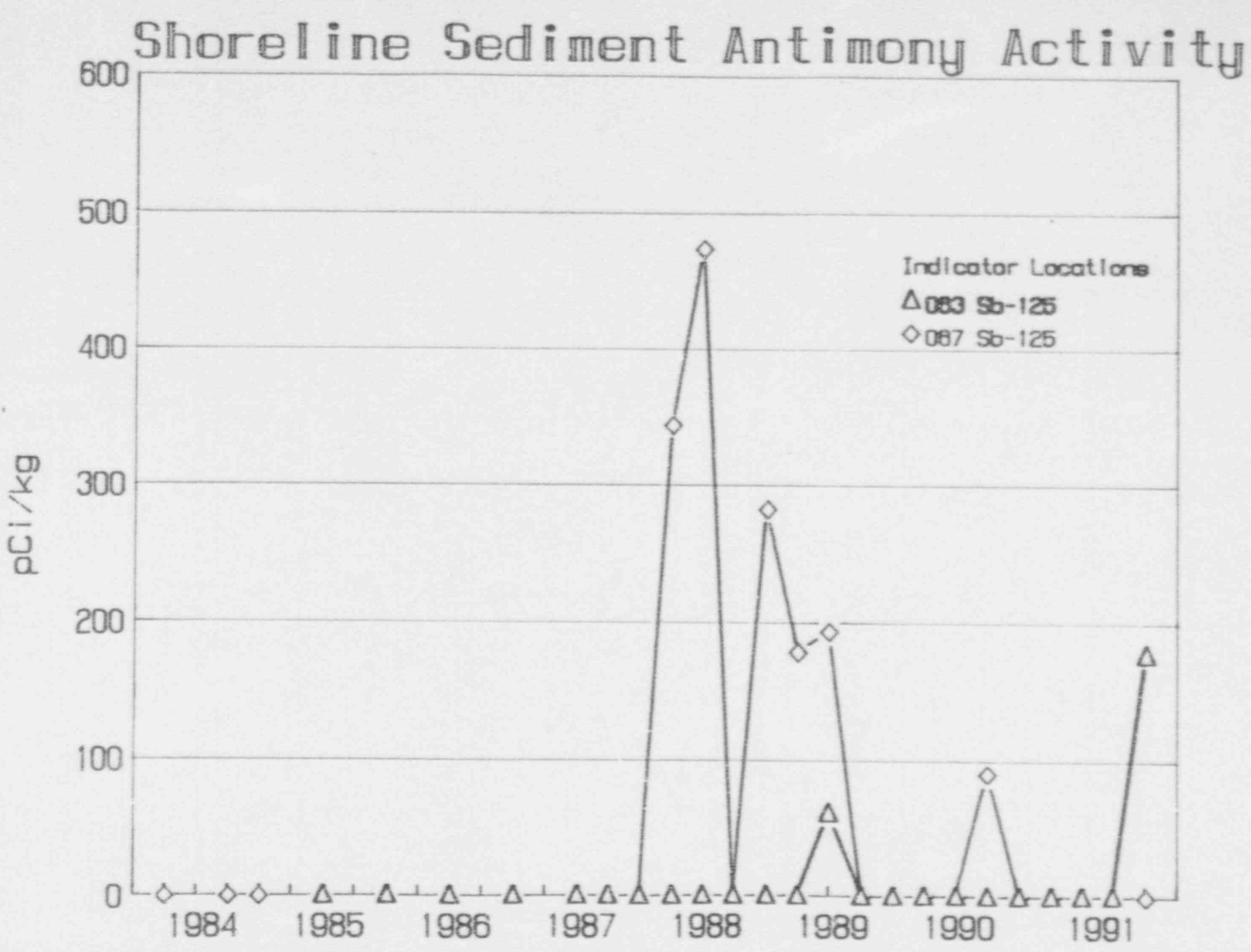
Value in parenthesis is the fraction of detectable measurements. NS = none specified by Selected Licensee Commitments.

TABLE 3.6-2
SHORELINE SEDIMENT
TREND ANALYSIS OF MEAN ANNUAL CONCENTRATIONS
CONCENTRATION (pCi/kg)

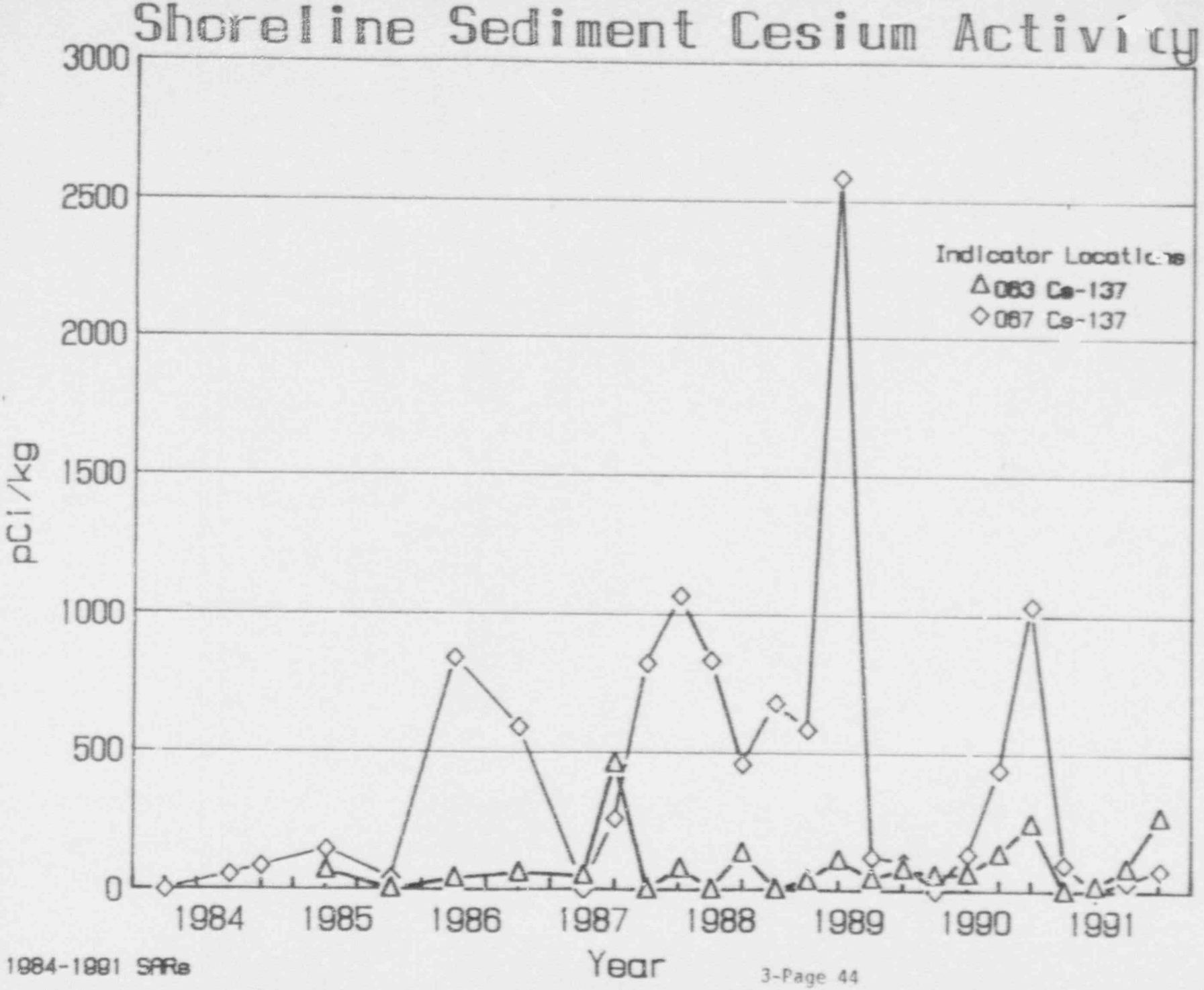
YEAR	Mn-54 INDICATOR	Co-58 INDICATOR	Fe-59 INDICATOR	Co-60 INDICATOR	Zn-65 INDICATOR	Nb-95 INDICATOR	Zr-95 INDICATOR	I-131 INDICATOR	Cs-134 INDICATOR	Cs-137 INDICATOR	BaLa-140 INDICATOR	Ag-110m INDICATOR	Sb-125 INDICATOR
1984	1.10E+01	1.09E+01	0.00E+00	1.19E+01	0.00E+00	3.11E+01	6.05E+01	3.66E+01	7.77E+01	5.16E+01	0.00E+00	0.00E+00	0.00E+00
1985	9.39E+00	1.27E+00	3.82E+01	4.79E+00	0.00E+00	0.00E+00	5.48E+00	4.95E-01	7.63E+01	9.47E+01	9.77E+00	0.00E+00	0.00E+00
1986	2.53E+01	2.38E+00	0.00E+00	2.63E+01	5.61E+00	2.62E+01	3.21E+01	2.68E+01	1.12E+02	5.87E+02	6.80E+00	0.00E+00	0.00E+00
1987	5.40E+01	4.70E+02	0.00E+00	5.07E+02	0.00E+00	0.00E+00	5.80E+01	0.00E+00	1.01E+02	6.22E+02	0.00E+00	3.46E+02	0.00E+00
1988	3.30E+01	1.27E+02	0.00E+00	1.87E+02	6.70E+01	0.00E+00	0.00E+00	0.00E+00	6.60E+01	7.59E+02	0.00E+00	1.62E+02	3.67E+02
1989	2.30E+01	1.24E+02	0.00E+00	1.96E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.40E+01	8.48E+02	0.00E+00	5.50E+01	1.86E+02
1990	3.40E+01	8.00E+01	0.00E+00	2.59E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.50E+01	5.36E+02	0.00E+00	1.71E+02	9.06E+01
1991	3.26E+01	5.60E+01	0.00E+00	8.57E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.91E+01	1.24E+02	0.00E+00	1.10E+02	1.78E+02
Correl. Coeff.	5.03E-01	1.37E-01	-4.12E-01	3.40E-01	6.23E-02	-6.48E-01	-6.58E-01	-6.65E-01	-5.40E-01	3.35E-01	-5.16E-01	3.89E-01	5.72E-01
Trend Prob.	Moderate	Poor	Moderate	Moderate	Poor	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Type Trend	Increase	Increase	Decrease	Increase	Increase	Decrease	Decrease	Decrease	Decrease	Increase	Decrease	Increase	Increase

Note: All negative mean values were replaced with "zeros" for calculational purposes.


Shoreline Sediment Co-60 and Ag-110m Activity
Indicator Locations
063 Co-60
067 Co-60
063-Ag-110m
067 Ag-110m
pCi/kg
600
500
400
300
200
100
0
1984
1985
1986
1987
1988
1989
1990
1991
Year



1984-1991 SARs



1984-1991 SARs

3.7 FISH

Gamma spectroscopy was performed on 12 fish samples. Table 3.7-1 summarizes the radionuclides that were detected. Comparison of data to previous years does not indicate any significant increases in concentrations. There were no 1991 fish sample results determined to have concentrations of radionuclides that exceeded reporting levels.

TABLE 3.7-1
FISH
MEAN ANNUAL CONCENTRATIONS (pCi/kg,wet)

Isotope	1990 Highest Mean	1991 Highest Mean	1991 %Reporting Level	1991 Control Mean	1991 %Reporting Level
Co-58	1.50E1(2/4)	4.59E1(1/4)	0.15%	---(0/4)---	
Cs-134	4.80E1(3/4)	1.25E2(2/4)	12.5%	---(0/4)---	
Cs-137	1.19E2(4/4)	1.94E2(4/4)	9.7%	1.47E1(2/4)	0.74%

Value in parenthesis is the fraction of detectable measurements.

Visual inspection of tabular data from previous environmental report summaries and the 1991 summary did not reveal any increasing trends. Linear regression analysis was applied to radionuclides routinely evaluated for in fish samples. Table 3.7-2 lists the data used. None of the radionuclides indicated a high probability of an increasing trend. Cs-134, Cs-137, and Co-58 results indicated moderate probabilities of an increasing trends. One factor affecting the trend analysis is a change in sampling locations. In 1984, a second downstream fish location was added. Location 063 is closer to the liquid effluent discharge point and has been the highest mean indicator since it was added.

Graphs showing Cesium levels in both bass and catfish were prepared since Cs-134 and Cs-137 are major effluent dose contributors through the fish pathway. Figures 3.7-1 and 3.7-2 contain the graphs displaying individual sample results. Based on these graphs, the levels at the two downstream locations do not appear to be increasing.

K-40 was observed in fish samples in addition to the radionuclides listed in the tables.

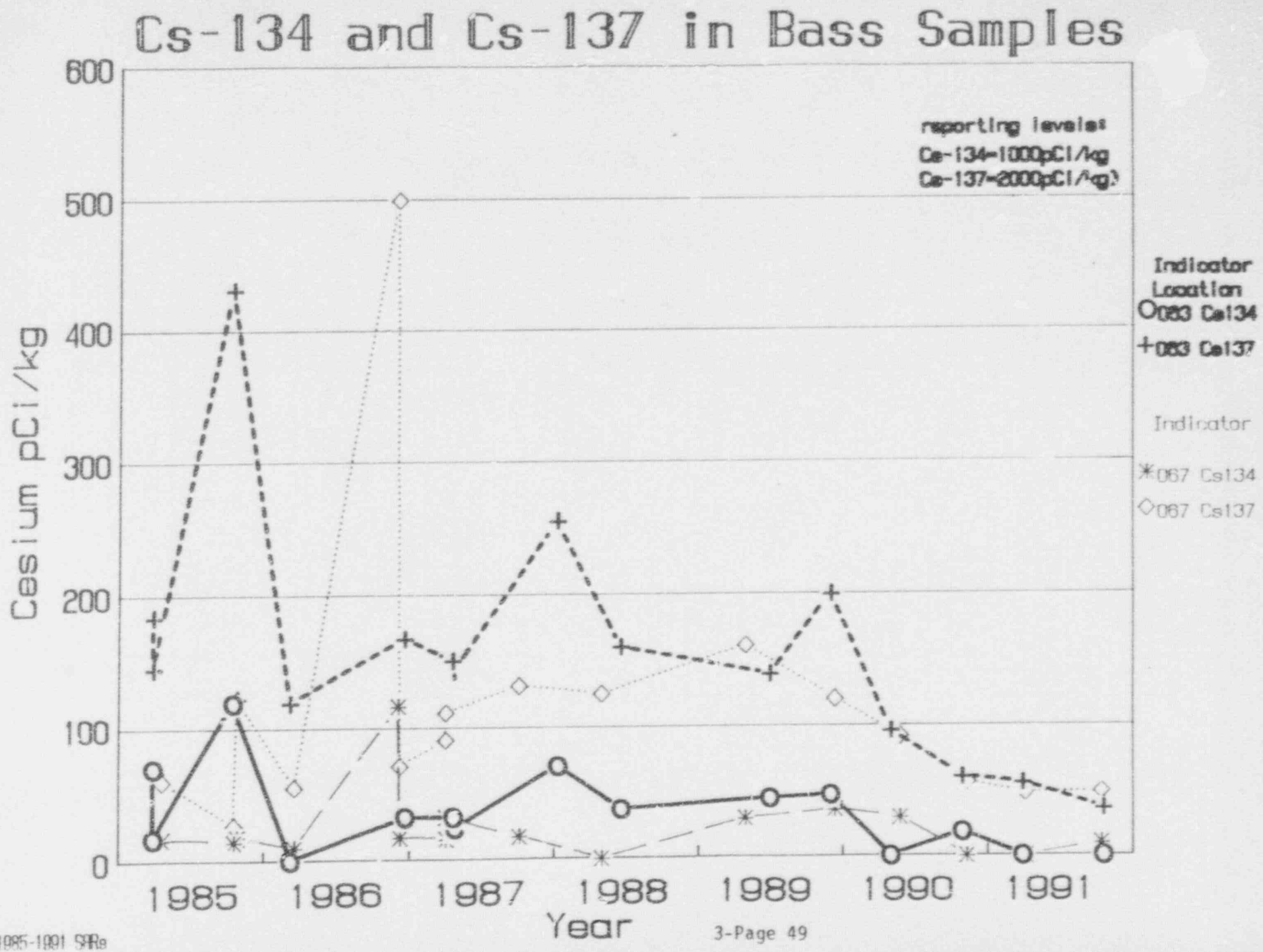
TABLE 3.7-2
FISH
TREND ANALYSIS OF MEAN ANNUAL CONCENTRATIONS
CONCENTRATION (pCi/kg)

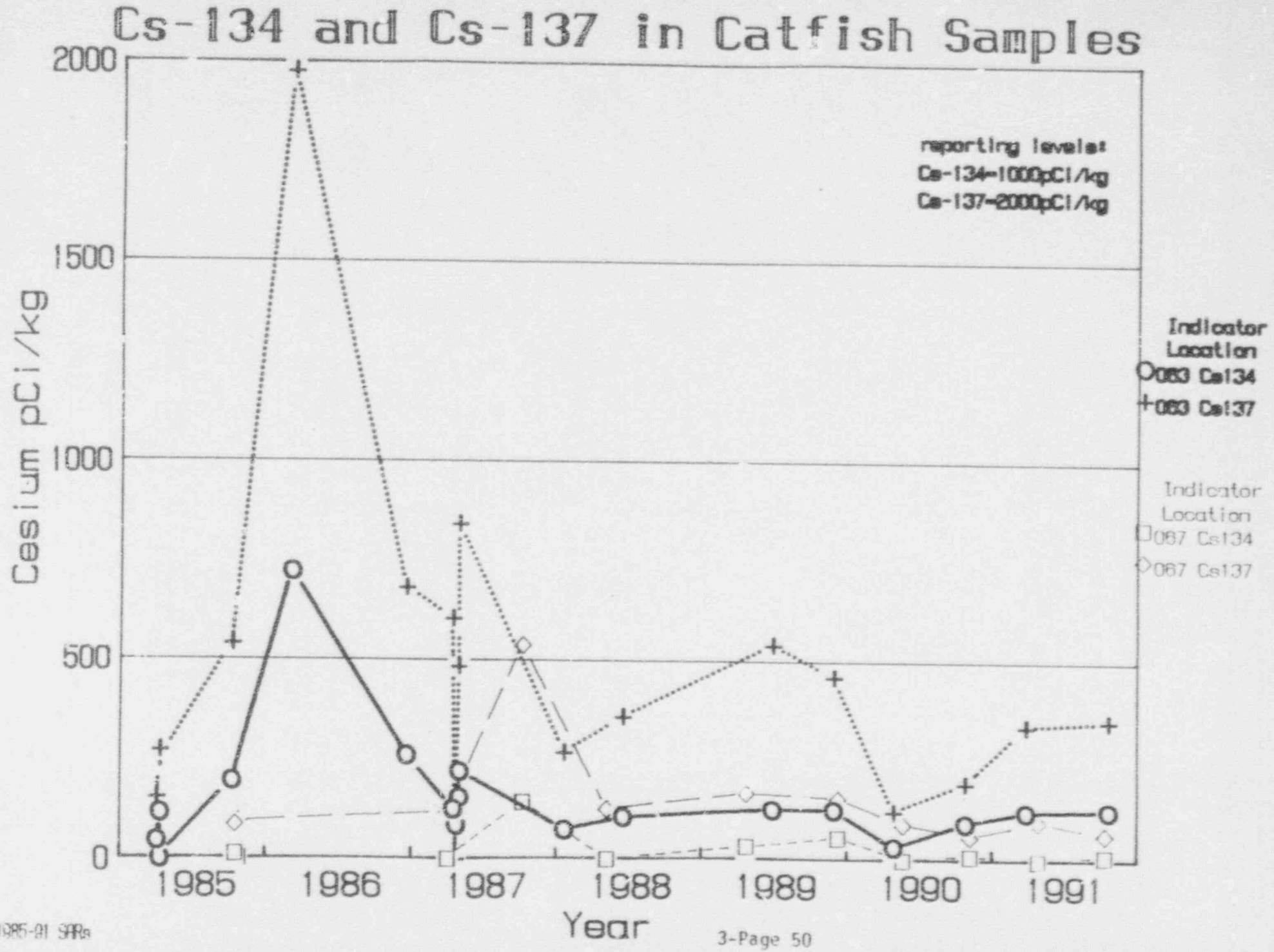
YEAR	Mn-54 INDICATOR	Co-58 INDICATOR	Fe-59 INDICATOR	Co-60 INDICATOR	Zn-65 INDICATOR	Nb-95 INDICATOR	Zr-95 INDICATOR	I-131 INDICATOR	BaLa-140 INDICATOR
1979	0.00E+00	1.91E+00	2.81E+00	1.56E+01	0.00E+00	9.63E+00	9.63E+00	1.72E+01	0.00E+00
1980	3.33E-01	1.45E+01	0.00E+00	1.90E+01	0.00E+00	7.78E+00	7.78E+00	1.29E+01	1.85E+00
1981	0.00E+00	2.25E+01	0.00E+00	1.49E+01	1.93E+01	6.97E+00	0.00E+00	2.54E+01	1.44E+00
1982	0.00E+00	9.83E-01	1.29E+01	8.03E+00	0.00E+00	1.69E+00	0.00E+00	1.66E+01	1.17E+01
1983	0.00E+00	3.35E+01	7.85E-01	4.53E+00	0.00E+00	0.00E+00	7.03E+00	1.49E+00	5.73E+01
1984	4.36E+00	1.21E+02	2.30E+01	6.23E+01	8.27E+00	1.93E+01	7.76E+00	3.56E+01	0.00E+00
1985	2.81E+00	1.62E+01	1.11E+01	1.10E+01	0.00E+00	1.01E+01	1.92E+00	1.41E+01	3.26E-01
1986	0.00E+00	9.56E+01	0.00E+00	2.59E+01	0.00E+00	4.87E+00	0.00E+00	0.00E+00	4.75E+00
1987	2.20E+01	1.63E+02	0.00E+00	6.30E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1988	0.00E+00	9.60E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1989	0.00E+00	4.30E+01	0.00E+00	1.50E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1990	0.00E+00	1.50E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1991	0.00E+00	4.59E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Correlation Coefficient	1.34E-01	3.63E-01	-2.37E-01	-1.33E-01	-3.24E-01	-5.19E-01	-6.60E-01	-6.46E-01	-2.17E-01
Trend Probability	Poor	Moderate	Poor	Poor	Moderate	Moderate	Moderate	Moderate	Poor
Type Trend	Increasing	Increasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing

Note: All negative mean values were replaced with "zeros" for calculational purposes.

TABLE 3.7-2
FISH
TREND ANALYSIS OF MEAN ANNUAL CONCENTRATIONS

YEAR	Cs-134 INDICATOR	Cs-137 INDICATOR
1969	0.00E+00	1.29E+02
1970	0.00E+00	1.66E+02
1971	0.00E+00	1.90E+02
1972	0.00E+00	1.41E+02
1973	0.00E+00	1.89E+02
1974	0.00E+00	1.84E+01
1975	2.16E+01	1.87E+02
1976	2.23E+01	1.66E+02
1977	1.17E+02	3.22E+02
1978	2.76E+02	6.90E+02
1979	7.56E+01	4.09E+02
1980	8.14E+01	3.93E+02
1981	9.19E+01	3.38E+02
1982	1.18E+02	2.94E+02
1983	1.24E+02	3.06E+02
1984	3.79E+02	1.04E+03
1985	8.95E+01	2.93E+02
1986	2.42E+02	7.36E+02
1987	9.80E+01	3.93E+02
1988	7.20E+01	2.60E+02
1989	8.60E+01	3.36E+02
1990	4.80E+01	1.19E+02
1991	1.25E+02	1.94E+02
Correlation Coefficient	4.72E-01	3.30E-01
Trend Probability	Moderate	Moderate
Type Trend	Increasing	Increasing


Cs-134 and Cs-137 in Bass Samples
reporting levels:
Cs-134-1000pCi/kg
Cs-137-2000pCi/kg)
Indicator Location
083 Cs134
083 Cs137
Indicator
067 Cs134
067 Cs137
Cesium pCi/kg
600
500
400
300
200
100
0
1985
1986
1987
1988
1989
1990
1991
Year


Cs-134 and Cs-137 in Catfish Samples
2000
1500
1000
500
0
Cesium pCi/kg
reporting levels:
Cs-134-1000pCi/kg
Cs-137-2000pCi/kg
Indicator Location
063 Cs134
063 Cs137
Indicator Location
067 Cs134
067 Cs137
1985
1986
1987
1988
1989
1990
1991
Year

3.8 DIRECT GAMMA RADIATION

Thermoluminescent Dosimeter (TLD) measurements for direct gamma radiation were made each quarter at forty locations. Many of the TLDs are placed at the same site used by the NRC in their TLD Direct Radiation Monitoring Network. One hundred and fifty-five of the TLDs were recovered and processed. The highest annual mean for an indicator location was 26 millirem per quarter. This TLD was located at indicator location 059, Tamassee DAR School. The annual mean for the control location was 22 millirem per quarter. A graph showing the average quarterly TLD doserate is found in Figure 3.8-1

The test statistic, or t-test, was used to compare the TLD measurements taken during preoperation to those taken during 1991. In this case, the ratios of results from the 1-2 mile radius and the 4-5 mile radius were compared from one year to the next. Since the inner ring of TLD's are most likely to be affected by plant operations, the hypothesis was used that a significant change in the ratio from one year to another would be indicative of an environmental affect, or at least some phenomena requiring further investigation. A statistically significant change in ratio was determined by comparing the calculated t-value to expected values of the t-statistic based on the number of measurements and the desired accuracy of the results.

The value of t-statistic was calculated by comparing preoperational results to 1991. As shown in Table 3.8-1 the t-value was -1.781. This compared well to the expected value of the t-statistic, -2.030, based on 35 measurements and 95% confidence in the result. Therefore, it can be concluded that the doserates measured around Oconee during 1991 do not differ significantly with those existing during preoperation (Table 3.8-2).

Table 3.8-1

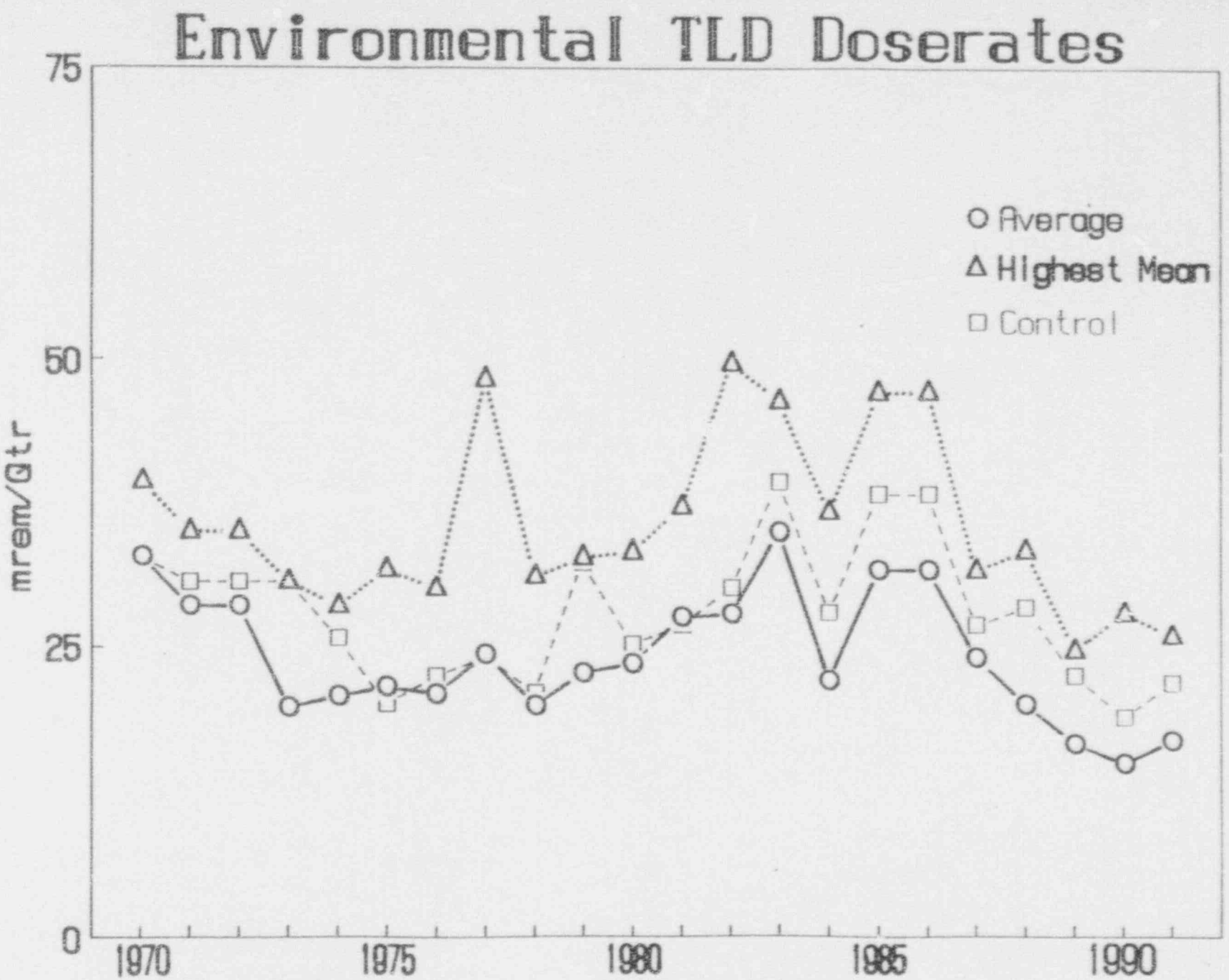
Comparison of Inner Ring/Outer Ring TLD Results

	1991 (mR/qtr)	Preop (mR/qtr)
Inner Ring	15.29	28.27
Outer Ring	16.24	30.98
Ratio	0.94	0.91
t-value	-1.781	
t-statistic	-2.030	

TABLE 3.8-2
DIRECT RADIATION AS MEASURED BY TLDS
MEAN ANNUAL DOSE RATES

DOSE RATE MREM/QTR

YEAR	MREM/QTR INDICATOR
1970	3.94E+01
1971	3.50E+01
1972	3.50E+01
1973	3.07E+01
1974	2.85E+01
1975	3.18E+01
1976	3.00E+01
1977	4.82E+01
1978	3.11E+01
1979	3.29E+01
1980	3.33E+01
1981	3.72E+01
1982	4.97E+01
1983	4.64E+01
1984	3.68E+01
1985	4.71E+01
1986	4.71E+01
1987	3.18E+01
1988	3.35E+01
1989	2.48E+01
1990	2.80E+01
1991	2.60E+01


Environmental TLD Doserates
75
50
25
0
mrem/Qtr
1970
1975
1980
1985
1990
Year
Average
Highest Mean
Control
5/2/90,05778.00 and AREOP

3.9 LAND USE CENSUS

The Land Use Census was conducted during August in 1991. The census results are contained in Table 3.9-1. Milk animals were identified in sectors other than the one where milk samples were being collected, however the milk was not being used for human consumption. No changes to the program were made during 1991.

TABLE 3.3-1

LAND USE CENSUS DATA SHEET

Dates(s) Performed: 8-7-91 through 8-13-91

Sector		Distance (Miles)	Sector		Distance (Miles)
N	Nearest Residence	3.5	S	Nearest Residence	1.75
	Nearest Meat Animal	-		Nearest Meat Animal	-
	Nearest Cow	-		Nearest Cow	-
	Nearest Goat	-		Nearest Goat	-
NNE	Nearest Residence	2.25	SSW	Nearest Residence	1.0
	Nearest Meat Animal	-		Nearest Meat Animal	-
	Nearest Cow	-		Nearest Cow	-
	Nearest Goat	3.25*		Nearest Goat	-
NE	Nearest Residence	1.25	SW	Nearest Residence	1.5
	Nearest Meat Animal	-		Nearest Meat Animal	-
	Nearest Cow	3.5*		Nearest Cow	-
	Nearest Goat	3.5*		Nearest Goat	-
ENE	Nearest Residence	1.0	WSW	Nearest Residence	1.5
	Nearest Meat Animal	3.5		Nearest Meat Animal	2.5
	Nearest Cow	3.5*		Nearest Cow	2.5*
	Nearest Goat	-		Nearest Goat	-
E	Nearest Residence	1.0	W	Nearest Residence	1.75
	Nearest Meat Animal	2.75		Nearest Meat Animal	-
	Nearest Cow	2.75*		Nearest Cow	-
	Nearest Goat	-		Nearest Goat	-
ESE	Nearest Residence	1.0	WNW	Nearest Residence	1.75
	Nearest Meat Animal	2.25		Nearest Meat Animal	3.5
	Nearest Cow	2.25*		Nearest Cow	4.5
	Nearest Goat	4.75*		Nearest Goat	-
SE	Nearest Residence	1.75	NW	Nearest Residence	1.5
	Nearest Meat Animal	4.75		Nearest Meat Animal	-
	Nearest Cow	4.75*		Nearest Cow	-
	Nearest Goat	-		Nearest Goat	-
SSE	Nearest Residence	1.4	NNW	Nearest Residence	1.0
	Nearest Meat Animal	-		Nearest Meat Animal	-
	Nearest Cow	-		Nearest Cow	-
	Nearest Goat	-		Nearest Goat	-

*Milk not used for human consumption.

SECTION 4.

EVALUATION OF DOSE FROM ENVIRONMENTAL MEASUREMENTS VERSUS ESTIMATED DOSE FROM RELEASES

4.1 DOSE FROM ENVIRONMENTAL MEASUREMENTS

Doses were estimated for measured concentrations of radionuclides in direct pathways to man using NRC Regulatory Guide 1.109 methodology and factors. NUREG/CR-1276 Appendix C dose factors were used when a radionuclide was not listed in Regulatory Guide 1.109. A dose factor of zero was used when the Guides listed "NO DATA" for a factor. The highest annual mean values for each sample type and radionuclide as given in Section 3 and Appendix B were used after the background concentrations, as measured at the control location, had been subtracted. The high mean and control mean are conservatively based on detectable measurements only. The maximum exposed individual doses are summarized in Table 4.1. The individual population and pathway dose calculations are contained in Table 4.2.

4.2 ESTIMATED DOSE FROM RELEASES

Doses were estimated for released concentrations of radionuclides in direct pathways to man using NRC Regulatory Guide 1.109 methodology. The doses were calculated using GASPAR and LADTAP computer programs. The maximum exposed individual doses are summarized in Table 4.1.

4.3 COMPARISON OF DOSES

The environmental and release data doses given in Table 4.1 agree reasonably well. The similarity of the doses indicate that the radioactivity levels in the environment do not differ significantly from those expected based on effluent measurements and modeling of the environmental exposure pathways.

Upon further review of the 1990 and 1991 doses from environmental measurement and estimated doses from ingestion, it was noted that in 1991 the environmental doses were more frequently the slightly higher of the two values. After examining the individual pathway doses it was determined that this difference in 1991 was due to the fish pathway. Out of all locations and all the fish sampled, the bottom feeder (catfish) at location 063 would be expected to have the higher activity. (This was noted in section 3.7). This is the case in 1991 with location 063 being the fish high mean indicator location. It is recognized that the Co-58, Cs-134, and Cs-137 radionuclides in fish demonstrate a moderate increasing trend by linear regression analysis (Table 3.7-2). These trends are also supported by the trends noted for shoreline sediment. In Table 4.1, the doses from environmental measurements are higher than the estimated effluent doses when fish is the critical pathway. Considering the above noted trends, the sample type and the location where the sample was collected, this was an expected result and it will continue to be closely monitored.

Drinking water, shoreline sediment, and fish sample results were summed to determine the maximum total doses for all sampled liquid release pathways. Likewise, airborne radioiodine, airborne particulate, milk, and broadleaf vegetation sample results were summed to determine the maximum total doses for all sampled gaseous release pathways.

The doses calculated do not exceed the 40 CFR 190 annual dose commitment limits for members of the public.

TABLE 4.1

1991 ENVIRONMENTAL AND EFFLUENT DOSES

Liquid Release Pathway

Organ	Environmental or Effluent Data	Critical Age	Critical Pathway	Maximum Dose (mrem/yr)
Skin	Environ.	Teen	Shoreline Sediment	3.70E-3
Skin	Effluent	Teen	Shoreline Sediment	9.68E-3
Bone	Environ.	Child	Fish	6.08E-1
Bone	Effluent	Child	Fish	3.39E-1
Liver	Environ.	Teen	Fish	8.33E-1
Liver	Effluent	Teen	Fish	4.74E-1
T.Body	Environ.	Adult	Fish	6.01E-1
T.Body	Effluent	Adult	Fish	3.57E-1
Thyroid	Environ.	Child	Drinking	5.78E-2
Thyroid	Effluent	Infant	Drinking	2.02E-1
Kidney	Environ.	Teen	Fish	2.80E-1
Kidney	Effluent	Child	Fish	1.96E-1
Lung	Environ.	Teen	Fish	1.13E-1
Lung	Effluent	Child	Drinking	1.16E-1
GI-LLI	Environ.	Child	Drinking	5.78E-2
GI-LLI	Effluent	Adult	Fish	2.33E-1

1991 ENVIRONMENTAL AND EFFLUENT DOSES

Gaseous Release Pathway

Noble Gas Exposure

Organ	Environmental or Effluent Data	Critical Age	Critical Pathway	Maximum Dose (mrem/yr)
Skin	Environ.	-	-	Noble Gas Not Sampled
Skin	Effluent	N/A	Noble Gas Exposure	4.29E-2
T.Body	Environ.	-	-	Noble Gas Not Sampled
T.Body	Effluent	N/A	Noble Gas Exposure	1.58E-2

Iodine, Particulate, and Tritium Exposure

Organ	Environmental or Effluent Data	Critical Age	Critical Pathway	Maximum Dose (mrem/yr)
Bone	Environ.	Infant	Milk	8.60E-1
Liver	Environ.	Infant	Milk	1.01E0
T.Body	Environ.	Adult	Milk	1.10E-1
Thyroid	Environ.	-	-	0.00E0
Thyroid	Effluent	Infant	Goat Milk	2.26E-1
Kidney	Environ.	Infant	Milk	2.70E-1
Lung	Environ.	Infant	Milk	1.09E-1
GI-LLI	Environ.	Teen	Milk	4.23E-3

Table 4.2

Dose from Inhalation Pathway for 1991 Data

Maximum Exposed Adult

Breathing rate = 8000 m3/yr

Radionuclide	Adult Inhalation Dose Factor (mrem per pCi inhaled) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Highest Ann. Mean Location Dist/ Direction	Conc. in Air (pCi/m)	Dose (mrem/yr) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54 Particulate	NO DATA	4.95E-06	7.87E-07	NO DATA	1.23E-06	1.75E-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 Particulate	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 Particulate	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 Particulate	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 Particulate	4.05E-06	1.29E-05	5.82E-06	NO DATA	8.62E-06	1.38E-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 Particulate	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 Particulate	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 Particulate	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
I-131 Charcoal	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 Particulate	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 Particulate	5.98E-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
Ba-La-140 Particulate	4.88E-06	2.17E-08	3.21E-07	NO DATA	2.09E-09	1.59E-04	5.73E-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 (mrem/yr) =		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Dose from Inhalation Pathway for 1991 Data

Maximum Exposed Teenager

Breathing rate = 8000 m3/yr

Radionuclide	Teenager Inhalation Dose Factor (mrem per pCi inhaled) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Highest Ann. Mean Location Dist/ Direction	Conc. in Air (pCi/m)	Dose (mrem/yr) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54 Particulate	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 Particulate	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 Particulate	1.99E-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 Particulate	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 Particulate	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 Particulate	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 Particulate	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 Particulate	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
I-131 Charcoal	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 Particulate	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 Particulate	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 Particulate	6.84E-06	2.95E-08	4.40E-07	NO DATA	2.85E-09	2.54E-04	6.09E-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 (mrem/yr) =		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4.2 (continued)

Dose from Inhalation Pathway for 1991 Data

Maximum Exposed Child

Breathing rate = 3700 m3/yr

Radionuclide	Child Inhalation Dose Factor (mrem per pCi inhaled) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Highest Ann. Mean Location Dist/ Direction	Conc. in Air (pCi/m)	Dose (mrem/yr) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54 Particulate	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 Particulate	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 Particulate	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 Particulate	NO DATA	3.55E-06	6.12E-06	NO DATA	NO DATA	1.91E-03	2.60E-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 Particulate	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 Particulate	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 Particulate	5.13E-05	1.13E-05	1.00E-05	NO DATA	1.61E-05	6.03E-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 Particulate	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
I-131 Charcoal	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 Particulate	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 Particulate	2.13E-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 Particulate	2.00E-05	6.08E-08	1.17E-06	NO DATA	5.71E-09	4.71E-04	6.10E-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 (mrem/yr) =		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Dose from Inhalation Pathway for 1991 Data

Maximum Exposed Infant

Breathing rate = 1400 m3/yr

Radionuclide	Infant Inhalation Dose Factor (mrem per pCi inhaled) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Highest Ann. Mean Location Dist/ Direction	Conc. in Air (pCi/m)	Dose (mrem/yr) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54 Particulate	NO DATA	1.81E-05	3.56E-06	NO DATA	3.56E-06	7.14E-04	5.04E-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
Co-58 Particulate	NO DATA	8.71E-07	1.30E-06	NO DATA	NO DATA	5.55E-04	7.95E-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 Particulate	9.69E-06	1.68E-05	6.77E-06	NO DATA	NO DATA	7.25E-04	1.77E-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 Particulate	NO DATA	5.73E-06	8.41E-06	NO DATA	NO DATA	3.22E-03	2.28E-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 Particulate	1.38E-05	4.47E-05	2.22E-05	NO DATA	2.32E-05	4.62E-04	3.67E-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
Nb-95 Particulate	1.12E-05	4.59E-06	2.70E-06	NO DATA	3.37E-06	3.42E-04	9.05E-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
Zr-95 Particulate	8.24E-05	1.99E-05	1.45E-05	NO DATA	2.22E-05	1.25E-03	1.55E-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 Particulate	2.71E-05	3.17E-05	1.40E-05	1.06E-02	3.70E-05	NO DATA	7.56E-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
I-131 Charcoal	2.71E-05	3.17E-05	1.40E-05	1.06E-02	3.70E-05	NO DATA	7.56E-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 Particulate	2.83E-04	5.02E-04	5.32E-05	NO DATA	1.36E-04	5.69E-05	9.53E-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-137 Particulate	3.92E-04	4.37E-04	3.25E-05	NO DATA	1.23E-04	5.09E-05	9.53E-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 Particulate	4.00E-05	1.43E-07	2.07E-06	NO DATA	9.59E-09	1.14E-03	6.06E-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 (mrem/yr) =		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 4.2 (continued)

Dose from Drinking Water Pathway for 1991 Data

Maximum Exposed Adult

Usage (intake rate) = 730 L/yr

Radionuclide	Adult Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Highest Ann. Mean Location Dist/ Direction	Conc. in Water (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	3.40E-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-58	NO DATA	7.45E-07	1.67E-06	NO DATA	NO DATA	NO DATA	1.51E-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	4.34E-06	1.02E-05	3.91E-06	NO DATA	NO DATA	2.85E-06	3.40E-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	2.14E-06	4.72E-06	NO DATA	NO DATA	NO DATA	4.02E-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	4.84E-06	1.54E-05	6.96E-06	NO DATA	1.03E-05	NO DATA	9.70E-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	6.22E-09	3.46E-09	1.86E-09	NO DATA	3.42E-09	NO DATA	2.10E-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	3.04E-08	9.75E-09	6.60E-09	NO DATA	1.53E-08	NO DATA	3.09E-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	4.16E-06	5.95E-06	3.41E-06	1.95E-03	1.02E-05	NO DATA	1.57E-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-134	6.22E-05	1.48E-04	1.21E-04	NO DATA	4.79E-05	1.59E-05	2.59E-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	7.97E-05	1.09E-04	7.14E-05	NO DATA	3.70E-05	1.23E-05	2.11E-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	2.03E-05	2.55E-08	1.33E-06	NO DATA	8.67E-09	1.46E-08	9.25E-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
H-3	NO DATA	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	G66 19.0mi/SSE	5.58E+02	0.00E+00	4.28E-02	4.28E-02	4.28E-02	4.28E-02	4.28E-02	4.28E-02
								Total Dose (mrem/yr)=		0.00E+00	4.28E-02	4.28E-02	4.28E-02	4.28E-02	4.28E-02	4.28E-02

Dose from Drinking Water Pathway for 1991 Data

Maximum Exposed Teenager

Usage (intake rate) = 510 L/yr

Radionuclide	Teenager Ingestion Dose Factor (mrem per pCi ingested)							Highest Ann. Mean		Dose (mrem/yr)						
	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Location Dist/ Direction	Conc. in Water (pCi/L)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	5.90E-06	1.17E-06	NO DATA	1.76E-06	NO DATA	1.21E-05	ALL	0.00E+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	9.72E-07	2.24E-06	NO DATA	NO DATA	NO DATA	1.34E-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	5.87E-06	1.37E-05	5.29E-06	NO DATA	NO DATA	4.32E-06	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
Co-60	NO DATA	2.81E-06	6.33E-06	NO DATA	NO DATA	NO DATA	3.66E-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	5.76E-06	2.00E-05	9.33E-06	NO DATA	1.28E-05	NO DATA	8.47E-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	8.22E-09	4.56E-09	2.51E-09	NO DATA	4.42E-09	NO DATA	1.95E-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	4.12E-08	1.30E-08	8.94E-09	NO DATA	1.91E-08	NO DATA	3.00E-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
I-131	5.85E-06	8.19E-06	4.40E-06	2.39E-03	1.41E-05	NO DATA	1.62E-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-134	8.37E-05	1.97E-04	9.14E-05	NO DATA	6.26E-05	2.39E-05	2.45E-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	1.12E-04	1.49E-04	5.19E-05	NO DATA	5.07E-05	1.97E-05	2.12E-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	2.84E-05	3.48E-08	1.83E-06	NO DATA	1.18E-08	2.34E-08	9.82E-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
H-3	NO DATA	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07	066 19.0mi/SSE	5.58E+02	0.00E+00	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02
							Total Dose (mrem/yr)=			0.00E+00	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02	3.02E-02

Dose from Drinking Water Pathway for 1991 Data

Maximum Exposed Child

Usage (intake rate) = 510 kg/yr

Radionuclide	Child Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Highest Ann. Mean Conc. in Water Location Dist/ Direction	(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	0.00E+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	1.80E-06	5.51E-06	NO DATA	NO DATA	NO DATA	1.05E-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	1.65E-05	2.67E-05	1.33E-05	NO DATA	NO DATA	7.74E-06	2.78E-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	5.29E-06	1.56E-05	NO DATA	NO DATA	NO DATA	2.93E-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	1.37E-05	3.65E-05	2.27E-05	NO DATA	2.30E-05	NO DATA	6.41E-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	2.25E-08	8.76E-09	6.26E-09	NO DATA	8.23E-09	NO DATA	1.62E-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	1.16E-07	2.55E-08	2.27E-08	NO DATA	3.65E-08	NO DATA	2.66E-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	1.72E-05	1.73E-05	9.83E-06	5.72E-03	2.84E-05	NO DATA	1.54E-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-134	2.34E-04	3.84E-04	8.10E-05	NO DATA	1.19E-04	4.27E-05	2.07E-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	3.27E-04	3.13E-04	4.62E-05	NO DATA	1.02E-04	3.67E-05	1.96E-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	8.31E-05	7.28E-08	4.85E-06	NO DATA	2.37E-08	4.34E-08	9.84E-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
H-3	NO DATA	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07	066 19.9mi/SSE	5.58E+02	0.00E+00	5.78E-02	5.78E-02	5.78E-02	5.78E-02	5.78E-02	5.78E-02
								Total Dose (mrem/yr)=		0.00E+00	5.78E-02	5.78E-02	5.78E-02	5.78E-02	5.78E-02	5.78E-02

Dose from Drinking Water Pathway for 1991 Data

Maximum Exposed Infant

Usage (intake rate) = 330 L/yr

Radionuclide	Infant ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Highest Ann. Mean Location Dist/ Direction	Conc. in Water (pCi/L)	Dose (mrem/yr) 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	0.00E+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	3.[illegible]9E-06	8.5[illegible]3-06	NO DATA	NO DATA	NO DATA	8.97E-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	3.08E-05	5.31E-05	2.12E-05	NO DATA	NO DATA	1.59E-05	2.57E-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	1.08E-05	2.55E-05	NO DATA	NO DATA	NO DATA	2.57E-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	1.84E-05	6.31E-05	2.91E-05	NO DATA	3.06E-05	NO DATA	5.33E-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
Nb-95	4.20E-08	1.73E-08	1.09E-08	NO DATA	1.24E-08	NO DATA	1.46E-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	2.06E-07	5.02E-08	3.56E-08	NO DATA	5.41E-08	NO DATA	2.50E-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	3.59E-05	4.23E-05	1.86E-05	1.39E-02	4.94E-05	NO DATA	1.51E-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-134	3.77E-04	7.03E-04	7.10E-05	NO DATA	1.81E-04	7.42E-05	1.91E-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	5.22E-04	6.11E-04	4.33E-05	NO DATA	1.64E-04	6.64E-05	1.91E-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	1.71E-04	1.71E-07	8.81E-06	NO DATA	4.06E-08	1.05E-07	9.77E-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
H-3	NO DATA	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07	066 19.0mi/SSE	5.58E+02	0.00E+00	5.67E-02	5.67E-02	5.67E-02	5.67E-02	5.67E-02	5.67E-02
								Total Dose (mrem/yr) =		0.00E+00	5.67E-02	5.67E-02	5.67E-02	5.67E-02	5.67E-02	5.67E-02

Table 4.2 (continued)

Dose from Milk Pathway for 1991 Data

Maximum Exposed Adult

Usage (intake rate) = 310 L/yr

Radionuclide	Adult Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Highest Ann. Mean Conc. in Milk Location Dist/ Direction	(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	0.00E+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	7.45E-07	1.67E-06	NO DATA	NO DATA	NO DATA	1.51E-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	4.34E-06	1.02E-05	3.91E-06	NO DATA	NO DATA	2.85E-06	3.40E-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	2.14E-06	4.72E-06	NO DATA	NO DATA	NO DATA	4.03E-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	4.84E-06	1.54E-05	6.96E-06	NO DATA	1.03E-05	NO DATA	9.70E-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	6.22E-09	3.46E-09	1.86E-09	NO DATA	3.42E-09	NO DATA	2.10E-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	3.04E-08	9.75E-09	6.60E-09	NO DATA	1.53E-08	NO DATA	3.09E-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	4.16E-06	5.95E-06	3.41E-06	1.95E-03	1.02E-05	NO DATA	1.57E-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-134	6.22E-05	1.48E-04	1.21E-04	NO DATA	4.79E-05	1.59E-05	2.59E-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	7.97E-05	1.09E-04	7.14E-05	NO DATA	3.70E-05	1.23E-05	2.11E-06	069 4.5mi/WNW	4.99E+00	1.23E-01	1.69E-01	1.10E-01	0.00E+00	5.72E-02	1.90E-02	3.26E-03
BaLa-140	2.03E-05	2.55E-08	1.33E-06	NO DATA	8.67E-09	1.46E-08	9.25E-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 (mrem/yr) =		1.23E-01	1.69E-01	1.10E-01	0.00E+00	5.72E-02	1.90E-02	3.26E-03

Dose from Milk Pathway for 1991 Data

Maximum Exposed Teenager

Usage (intake rate) = 400 L/yr

Radionuclide	Teenager Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Highest Ann. Mean Location Dist/ Direction	Conc. in 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-05	NO DATA	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
Co-58	NO DATA	9.72E-07	2.24E-06	NO DATA	NO DATA	NO DATA	1.34E-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	5.87E-06	1.37E-05	5.29E-06	NO DATA	NO DATA	4.32E-06	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
Co-60	NO DATA	2.81E-06	6.33E-06	NO DATA	NO DATA	NO DATA	3.66E-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	5.7[illegible]-06	2.00E-05	9.33E-06	NO DATA	1.28E-05	NO DATA	8.47E-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	8.22E-09	4.56E-09	2.51E-09	NO DATA	4.42E-09	NO DATA	1.95E-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	4.12E-08	1.30E-08	8.94E-09	NO DATA	1.91E-08	NO DATA	3.00E-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
I-131	5.85E-06	8.19E-06	4.40E-06	2.39E-03	1.41E-05	NO DATA	1.62E-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-134	8.37E-05	1.97E-04	9.14E-05	NO DATA	6.26E-05	2.39E-05	2.45E-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	1.12E-04	1.49E-04	5.19E-05	NO DATA	5.07E-05	1.97E-05	2.12E-06	069 4.5mi/WNW	4.99E+00	2.24E-01	2.97E-01	1.04E-01	0.00E+00	1.01E-01	3.93E-02	4.23E-03
BaLa-140	2.84E-05	3.48E-08	1.83E-06	NO DATA	1.18E-08	2.34E-08	9.82E-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 (mrem/yr) =		2.24E-01	2.97E-01	1.04E-01	0.00E+00	1.01E-01	3.93E-02	4.23E-03

Dose from Milk Pathway for 1991 Data

Maximum Exposed Child

Usage (intake rate) = 330 kg/yr

Radionuclide	Child Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Highest Ann. Mean Location Dist/ Direction	Conc. in Milk (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	0.00E+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	1.80E-06	5.51E-06	NO DATA	NO DATA	NO DATA	1.05E-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	1.65E-05	2.67E-05	1.33E-05	NO DATA	NO DATA	7.74E-06	2.78E-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	5.29E-06	1.56E-05	NO DATA	NO DATA	NO DATA	2.93E-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	1.37E-05	3.65E-05	2.27E-05	NO DATA	2.30E-05	NO DATA	6.41E-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	2.25E-08	8.76E-09	6.26E-09	NO DATA	8.23E-09	NO DATA	1.62E-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	1.16E-07	2.55E-08	2.27E-08	NO DATA	3.65E-08	NO DATA	2.66E-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	1.72E-05	1.73E-05	9.83E-06	5.72E-03	2.84E-05	NO DATA	1.54E-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-134	2.34E-04	3.84E-04	8.10E-05	NO DATA	1.19E-04	4.27E-05	2.07E-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	3.27E-04	3.13E-04	4.62E-05	NO DATA	1.02E-04	3.67E-05	1.96E-06	069 4.5mi/WNW	4.99E+00	5.38E-01	5.15E-01	7.61E-02	0.00E+00	1.68E-01	6.04E-02	3.23E-03
BaLa-140	8.31E-05	7.28E-08	4.85E-06	NO DATA	2.37E-08	4.34E-08	9.84E-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 (mrem/yr) =		5.38E-01	5.15E-01	7.61E-02	0.00E+00	1.68E-01	6.04E-02	3.23E-03

Dose from Milk Pathway for 1991 Data

Maximum Exposed Infant

Usage (intake rate) = 330 L/yr

Radionuclide	Infant Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Highest Ann. Mean Location Dist/ Direction	Conc. in Milk (pCi/L)	Dose (mrem/yr) 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	0.00E+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	3.60E-06	8.93E-06	NO DATA	NO DATA	NO DATA	8.97E-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	3.08E-05	5.38E-05	2.12E-05	NO DATA	NO DATA	1.59E-05	2.57E-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	1.08E-05	2.55E-05	NO DATA	NO DATA	NO DATA	2.57E-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	1.84E-05	6.31E-05	2.91E-05	NO DATA	3.06E-05	NO DATA	5.33E-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
Nb-95	4.20E-08	1.73E-08	1.00E-08	NO DATA	1.24E-08	NO DATA	1.46E-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	3.59E-05	4.23E-05	1.86E-05	1.39E-02	4.94E-05	NO DATA	1.51E-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
Zr-95	2.06E-07	5.02E-08	3.56E-08	NO DATA	5.41E-08	NO DATA	2.50E-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
Cs-134	3.77E-04	7.03E-04	7.10E-05	NO DATA	1.81E-04	7.42E-05	1.91E-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	5.22E-04	6.11E-04	4.33E-05	NO DATA	1.64E-04	6.64E-05	1.91E-06	089 4.5mi/WNW	4.99E+00	8.60E-01	1.01E+00	7.13E-02	0.00E+00	2.70E-01	1.09E-01	3.15E-03
Ba-140	1.71E-04	1.71E-07	8.81E-06	NO DATA	4.06E-03	1.05E-07	9.77E-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 (mrem/yr) =		8.60E-01	1.01E+00	7.13E-02	0.00E+00	2.70E-01	1.09E-01	3.15E-03

Dose from Broadleaf Veg. Pathway for 1991 Data

Maximum Exposed Adult

Usage (intake rate) = 64 kg/yr

Radionuclide	Adult Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Highest Ann. Mean Location Dist/ Direction	Conc. in Vegetation (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	0.00E+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	7.45E-07	1.67E-06	NO DATA	NO DATA	NO DATA	1.51E-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	4.34E-06	1.02E-05	3.91E-06	NO DATA	NO DATA	2.85E-06	3.40E-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	2.14E-06	4.72E-06	NO DATA	NO DATA	NO DATA	4.02E-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	4.84E-06	1.54E-05	6.96E-06	NO DATA	1.03E-05	NO DATA	9.70E-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	6.22E-09	3.46E-09	1.86E-09	NO DATA	3.42E-09	NO DATA	2.10E-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	3.04E-08	9.75E-09	6.60E-09	NO DATA	1.53E-08	NO DATA	3.09E-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	4.16E-06	5.95E-06	3.41E-06	1.95E-03	1.02E-05	NO DATA	1.57E-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-134	6.22E-05	1.48E-04	1.21E-04	NO DATA	4.79E-05	1.59E-05	2.59E	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	7.97E-05	1.09E-04	7.14E-05	NO DATA	3.70E-05	1.23E-05	2.11E-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	2.03E-05	2.55E-08	1.33E-06	NO DATA	8.67E-09	1.46E-08	9.25E-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 (mrem/yr)=		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Dose from Broadleaf Veg. Pathway for 1991 Data

Maximum Exposed Teenager

Usage (intake rate) = 42 kg/yr

Radionuclide	Teenager Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Highest Ann. Mean Location Dist/ Direction	Conc. in Vegetation (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	0.00E+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	9.72E-07	2.24E-06	NO DATA	NO DATA	NO DATA	1.34E-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	5.87E-06	1.37E-05	5.29E-06	NO DATA	NO DATA	4.32E-06	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
Co-60	NO DATA	2.81E-06	6.33E-06	NO DATA	NO DATA	NO DATA	3.66E-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	5.76E-06	2.00E-05	9.33E-06	NO DATA	1.28E-05	NO DATA	8.47E-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	8.22E-09	8.56E-09	2.51E-09	NO DATA	4.42E-09	NO DATA	1.95E-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	4.12E-08	1.30E-08	8.94E-09	NO DATA	1.91E-08	NO DATA	3.00E-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
I-131	5.85E-06	8.19E-06	4.40E-06	2.39E-03	1.41E-05	NO DATA	1.62E-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-134	8.37E-05	1.97E-04	9.14E-05	NO DATA	6.26E-05	2.39E-05	2.45E-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	1.12E-04	1.49E-04	5.19E-05	NO DATA	5.07E-05	1.97E-05	2.12E-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	2.84E-05	3.48E-08	1.83E-06	NO DATA	1.18E-08	2.34E-08	9.82E-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 (mrem/yr)=			0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Dose from Broadleaf Veg. Pathway for 1991 Data

Maximum Exposed Child

Usage (intake rate) = 26 kg 26 kg/yr

Radionuclide	Child Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Highest Ann. Mean Location Dist/ Direction	Conc. in Vegetation (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	0.00E+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	1.80E-06	5.51E-06	NO DATA	NO DATA	NO DATA	1.05E-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	1.65E-05	2.67E-05	1.33E-05	NO DATA	NO DATA	7.74E-06	2.78E-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	5.29E-06	1.56E-05	NO DATA	NO DATA	NO DATA	2.93E-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	1.37E-05	3.65E-05	2.27E-05	NO DATA	2.30E-05	NO DATA	6.41E-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	2.25E-08	8.76E-09	6.26E-09	NO DATA	8.23E-09	NO DATA	1.62E-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	1.16E-07	2.55E-08	2.27E-08	NO DATA	3.65E-08	NO DATA	2.66E-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	1.72E-05	1.73E-05	9.83E-06	5.72E-03	2.84E-05	NO DATA	1.54E-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
Cs-134	2.34E-04	3.84E-04	8.10E-05	NO DATA	1.19E-04	4.27E-05	2.07E-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	3.27E-04	3.13E-04	4.62E-05	NO DATA	1.02E-04	3.67E-05	1.96E-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	8.31E-05	7.28E-08	4.85E-06	NO DATA	2.37E-08	4.34E-08	9.84E-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 (mrem/yr)=		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Dose from Shoreline Sediment Pathway for 1991 Data
Maximum Exposed Adult

Shoreline Recreation= 12 hr/yr
Shore Width Factor= 0.2 (river shoreline)
Sediment Surface Mass = 40 kg/m2

Radionuclide	External Dose Factor for Standing on Contaminated Ground (mrem/hr per pci/m2) T. Body	Skin	Location Dist/ Direction	Highest Ann. Mean Conc. in Sediment (pCi/kg)	T. Body	Skin
Mn-54	5.80E-09	6.80E-09	067 4.2mi/SSE	7.26E+01	1.82E-05	2.13E-05
Co-58	7.00E-09	8.20E-09	063 0.8mi/ESE	5.80E+01	3.76E-05	4.41E-05
Fe-59	8.00E-09	9.40E-09	ALL	0.00E+00	0.00E+00	0.00E+00
Co-60	1.70E-08	2.00E-08	063 0.8mi/ESE	8.57E+01	1.40E-04	1.65E-04
Zn-65	4.00E-09	4.60E-09	ALL	0.00E+00	0.00E+00	0.00E+00
Nb-95	5.10E-09	6.00E-09	ALL	0.00E+00	0.00E+00	0.00E+00
Zr-95	5.00E-09	5.80E-09	ALL	0.00E+00	0.00E+00	0.00E+00
I-131	2.80E-09	3.40E-09	ALL	0.00E+00	0.00E+00	0.00E+00
Cs-134	1.20E-08	1.40E-08	063 0.8mi/ESE	6.91E+01	7.96E-05	9.29E-05
Cs-137	4.20E-09	4.96E-09	063 0.8mi/ESE	1.24E+02	5.00E-05	5.87E-05
BaLa-140	1.50E-08	1.70E-08	ALL	0.00E+00	0.00E+00	0.00E+00
Ag-110m	1.80E-08	2.10E-08	063 0.8mi/ESE	1.10E+02	1.90E-04	2.22E-04
Sb-125	3.10E-09	3.50E-09	063 0.8mi/ESE	1.78E+02	5.30E-05	5.98E-05
			Total Dose (mrem/yr) =		5.68E-04	6.63E-04

Dose from Shoreline Sedime... Pathway for 1991 Data
Maximum Exposed Teenager

Shoreline Recreation= 67 hr/yr
Shore Width Factor= 0.2 (river shoreline)
Sediment Surface Mass= = 40 kg/m2

Radionuclide	External Dose Factor for Standing on Contaminated Ground (mrem/hr per pCi/m2) T. Body	Skin	Location Dist/ Direction	..ighest Ann. Mean Conc. in Sediment (pCi/kg)	T. Body	Skin
Mn-54	5.80E-09	6.80E-09	067 4.2mi/SSE	3.26E+01	1.01E-04	1.19E-04
Co-58	7.00E-09	8.20E-09	063 0.8mi/ESE	5.60E+01	2.10E-04	2.46E-04
Fe-59	8.00E-09	9.40E-09	ALL	0.00E+00	0.00E+00	0.00E+00
Co-60	1.70E-08	2.00E-08	0.8mi/ESE	8.57E+01	7.81E-04	9.19E-04
Zn-65	4.00E-09	4.60E-09	ALL	0.00E+00	0.00E+00	0.00E+00
Nb-95	5.10E-09	6.00E-09	ALL	0.00E+00	0.00E+00	0.00E+00
Zr-95	5.00E-09	5.80E-09	ALL	0.00E+00	0.00E+00	0.00E+00
I-131	2.80E-09	3.40E-09	ALL	0.00E+00	0.00E+00	0.00E+00
Cs-134	1.20E-08	1.40E-08	063 0.8mi/ESE	6.91E+01	4.44E-04	5.19E-04
Cs-137	4.20E-09	4.90E-09	063 0.8mi/ESE	1.24E+02	2.79E-04	3.26E-04
BaLa-140	1.50E-08	1.70E-08	ALL	0.00E+00	0.00E+00	0.00E+00
Ag-110m	1.80E-08	2.10E-08	063 0.8mi/ESE	1.10E+02	1.06E-03	1.24E-03
Sb-125	3.10E-09	3.50E-09	063 0.8mi/ESE	1.78E+02	2.96E-04	3.34E-04
		Total Dose (mrem/yr) =			3.17E-03	3.70E-03

Dose from Shoreline Sediment Pathway for 1991 Data
Maximum Exposed Child

Shoreline Recreation= 14 hr/yr
Shore Width Factor= 0.2 (river shoreline)
Sediment Surface Mass= = 40 kg/m2

Radionuclide	External Dose Factor for Standing on Contaminated Ground (mrem/hr per pCi/m2) T. Body	Skin	Location Dist/ Direction	Highest Ann. Mean Conc. in Sediment (pCi/kg)	T. Body	Skin
Mn-54	5.80E-09	6.80E-09	067 4.2mi/SSE	3.26E+01	2.12E-05	2.48E-05
Co-58	7.00E-09	8.20E-09	063 0.8mi/ESE	5.60E+01	4.39E-05	5.12E-05
Fe-59	8.00E-09	9.40E-09	ALL	0.00E+00	0.00E+00	0.00E+00
Co-60	1.70E-08	2.00E-08	063 0.8mi/ESE	8.57E+01	1.63E-04	1.92E-04
Zn-65	4.00E-09	4.60E-09	ALL	0.00E+00	0.00E+00	0.00E+00
Nb-95	5.10E-09	6.00E-09	ALL	0.00E+00	0.00E+00	0.00E+00
Zr-95	5.00E-09	5.80E-09	ALL	0.00E+00	0.00E+00	0.00E+00
I-131	2.80E-09	3.40E-09	ALL	0.00E+00	0.00E+00	0.00E+00
Cs-134	1.20E-08	1.40E-08	063 0.8mi/ESE	6.51E+01	9.29E-05	1.08E-04
Cs-137	4.20E-09	4.90E-09	063 0.8mi/ESE	1.24E+02	5.83E-05	6.81E-05
BaLa-140	1.50E-08	1.70E-08	ALL	0.00E+00	0.00E+00	0.00E+00
Ag-110m	1.80E-08	2.10E-08	063 0.8mi/ESE	1.10E+02	2.22E-04	2.59E-04
Sb-125	3.10E-09	3.50E-09	063 0.8mi/ESE	1.78E+02	6.18E-05	6.98E-05
		Total Dose (mrem/yr) =			6.63E-04	7.77E-04

Dose from Fish Pathway for 1991 Data

Maximum Exposed Adult

Usage (intake rate) = 21 kg/yr

H-3 conc. in Fish = Surface Water pCi/l x Bio. Factor 0.9 pCi/kg per pCi/l

= 5.76E+03 pCi/L x 0.9 = 5.18E+03 pCi/kg

Radionuclide	Adult Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Highest Ann. Mean Location Dist/ Direction	Conc. in Fish (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[illegible]E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-58	NO DATA	7.45E-07	1.67E-06	NO DATA	NO DATA	NO DATA	1.51E-05	063 0.8mi/ESE	4.59E+01	0.00E+00	7.18E-04	1.61E-03	0.00E+00	0.00E+00	0.00E+00	1.46E-02
Fe-59	4.34E-06	1.02E-05	3.91E-06	NO DATA	NO DATA	2.85E-06	3.40E-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	2.14E-06	4.72E-06	NO DATA	NO DATA	NO DATA	4.02E-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	4.86E-06	1.54E-05	6.96E-06	NO DATA	1.03E-05	NO DATA	9.70E-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	6.22E-09	3.46E-09	1.86E-09	NO DATA	3.42E-09	NO DATA	2.10E-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	3.04E-08	9.75E-09	6.60E-09	NO DATA	1.53E-08	NO DATA	3.09E-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	4.16E-06	5.95E-06	3.41E-06	1.95E-03	1.02E-05	NO DATA	1.57E-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-134	6.22E-05	1.48E-04	1.21E-04	NO DATA	4.79E-05	1.59E-05	2.59E-06	063 0.8mi/ESE	1.25E+02	1.63E-01	3.89E-01	3.18E-01	0.00E+00	1.26E-01	4.17E-02	6.80E-03
Cs-137	7.97E-05	1.09E-04	7.14E-05	NO DATA	3.70E-05	1.23E-05	2.11E-06	063 0.8mi/ESE	1.20E+02	3.01E-01	4.12E-01	2.70E-01	0.00E+00	1.40E-01	4.65E-02	7.98E-03
BaLa-140	2.03E-05	2.55E-08	1.33E-06	NO DATA	8.67E-09	1.46E-08	9.25E-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
H-3	NO DATA	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	063 0.8mi/ESE	5.18E+03	0.00E+00	1.14E-02	1.14E-02	1.14E-02	1.14E-02	1.14E-02	1.14E-02
								Total Dose (mrem/yr) =		4.65E-01	8.13E-01	6.01E-01	1.14E-02	2.77E-01	9.97E-02	4.08E-02

Dose from Fish Pathway for 1991 Data

Maximum Exposed Teenager

Usage (intake rate) = 16 kg/yr

H-3 Conc. in Fish = Surface Water pCi/l x Bio. Factor 0.9 pci/kg per pCi/L

= 5.76E+03 pCi/L x 0.9 = 5.18E+03 pCi/kg

Radionuclide	Teenager Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Highest Ann. Mean Conc. is Location Dist/ Direction	Fish (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	0.00E+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	9.72E-07	2.24E-06	NO DATA	NO DATA	NO DATA	1.34E-05	063 0.8mi/ESE	4.59E+01	0.00E+00	7.14E-04	1.65E-03	0.00E+00	0.00E+00	0.00E+00	9.84E-03
Fe-59	5.87E-06	1.37E-05	5.29E-06	NO DATA	NO DATA	4.32E-06	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
Co-60	NO DATA	2.81E-06	6.33E-06	NO DATA	NO DATA	NO DATA	3.66E-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	5.76E-06	2.00E-05	9.33E-06	NO DATA	1.28E-05	NO DATA	8.47E-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	8.22E-09	4.56E-09	2.51E-09	NO DATA	4.42E-09	NO DATA	1.95E-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	4.12E-08	1.30E-08	8.94E-09	NO DATA	1.91E-08	NO DATA	3.00E-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
I-131	5.85E-06	8.19E-06	4.40E-06	2.39E-03	1.41E-05	NO DATA	1.62E-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-134	8.37E-05	1.97E-04	9.14E-05	NO DATA	6.26E-05	2.39E-05	2.45E-06	063 0.8mi/ESE	1.25E+02	1.67E-01	3.94E-01	1.83E-01	0.00E+00	1.25E-01	4.78E-02	4.90E-03
Cs-137	1.12E-04	1.49E-04	5.19E-05	NO DATA	5.07E-05	1.97E-05	2.12E-06	063 0.8mi/ESE	1.80E+02	3.23E-01	4.29E-01	1.49E-01	0.00E+00	1.46E-01	5.67E-02	6.11E-03
BaLa-140	2.84E-05	3.48E-08	1.83E-06	NO DATA	1.18E-08	2.34E-08	9.82E-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
H-3	NO DATA	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07	063 0.9mi/ESE	5.18E+03	0.00E+00	8.79E-03	8.79E-03	8.79E-03	8.79E-03	8.79E-03	8.79E-03
								Total Dose (mrem/yr) =		4.90E-01	8.33E-01	3.43E-01	8.79E-03	2.89E-01	1.13E-01	2.96E-02

Dose from Fish Pathway for 1991 Data

Maximum Exposed Child

Usage (intake rate) = 6.9 kg/yr

H-3 conc. in Fish = Surface Water pCi/L x Bio. Factor 0.9 pCi/kg per pCi/L

= 5.76E+03 pCi/L x 0.9 = 5.18E+03 pCi/kg

Radionuclide	Child Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Highest Ann. Mean Location Dist/ Direction	Conc. in 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	3.90E-06	NO DATA	8.98E-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	1.80E-06	5.51E-06	NO DATA	NO DATA	NO DATA	1.95E-05	063 0.8mi/ESE	4.79E+01	0.00E+00	5.70E-04	1.75E-03	0.00E+00	0.00E+00	0.00E+00	3.33E-03
Fe-59	1.65E-05	2.67E-05	1.33E-05	NO DATA	NO DATA	7.74E-06	2.78E-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	5.29E-06	1.56E-05	NO DATA	NO DATA	NO DATA	2.93E-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	1.37E-05	3.65E-05	2.27E-05	NO DATA	2.30E-05	NO DATA	6.41E-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	2.25E-08	8.76E-09	6.26E-09	NO DATA	8.23E-09	NO DATA	1.62E-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	1.16E-07	2.55E-08	2.27E-08	NO DATA	3.65E-08	NO DATA	2.66E-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	1.72E-05	1.73E-05	9.83E-06	5.72E-03	2.84E-05	NO DATA	1.54E-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-134	2.34E-04	3.84E-04	8.10E-05	NO DATA	1.19E-04	4.27E-05	2.07E-06	063 0.8mi/ESE	1.25E+02	2.02E-01	3.31E-01	6.99E-02	0.00E+00	1.03E-01	3.68E-02	1.79E-03
Cs-137	3.27E-04	3.13E-04	4.62E-05	NO DATA	1.02E-04	3.67E-05	1.96E-06	063 0.8mi/ESE	1.89E+02	4.06E-01	3.89E-01	5.74E-02	0.00E+00	1.27E-01	4.56E-02	2.43E-03
BaLa-140	8.31E-05	7.28E-08	4.85E-06	NO DATA	2.37E-08	4.34E-08	9.84E-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
H-3	NO DATA	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07	063 0.8mi/ESE	5.18E+03	0.00E+00	7.26E-03	7.26E-03	7.26E-03	7.26E-03	7.26E-03	7.25E-03
								Total Dose (mrem/yr) =		6.08E-01	7.28E-01	1.36E-01	7.26E-03	2.37E-01	8.97E-02	1.48E-02

SECTION 5.

QUALITY ASSURANCE

5.1 DUKE POWER COMPANY'S RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

5.1.1 SAMPLE COLLECTION

The ONS Chemistry Section performs the environmental sample collections as specified by approved sample collection procedures.

5.1.2 SAMPLE ANALYSIS

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

5.1.3 DOSIMETRY ANALYSIS

The Dosimetry Laboratory performs 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

Radiological and Environmental Services, and the Dosimetry Laboratory were participants in a Quality Assurance audit in 1991, performed by Duke Power's Audit Division. No findings or recommendations concerning the Oconee Nuclear Station Radiological Environmental Monitoring Program were identified in the audit.

The ONS Chemistry and Radiation Protection Sections responsible for environmental monitoring were evaluated by Quality Assurance in 1991. No findings were identified, but a recommendation was made to establish a consistent basis for environmental air sampler flow rates. Several regulatory guides and EPA guidelines were reviewed for applicability by the G.O. Radiation Protection. The guidance discussed several factors that influence volume requirements, such as LLD's, MPC's, radioactive decay characteristics, analysis method, filter media, etc. Based upon this review, it was recommended that the air sampler flow rates be lowered to 1.0 CFM to 3.0 CFM.

5.1.5.2 DUKE POWER'S NUCLEAR PRODUCTION INTERCOMPARISON PROGRAM

Radiological and Environmental Services participated in the Duke Power Nuclear Production Intercomparison Program during 1991. 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, ONS Chemistry and Radiation Protection Sections were audited by the NRC in 1991. No violations, deviations or follow-up items were identified by the inspector concerning the Oconee Nuclear Station Radiological Environmental Monitoring Program.

5.1.5.4 UNITED STATES ENVIRONMENTAL PROTECTION AGENCY INTERCOMPARISON PROGRAM

Radiological and Environmental Services participates in the Environmental Protection Agency (EPA) Environmental Monitoring Systems Laboratory Intercomparison Program. The EPA sample types include 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 prepares and analyzes each sample as quickly as possible. Should the data obtained be out of EPA limits, Radiological and Environmental Services performs and documents follow-up investigations. The Radiological and Environmental Services EPA Intercomparison Report code is "CP". A summary of the EPA Intercomparison Reports for 1991 is documented in Table 5.1. Of the thirty-Seven (37) analyses performed in 1991, one analysis (Gross Alpha/Beta in Air Filter cross-check, reference date 3/29/91) was out of EPA acceptance limits.

An investigation was performed to find out why the results were not within statistical limits. The following areas were investigated:

1. Sample geometry
2. Gas flow
3. Efficiency calibration files
4. Activity calculations
5. Cross-checks and verifications performed approximately the same time (April 1991) of the EPA analysis
6. Past trends of EPA Alpha/Beta Cross-checks
7. Recounting of the EPA Cross-Check Air Filters
8. Trending alpha/beta air filter sample results for 1991

In the first area of investigation, geometry, it was noticed that the filter media the EPA uses is considerably thicker than that of our regular air samples, therefore the sample will be placed closer to the counting window during the time of analysis. This closer placement of the sample will then produce a higher alpha count rate than

that of a sample that is more distant from the window. This would in turn produce a higher activity reported for alpha, but the beta results would not necessarily change, because of the high energy of the Cs-137 beta.

The results of the EPA Cross-Checks for Air Filters and Drinking Waters since 1984 were gathered and plotted to see if there was any trends in the results. The EPA started using a new disk media to simulate an air filter in April of 1987. By studying these graphs it was seen that the alpha results, from 1988 on, start to trend high. This trend can be related to either the change in filter media or change in calibration standards (new standards made in October 1987). By comparing the graphs it was seen that the change in results is due to the change in filter media, because the Drinking Water results did not trend in the same manner as those of the Air Filters.

The EPA Air Filters were analyzed again under the new calibration that was performed in June 1991. These results were acceptable for Beta activity, but were right at the warning limit for Alpha. The Air Filters were also counted with the Air Filters setting directly in the holders (i.e. not in planchets), and these results were within statistical limits. These results support the geometry investigation for Alpha, because the results were produced with the sample being further away from the counting window and closer to being the geometry used prior to April 1987. But on the other hand, this does not support the Beta, because even though the results are within statistical limits the activity had dropped.

In conclusion of this investigation, it appeared that just one reason for the poor results could be identified. The instruments will continue to be checked on a quarterly basis to ensure they are within calibration limits. 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 participate with the State of South Carolina in their NRC/State Contract Environmental Monitoring Program. The ONS Chemistry Section 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 ONS. Results of the analyses performed on split and duplicate samples by Radiological and Environmental Services, 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 which have been collected 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 1991 is documented in Table 5.2. The Dosimetry Laboratory results were within 8.13% of the State of North Carolina results (excluding Standard Deviation values) for the March 1991 cross-check, and 3.79% (excluding Standard Deviation values) for the December 1991 cross-check.

5.1.5.7 U.S. DEPARTMENT OF ENERGY INTERCOMPARISON PROGRAM

There was no DOE intercomparison program during calendar year 1991.

5.2 CONTRACTOR LABORATORY

No contractor laboratories were used during 1991.

TABLE 5.1 (Page 1 of 2)

U.S. ENVIRONMENTAL PROTECTION AGENCY INTERLABORATORY COMPARISON PROGRAM
1991 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	2/08/91	Ba-133	75 pCi/L	61.1 - 88.9 pCi/L	78.3 pCi/L
		Co-60	40 pCi/L	31.3 - 48.7 pCi/L	42.3 pCi/L
		Zn-65	149 pCi/L	123.0 - 175.0 pCi/L	158.0 pCi/L
		Ru-106	186 pCi/L	153.0 - 219.0 pCi/L	212.3 pCi/L
		Cs-134	8 pCi/L	0.0 - 16.7 pCi/L	8.3 pCi/L
		Cs-137	8 pCi/L	0.0 - 16.7 pCi/L	9.3 pCi/L
	6/07/91	Ba-133	62 pCi/L	51.6 - 72.4 pCi/L	65.0 pCi/L
		Co-60	10 pCi/L	1.3 - 18.7 pCi/L	11.0 pCi/L
		Zn-65	108 pCi/L	88.9 - 127.1 pCi/L	112.7 pCi/L
		Ru-106	149 pCi/L	123.0 - 175.0 pCi/L	159.0 pCi/L
		Cs-134	15 pCi/L	6.3 - 23.7 pCi/L	15.0 pCi/L
		Cs-137	14 pCi/L	5.3 - 22.7 pCi/L	15.3 pCi/L
	10/04/91	Ba-133	98 pCi/L	80.7 - 115.3 pCi/L	100.7 pCi/L
		Co-60	29 pCi/L	20.3 - 37.7 pCi/L	32.7 pCi/L
		Zn-65	73 pCi/L	60.9 - 85.1 pCi/L	83.3 pCi/L
		Ru-106	199 pCi/L	164.3 - 233.7 pCi/L	218.0 pCi/L
		Cs-134	10 pCi/L	1.3 - 18.7 pCi/L	10.3 pCi/L
		Cs-137	10 pCi/L	1.3 - 18.7 pCi/L	11.0 pCi/L
	2/15/91	I-131	75 pCi/L	61.1 - 88.9 pCi/L	78.7 pCi/L
	8/09/91	I-131	20 pCi/L	9.6 - 30.4 pCi/L	20.7 pCi/L
Air Filter	3/29/91	Cs-137	40 pCi/Filter	34.2 - 45.8 pCi/Filter	39.3 pCi/Filter
		Gross Alpha	25 pCi/Filter	18.1 - 31.9 pCi/Filter	41.7 pCi/Filter
		Gross Beta	124 pCi/Filter	117.1 - 130.9 pCi/Filter	108.0 pCi/Filter

TABLE 5.1 (PAGE 2 OF 2)

U.S. ENVIRONMENTAL PROTECTION AGENCY INTERLABORATORY COMPARISON PROGRAM
1991 CROSS-CHECK RESULTS FOR THE RADIOLOGICAL AND ENVIRONMENTAL SERVICES LABORATORY

ANALYSIS	DATE	NUCLIDE(S)	KNOWN VALUE	CONTROL LIMITS (3 SIGMA; N=3)	REPORTED VALUE
Air Filter	8/30/91	Cs-137	30 pCi/Filter	21.3 - 38.7 pCi/Filter	31.7 pCi/Filter
		Gross Alpha	25 pCi/Filter	14.6 - 35.4 pCi/Filter	35.0 pCi/Filter
		Gross Beta	92 pCi/Filter	74.7 - 109.3 pCi/Filter	93.0 pCi/Filter
Tritium in Water	2/22/91	H-3	4418 pCi/L	3651.2 - 5184.8 pCi/L	4676.0 pCi/L
	6/21/91	H-3	12480 pCi/L	10314.8 - 14645.2 pCi/L	12387.7 pCi/L
	10/18/91	H-3	2454 pCi/L	1843.3 - 3064.7 pCi/L	2839.0 pCi/L
Gamma in Milk	04/26/91	I-131	60 pCi/L	49.6 - 70.4 pCi/L	67.0 pCi/L
		Cs-137	49 pCi/L	40.3 - 57.7 pCi/L	49.7 pCi/L
	9/27/91	I-131	108 pCi/L	88.9 - 127.1 pCi/L	110.7 pCi/L
		Cs-137	30 pCi/L	21.3 - 38.7 pCi/L	31.0 pCi/L
Alpha-Beta in Water	1/25/91	Gross Alpha	5 pCi/L	0.0 - 13.7 pCi/L	7.7 pCi/L
		Gross Beta	5 pCi/L	0.0 - 13.7 pCi/L	9.3 pCi/L
	9/20/91	Gross Alpha	10 pCi/L	1.3 - 18.7 pCi/L	10.7 pCi/L
		Gross Beta	20 pCi/L	11.3 - 28.7 pCi/L	21.3 pCi/L

TABLE 5.2

STATE OF NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL HEALTH AND NATURAL RESOURCES
ENVIRONMENTAL DOSIMETER CROSS-CHECK 1991

	State of N.C. Estimated Value		Dosimetry Laboratory Estimated Value	
Cross-Check Date	Exposure (mR)	Estimated Uncertainty (1 S.D. mR)	Exposure (mR)	Estimated Uncertainty (1 S.D. mR)
3/91	49.6	± 1.2	47.72	± 1.91
12/91	49.8	± 0.7	45.75	± 1.19

SECTION 6.

REFERENCES

1. ONS Selected Licensee Commitments, 16.11-6 Radiological Environmental Monitoring
2. Duke Power Company, Offsite Dose Calculation Manual, Section A5.0
3. ONS Chemistry Procedures for Sample Collection and Land Use Census
4. Production Environmental Services, Radioanalysis Laboratory Procedures and Dosimetry Laboratory Procedures
5. ONS Final Safety Analysis Report
6. ONS Preoperational Environmental Radioactivity Monitoring Reports and Annual Radiological Environmental Operating Reports, 1969-1990
7. NRC Regulatory Guide 1.109, Calculation of Annual Doses To Man From Routine Releases Of Reactor Effluents For The Purposes Of Evaluating Compliance With 10 CFR Part 50, Appendix I
8. NRC Regulatory Guide 4.15, Quality Assurance For Radiological Monitoring Programs (Normal Operations)-Effluent Streams And The Environment
9. 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
10. ONS 1991 Annual Liquid and Gaseous Effluent Report, 1/20/92, OS-215.02
11. Probability and Statistics in Engineering and Management Science, Hines and Montogomery, 1969, Pages 287 - 293

APPENDIX A

ENVIRONMENTAL SAMPLING AND ANALYSIS PROCEDURES

Adherence to established procedures for sampling and analysis of environmental media is required to ensure compliance to the Radiological Environmental Monitoring Program as defined by ONS Selected Licensee Commitments and the ODCM. These procedures ensure that environmental media are sampled and analyzed according to the specific locations, frequencies, and types of analyses given in the ODCM (Tables 2.1-1, 2.1-2 and 2.2-1). Analysis procedures ensure the detection capabilities given in Selected Licensee Commitments will be achieved (Table 2.2-2).

The required detection capabilities were met for the analyses performed in 1991. Deviations from analytical procedures are listed in Appendix D. Collection requirements were also met with the exceptions listed in Appendix C. For some sample media, collection is performed at more locations than required by Selected Licensee Commitments. These include Broadleaf Vegetation, Shoreline Sediment and Fish. The additional samples make it possible to compare different sample media collected from the same location.

Environmental sampling is performed by the ONS Chemistry Section. Sample analyses are performed by Duke Power Company's Radiological and Environmental Services. TLDs are processed by Duke Power Company's Dosimetry Laboratory. Sections A.1-A.9 describe the sampling and analysis procedures by media type. The actual procedures which are applicable to the sampling and analysis are found in References 3-4.

CHANGE OF SAMPLING PROCEDURES

There was a modification made in the starting flow rates for the environmental air samplers. The starting flow rates were lowered to 3.0 CFM to coincide with the 1991 QA audit recommendation (see section 5.1.5.1).

In addition to collecting fish with nets, electrofishing was performed in 1991. Electrofishing will continue to be an option for fish collection.

CHANGE OF ANALYSIS PROCEDURES

During 1991, a change in the procedure was made for gross beta samples. The samples are now counted in replicate, three times each, and a mean result is used in the calculation of activity.

The value used to determine if the gross beta activity is less than the critical level was re-evaluated and changed to be 50% of the MDA value, rather than 100%. This value is indicated on the activity calculation printout for each sample.

SAMPLING AND ANALYSIS PROCEDURES

A.1 AIRBORNE PARTICULATES AND RADIOIODINE

Particulate and Radioiodine activity in air is collected through use of fiber filters for particulate collection followed by charcoal cartridges for iodine absorption. Air samplers are operated continuously and samples are changed on a weekly frequency. The samplers are designed to operate at a constant flow rate (in order to compensate for any filter loading) and are set to sample approximately 3 cubic feet per minute. The volume of air usually sampled over the weekly period is approximately 8.5E2 cubic meters. Gamma spectroscopy is performed on each fiber filter and each charcoal cartridge separately.

A.2 DRINKING WATER

Drinking water samples are collected by operation of a composite sampler. The sampler is operated to collect an aliquot at least once every two hours. The sample is collected monthly and utilized for gamma spectroscopy, gross beta analysis, and low-level I-131. The beta analysis is performed with a proportional counter. A separate portion is saved to form a quarterly composite with two other monthly period samples. Tritium analysis is performed on this

quarterly composite using liquid scintillation. Low-level iodine analysis is performed in addition to the analyses required by Selected Licensee Commitments. An ion exchange resin is used to remove and concentrate any iodine in the drinking water. The resin is then analyzed by gamma spectroscopy.

A.3 SURFACE WATER

Surface water samples are collected by operation of a composite sampler. The sampler is operated to collect an aliquot at least every two hours. The sample is collected monthly and utilized for gamma spectroscopy. A separate portion is saved to form a quarterly composite with two other monthly period samples. Tritium analysis is performed on the quarterly composite.

A.4 MILK

Milk samples are collected on a semimonthly frequency. The normal volume collected is twelve liters. A portion of the milk is utilized for gamma spectroscopy. Part of the remaining portion is used for low-level iodine analysis. An ion exchange resin is used to remove and concentrate any iodine in the milk. The resin is then analyzed by gamma spectroscopy.

A.5 BROADLEAF VEGETATION

Broadleaf vegetation sampling is performed on a monthly frequency. At least 1 kilogram of vegetation is collected. The most recent growth possible is sampled. Gamma spectroscopy is performed on each sample.

A.6 SHORELINE SEDIMENT

Shoreline sediment is collected quarterly, although Selected Licensee Commitments requires semiannual collection. At least 500 grams of sample are collected from the top 7.5 centimeters of sediment at the edge of the water. Gamma spectroscopy analysis is

performed on each sample after drying and removal of rocks and clams.

A.7 FISH

Fish are collected on a semiannual frequency. Gillnets and traps are put in place or electrofishing is performed at the monitoring locations and fish are collected until the required sample size is met (~500 grams each species). Fish are prepared using just the fillets. Gamma Spectroscopy analysis is performed on each species of fish after they are prepared.

A.8 DIRECT GAMMA RADIATION

Direct Radiation measurements are accomplished by using $CaSO_4$:Dy TLDs. The TLDs are changed out on a quarterly frequency. The gamma dose determined for each TLD after processing is converted to a dose rate for reporting purposes.

A.9 LAND USE CENSUS

The Land Use Census is conducted to identify the location of the nearest milk animal, meat animal, and nearest residence in each of the sixteen meteorological sectors within a distance of 5 miles of the station. The census is accomplished by a vehicle search of each sector. Aerial surveys or consulting local authorities may also be utilized to collect information. The census is performed between April and August each year.

In lieu of a survey of gardens in the area, sampling of broadleaf vegetation is performed at the site boundary in the direction sector with the highest deposition parameter. This location ensures that the highest potential exposure from the vegetation pathway is monitored.

APPENDIX B

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

SUMMARY OF RESULTS

Summary sheets for each media have been included in this appendix.

Name of Facility : DNS
Location of Facility : OCONEE COUNTY, S.C.
Time Report Generated : 23-JAN-1992 08:41:19
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1991 through 31-DEC-1991
Database Name : $DISK1:[USER.ASC]DNS91.SAF;1

Medium or Pathway Sampled (Units)	Type A 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.
AIR PARTICULATE (PCI/M3)							
3 Locations	MN-54 257	0.00E+00	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00	073 (9.0 Mi NW)	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	CO-58 257	0.00E+00	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	FE-59 257	0.00E+00	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	CO-60 257	0.00E+00	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	ZN-65 257	0.00E+00	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	NB-95 257	0.00E+00	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	ZR-95 257	0.00E+00	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	I-131 257	7.00E-02	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	CS-134 257	5.00E-02	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	CS-137 257	6.00E-02	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	BALA-140 257	0.00E+00	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 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 060 = Greenville Water Intake Road
Location 061 = Old Highway 183
Location 072 = Highway 130
Location 073 = Tamassee DAR School
Location 074 = Keowee Key Resort

Name of Facility : DNS
Location Facility : OCONEE COUNTY, S.C.
Time Report Generated : 23-JAN-1992 08:41:19
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1991 through 31-DEC-1991
Database Name : $DISK1:[USER.ASC]DN591.SAF;1

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.
AIR RADIOIODINES (PCI/M3)							
5 Locations	MN-54 257	0.00E+00	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	073 (9.0 Mi NW) 0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	CO-58 257	0.00E+00	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	FE-59 257	0.00E+00	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	CO-60 257	0.00E+00	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	ZN-65 257	0.00E+00	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	NB-95 257	0.00E+00	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	ZR-95 257	0.00E+00	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	I-131 257	7.00E-02	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	CS-134 257	5.00E-02	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	CS-137 257	6.00E-02	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	BALA-140 257	0.00E+00	0.00E+00(0/ 205) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 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 060 = Greenville Water Intake Road
Location 061 = Old Highway 183
Location 072 = Highway 130
Location 073 = Tamassee DAR School
Location 074 = Keowee Key Resort

Name of Facility : ONS
Location of Facility : OCONEE COUNTY, S.C.
Time Report Generated : 23-JAN-1992 08:41:19
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1991 through 31-DEC-1991
Database Name : $DISK1:[USER.ASC]ONS91.SAF;1

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.
BROAD LEAF VEGET (PCI/WET/KG)							
						073 (9.0 Mi NW)	
3 Locations	MN-54 39	0.00E+00	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	0.00E+00	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	0.00E+00	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	0.00E+00	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	0.00E+00	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	0.00E+00	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	0.00E+00	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	60.	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	60.	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
				060 (2.5 Mi NNE)			
	CS-137 39	80.	22. (1/ 26) 22. -- 22.		22. (1/ 13) 22. -- 22.	1.45E+02 (7/ 13) 36. -- 3.98E+02	0
	BALA-140 39	0.00E+00	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 028 = Site Boundry
Location 060 = Greenville Water Intake Road
Location 073 = Tamassee DAR School

Name of Facility : ONS
Location of Facility : OCONEE COUNTY, S.C.
Time Report Generated : 23-JAN-1992 08:41:19
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1991 through 31-DEC-1991
Database Name : $DISK1:[USER.ASC]ONS91.SAF;1

Medium or Pathway Sampled (Units)	Type & Number of Analyses Performed	Total	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 Mens.
DRINKING WATER (PCI/LITERS)								
3 Locations	ANALI-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	064 (6.7 Mi SW) 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+04 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
	BA-LA-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 060 = Greenville Water Intake
Location 064 = Seneca, SC
Location 066 = Anderson, SC

Name of Facility : ONS
Location of Facility : OCONEE COUNTY, S.C.
Time Report Generated : 23-JAN-1992 08:41:19
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1991 through 31-DEC-1991
Database Name : $DISK1:[USER.ASC]ONS91.SAF;1

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.
DRINKING WATER (PCI/LITERS)							
						064 (6.7 Mi SW)	
				066 (19.0Mi SSE)			
	BETA 39	4.0	1.5 (19/ 26)		1.8 (10/ 13)	1.4 (10/ 13)	0
			0.75 -- 3.1		0.71 -- 3.1	0.60 -- 3.9	
W TRITIUM (PCI/LITERS)							
						064 (6.7 Mi SW)	
Location	H-3 15	2.00E+03	5.58E+02(1/ 10)	066 (19.0Mi SSE)	5.58E+02(1/ 5)	0.00E+00(0/ 5)	0
			5.58E+02-- 5.58E+02		5.58E+02-- 5.58E+02	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 060 = Greenville Water Intake
Location 064 = Seneca, SC
Location 066 = Anderson, SC

Name of Facility : DNS
Location of Facility : OCONEE COUNTY, S.C.
Time Report Generated : 23-JAN-1992 08:41:19
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1991 through 31-DEC-1991
Database Name : $DISK1:[USER.ASC]DNS91.SAF;1

Medium or Pathway Sampled (Units)	Type & Number of Analyses Performed	Total 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.
FISH (PCI/WET/KG)							
Locations	MN-54	17 1.30E+02	0.00E+00(0/ 8) 0.00E+00-- 0.00E+00		0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	060 (2.5 Mi NNE) 0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0
	CO-58	12 1.30E+02	46. (1/ 8) 46. -- 46.	063 (0.8 Mi ESE)	46. (1/ 4) 46. -- 46.	0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0
	FE-59	12 2.60E+02	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/ 4) 0.00E+00-- 0.00E+00	0
	CO-60	12 1.30E+02	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/ 4) 0.00E+00-- 0.00E+00	0
	ZN-65	12 2.60E+02	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/ 4) 0.00E+00-- 0.00E+00	0
	NB-95	12 0.00E+00	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/ 4) 0.00E+00-- 0.00E+00	0
	ZR-95	12 0.00E+00	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/ 4) 0.00E+00-- 0.00E+00	0
	I-131	12 0.00E+00	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/ 4) 0.00E+00-- 0.00E+00	0
	CS-134	12 1.30E+02	69. (1/ 8) 9.9 -- 1.26E+02	063 (0.8 Mi ESE)	1.25E+02(2/ 4) 1.24E+02-- 1.26E+02	0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0
	CS-137	12 1.50E+02	1.29E+02(8/ 8) 35. -- 3.49E+02	063 (0.8 Mi ESE)	1.94E+02(4/ 4) 35. -- 3.49E+02	14. (2/ 4) 13. -- 15.	0
	BALA-140	12 0.00E+00	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/ 4) 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 060 = Greenville Water Intake Road
Location 063 = Lake Hartwell - Highway 183 Bridge
Location 067 = Highway 27 - Lawrence Ramsey Bridge

Name of Facility : DNS
Location of Facility : OCONEE COUNTY, S.C.
Time Report Generated : 23-JAN-1992 08:41:19
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1991 through 31-DEC-1991
Database Name : $DISK1:[USER.ASC]DNS91.SAF;1

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.
MILK (PCI/LITERS)							
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	066 (19.0 Mi SSE) 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.	5.0 (4/ 52) 1.9 -- 9.6	069 (4.5 Mi NNW)	5.0 (4/ 26) 1.9 -- 9.6	0.00E+00 (0/ 26) 0.00E+00 -- 0.00E+00	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 066 = Garrison Dairy
Location 069 = Orr Dairy
Location 071 = Clemson Dairy

Name of Facility : ONS
Location of Facility : OCONEE COUNTY, S.C.
Time Report Generated : 23-JAN-1992 11:17:47
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1991 through 31-DEC-1991
Database Name : $DISK1:[USER.ASC]ONS91.SAF;1

Medium or Pathway Sampled (Units)	Type & Number of Analyses Performed	Total	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)					067 (4.2 Mi SSE)		068 (2.0 Mi W)	
3 Locations	MN-54	12	0.00E+00	33. (1/ 8) 33. -- 33.		33. (1/ 4) 33. -- 33.	0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0
					063 (0.8 Mi ESE)			
	CO-58	12	0.00E+00	56. (1/ 8) 56. -- 56.		56. (1/ 4) 56. -- 56.	0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0
	FE-59	12	0.00E+00	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/ 4) 0.00E+00-- 0.00E+00	0
					063 (0.8 Mi ESE)			
	CO-60	12	0.00E+00	86. (1/ 8) 86. -- 86.		86. (1/ 4) 86. -- 86.	0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0
	ZN-65	12	0.00E+00	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/ 4) 0.00E+00-- 0.00E+00	0
	NB-95	12	0.00E+00	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/ 4) 0.00E+00-- 0.00E+00	0
	ZR-95	12	0.00E+00	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/ 4) 0.00E+00-- 0.00E+00	0
	I-131	12	0.00E+00	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/ 4) 0.00E+00-- 0.00E+00	0
					063 (0.8 Mi ESE)			
	CS-134	12	1.50E+02	69. (1/ 8) 69. -- 69.		69. (1/ 4) 69. -- 69.	0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0
					063 (0.8 Mi ESE)			
	CS-137	12	1.80E+02	98. (6/ 8) 16. -- 2.71E+02		1.24E+02(3/ 4) 16. -- 2.71E+02	0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0
	BA-LA-140	12	0.00E+00	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/ 4) 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 063 = Lake Hartwell- Highway 183 Bridge
Location 067 = Highway 27 - Lawrence Ramsey Bridge
Location 068 = High Falls County Park

Name of Facility : ONS
Location of Facility : OCONEE COUNTY, S.C.
Time Report Generated : 23-JAN-1992 08:41:19
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1991 through 31-DEC-1991
Database Name : $DISK1:[USER.ASC]ONS91.SAF;1

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/LITERS)							
2 Locations	MN-54 26	15.	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	06[illegible] (0.7 Mi ENE) 0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	CO-58 26	15.	5.4 (1/ 13) 5.4 -- 5.4	063 (0.8 Mi ESE)	5.4 (1/ 13) 5.4 -- 5.4	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	FE-59 26	30.	0.00E+00(0/ 13) 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 26	15.	0.00E+00(0/ 13) 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 26	30.	0.00E+00(0/ 13) 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 26	15.	0.00E+00(0/ 13) 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 26	15.	0.00E+00(0/ 13) 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 26	15.	0.00E+00(0/ 13) 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 26	15.	0.00E+00(0/ 13) 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 26	18.	0.00E+00(0/ 13) 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 26	15.	0.00E+00(0/ 13) 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
SW TRITIUM (PCI/LITERS)							
	H-3 10	2.00E+03	5.76E+03(4/ 5) 4.52E+03-- 6.28E+03	063 (0.8 Mi ESE)	5.76E+03(4/ 5) 4.52E+03-- 6.28E+03	0.00E+00(0/ 5) 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 062 = Lake Keowee/Hydro Intake
Location 063 = Lake Hartwell - Highway 183 Bridge

Name of Facility : DNS
Location of Facility : OCONEE COUNTY, S.C.
Date Report Generated : 23-JAN-1992 08:40:09
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1991 through 31-DEC-1991
Database Name : $DISK1:[USER.ASC]DNS91.SAF;1

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.
DIRECT RAD-TLD (mR/QTR)							
20 Locations	mR/QTR 155	0.00E+00	17. (151/ 151) 7.1 -- 29.	059(9.0 Mi NW)	26. (4/ 4) 22. -- 28.	058 (10.0 Mi WSW) 22. (4/ 4) 19. -- 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

Location 059 = Tamassee DAR School

APPENDIX C

SAMPLING DEVIATIONS AND UNAVAILABLE ANALYSES

I. SAMPLING DEVIATIONS

The deviations from sampling procedures that occurred during 1991 are listed below.

A. AIR FILTER/CARTRIDGE

1. Location #074, 7/9/91 to 7/16/91

   Reason: Due to an apparent power failure, the sampler ran only 79.6 hours out of a normal 168 hour sampling.

   Action: Replaced fuse and restarted sampler. Actual run time was 79.6 hours.

B. SURFACE WATER

1. Location #062, 12/26/90 to 1/22/91

   Reason: Sampler was inadvertently left off on the last collection date. No composite sample was available.

   Action: A "grab" sample was collected. Actual sampling period was 1/22/91.

2. Location #063, 5/14/91 to 6/11/91

   Reason: Due to composite pump being out of order from 5/14/91 to 5/27/91, a full composite sample was unavailable.

   Action: An abbreviated sample was collected. A work request was written when the problem was noticed and daily collections of "grab" samples were collected. Actual sampling period was 5/20/91 to 6/11/91.

3. Location #062, 9/5/91 to 10/1/91

   Reason: Due to the breaker to the pump tripping sometime between 9/9/91 to 9/12/91, a full composite sample was unavailable.

   Action: Breaker was reset with no other problems. An abbreviated sample was collected. Actual sampling period was 9/5/91

to 9/9/91 and 9/12/91 to 10/1/91.

II. UNAVAILABLE ANALYSES

The following unavailable analyses occurred during 1991.

A. AIR FILTER/CARTRIDGE

1. Location #061, 2/19/91 to 2/26/91

   Reason: Due to the correct sample having been thrown away, no sample was available

   Action: Replaced filter/cartridge and restarted sampler. Extra samples will be kept until the end of each week in case the mistake occurs again.

2. Location #072, 2/19/91 to 2/26/91

   Reason: Due to the correct sample having been thrown away, no sample was available.

   Action: Replaced filter/cartridge and restarted sampler. Extra samples will be kept until the end of each week in case the mistake occurs again.

3. Location #072, 10/29/91 to 11/5/91

   Reason: Due to a short in the power supply line, the sampler ran only 5 minutes out of a normal 168 hour sampling period.

   Action: A new power supply line was run to the sampling site. Power was restored on 11/5/91 at 14:00.

B. DIRECT RADIATION (TLD'S)

1. Location #024, 12/12/90 to 3/13/91

   Reason: TLD was found to be missing on 3/13/91 due to unknown reasons.

   Action: A new TLD was placed in the field on 3/13/91.

2. Location #051, 12/12/90 to 3/13/91

   Reason: TLD was found to be missing on 3/13/91 due unknown reasons.

Action: A new TLD was placed in a different location in the field on 3/13/91.

3. Location #039, 6/12/91 to 9/18/91

   Reason: TLD was found to be missing on 9/18/91 due unknown reasons.

   Action: A new TLD was placed in the field on 9/18/91.

4. Location #42, 9/12/91 to 12/12/91

   Reason: TLD was found to be missing on 12/12/91 due to unknown reasons.

   Action: A new TLD was placed in the field on 12/12/91.

5. Location #39, 9/12/91 to 12/12/91

   Reason: TLD was found to be missing on 12/12/91 due to unknown reasons.

   Action: A new TLD was placed in a different location in the field on 12/12/91.

The majority of samples scheduled were successfully collected and analyzed. Of those sample types having deviations, 98% of the air samples, 88% of the surface water samples, and 96% of the TLDs were available without any deviations associated with them.

APPENDIX D

ANALYTICAL DEVIATIONS

I. ANALYTICAL DEVIATIONS

No analytical deviations occurred during the calendar year 1991.

Note: No lower limits of detection were exceeded for any analyses performed for 1991.

DUKE POWER