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DUKE POWER

April 25, 1994

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

Dear Sir:

Pursuant to Oconee Technical Specification 6.6.1.5, please find enclosed the Oconee Nuclear Site Annual Radiological Environmental Operating Report for the calendar year 1993.

Very truly yours,

for J. W. Hampton

cc: Mr. S. D. Ebneter, Regional Administrator
U. S. Nuclear Regulatory Commission, Region II

Mr. L. A. Wiens, Project Manager
Office of Nuclear Reactor Regulation

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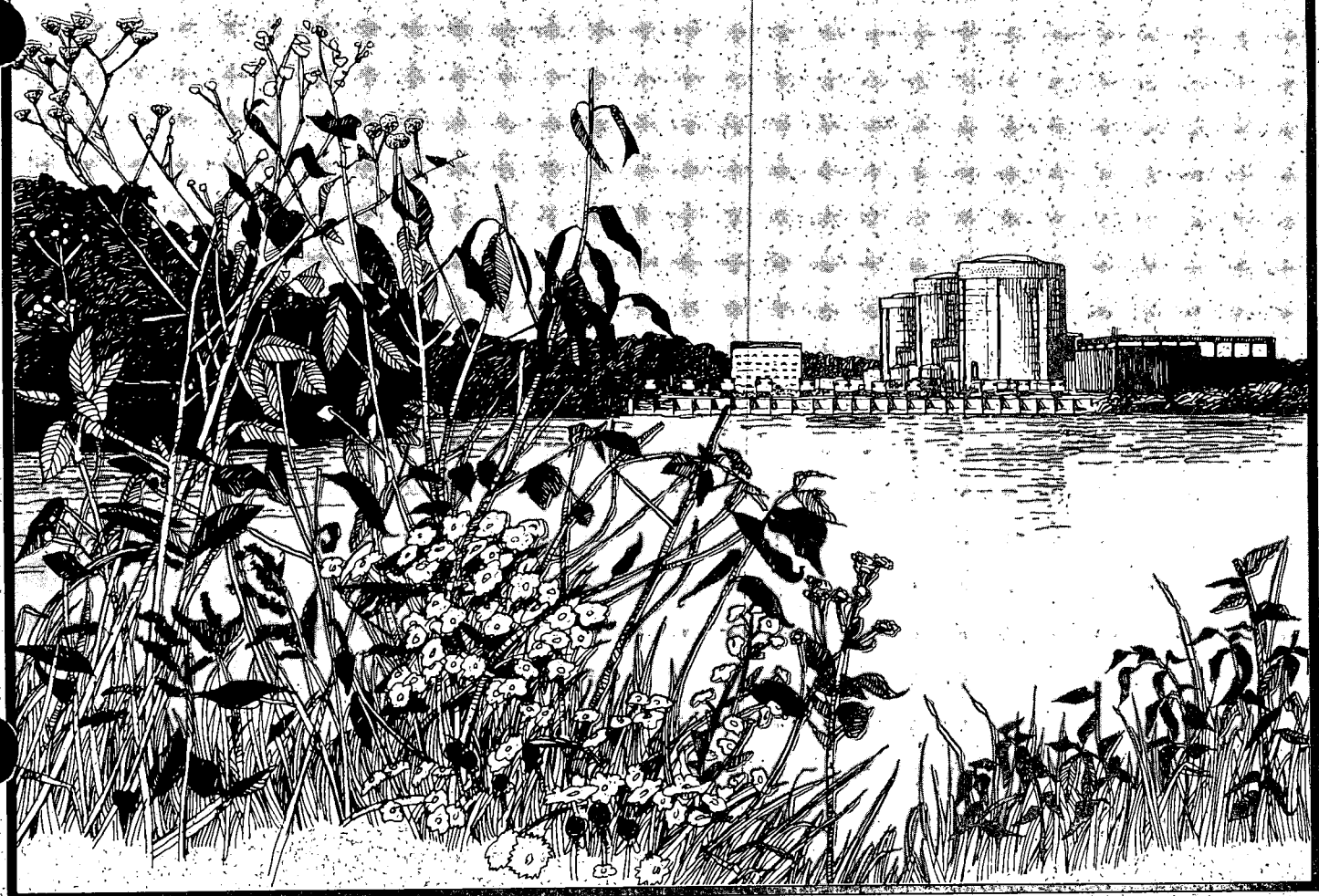

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

for

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

January 1, 1993 - December 31, 1993

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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 1993.

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 1993 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 1993 for station related radionuclides were generally within the ranges of concentrations observed in the past. Compared to 1992, 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 showed that radioactivity concentrations in surface water, shoreline sediment, and fish are higher than the activities reported for samples collected prior to operation of Oconee Nuclear Station. 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 as 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 Hydroelectric Plant near the station joins Lake Keowee and the upper reaches of Lake Hartwell. To the north, the Jocassee Hydroelectric 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 7/15/73. Unit 2 began commercial operation 9/09/74, 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. Indicator locations for monitoring the liquid release dose paths are generally below the liquid waste discharge point into Lake Hartwell at the Keowee Hydroelectric Plant. Locations for monitoring the gaseous release paths are based on dispersion/deposition parameters for the site and the highest potential dose receptors. 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 define the analysis type, frequency and detection capabilities for each sample. These are repeated in Tables 2.2-1 and 2.2-2. 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.

"Net activity (or concentration)", x_i, 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, MINIMUM DETECTABLE ACTIVITY, AND CRITICAL LEVEL

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 the average of batch background counts. The average is used to account for background fluctuations over the longer counting periods. 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.

For "gross" counters, a Critical Level calculation is also performed to determine statistically significant levels of

activity. The Critical Level is defined as the net count rate which must be exceeded before the sample is said to contain any measureable activity above background. In general, the Critical Level is equal to one half of the MDA. Activities exceeding the Critical Level are reported for gross counters to minimize data biases since most detectable activities fall within this range.

2.3.3 TREND IDENTIFICATION

One of the purposes of an environmental monitoring program is to determine if there is a buildup of radionuclides in the environment due to the operation of the nuclear station. 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 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 previous levels 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:

$$r = \frac{N\Sigma XY - \Sigma X \Sigma Y}{[\,(N\Sigma X^2 - (\Sigma X)^2)\,(N\Sigma Y^2 - (\Sigma Y)^2)\,]^{1/2}} \qquad \text{(eq.2-2)}$$

(Reference 14)

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:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_p \sqrt{1/n_1 + 1/n_2}} \qquad \text{(eq. 2-3)}$$

(Reference 11)

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,

$$s_p^2 = \frac{(n_1 - 1)\, s_1^2 + (n_2 - 1)\, s_2^2}{n_1 + n_2 - 2} \qquad \text{(eq.2-4)}$$

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. A positive result

occurs (the two sets of data are significantly different) when the absolute value of the calculated test statistic exceeds the absolute value of the expected tabulated value.

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 biases associated with the measurement process are minimized 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.

FIGURE 2.1-2

TLD MONITORING LOCATIONS AT THE SITE BOUNDARY

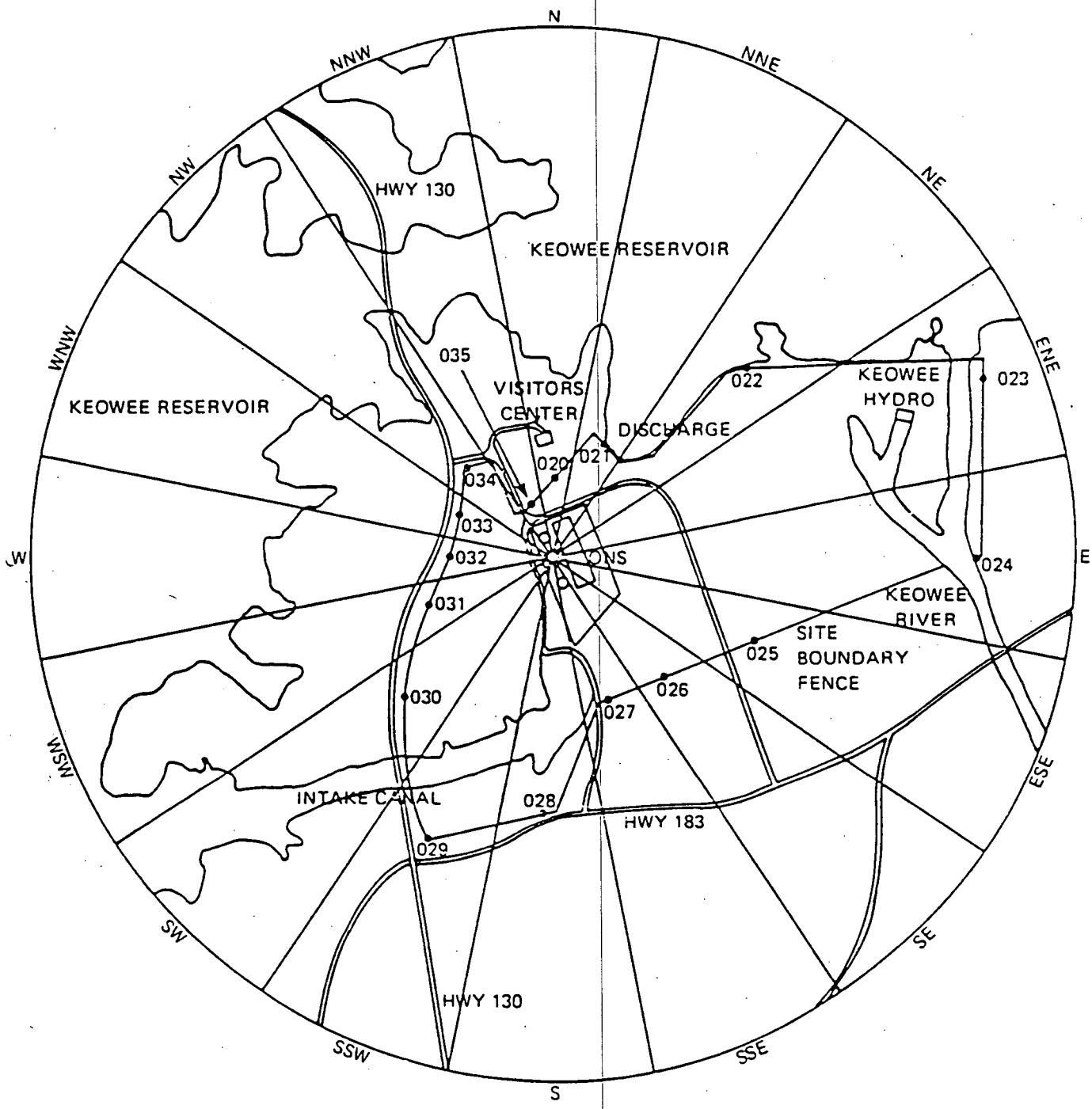

TABLE 2.1-1

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	Surface Water	Milk	Fish	Broadleaf Vegetation
028	Site Boundary (0.5 miles S)							M
060	New Greenville Water Intake Rd. (2.6 miles NNE)*	W		M			SA	M
061	Old Hwy. 183 (1.2 miles SSW)	W						
062	Lake Keowee/Hydro Intake (0.8 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	Orr's Dairy (4.5 miles WNW) [002.1]					SM		
071	Clemson Dairy (10.3 miles SSE) [006.3]					SM		
072	Hwy. 130 (1.8 miles S)	W						
073	Tamassee DAR School (9.2 miles NW) (CONTROL)	W						M
074	Keowee Key Resort (2.3 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	0.1 MILES N	SITE BOUNDARY	040	4.5 MILES E	MICROWAVE TOWER, SIX MILE
021	0.3 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 ISSAQUEENA PARK ENTRANCE
024	0.8 MILES E	SITE BOUNDARY	044	4.0 MILES S	HWY. 130 AT LITTLE RIVER DAM
025	0.4 MILES ESE	SITE BOUNDARY	045	5.0 MILES SSW	TERMINUS OF HWY. 588 AT CROOKED CREEK
026	0.3 MILES SE	SITE BOUNDARY	046	4.5 MILES SW	HWY. 188 AT CROOKED CREEK BRIDGE
027	0.4 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	0.3 MILES WSW	SITE BOUNDARY	051	4.5 MILES NNW	HWY. 128, 1 MILE N OF HWY. 130
076	0.2 MILES W	SITE BOUNDARY	052	12.0 MILES ENE	DPC BRANCH OFFICE-PICKENS
032	0.2 MILES WNW	SITE BOUNDARY	053	11.0 MILES E	DPC BRANCH OFFICE-LIBERTY
033	0.2 MILES WNW	SITE BOUNDARY	054	9.5 MILES ESE	POST OFFICE-HWY.93 NORRIS
034	0.2 MILES NW	SITE BOUNDARY	055	9.5 MILES SSE	CLEMSON METEOROLOGY PLOT
035	0.2 MILES NNW	SITE BOUNDARY	056	8.4 MILES SSW	WATER TOWER-SENECA
036	4.0 MILES N	MILE CREEK LANDING	057	9.0 MILES SW	OCONEE MEMORIAL HOSPITAL
037	4.5 MILES NNE	KEOWEE CHURCH, HWY. 327	058	9.4 MILES WSW	BRANCH ROAD SUBSTATION-WALHALLA (CONTROL)
038	4.0 MILES NE	DURHAM CONVENIENCE MART, JCT. HWY. 183 & 133	059	9.2 MILES NW	TAMASSEE DAR SCHOOL
039	4.0 MILES ENE	HWY. 133, 1 MILE EAST OF JCT. HWY. 183 & 133			

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			X	
		Quarterly Composite		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		

*LLD for low-level I-131 analysis is 1 pCi/liter.

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.

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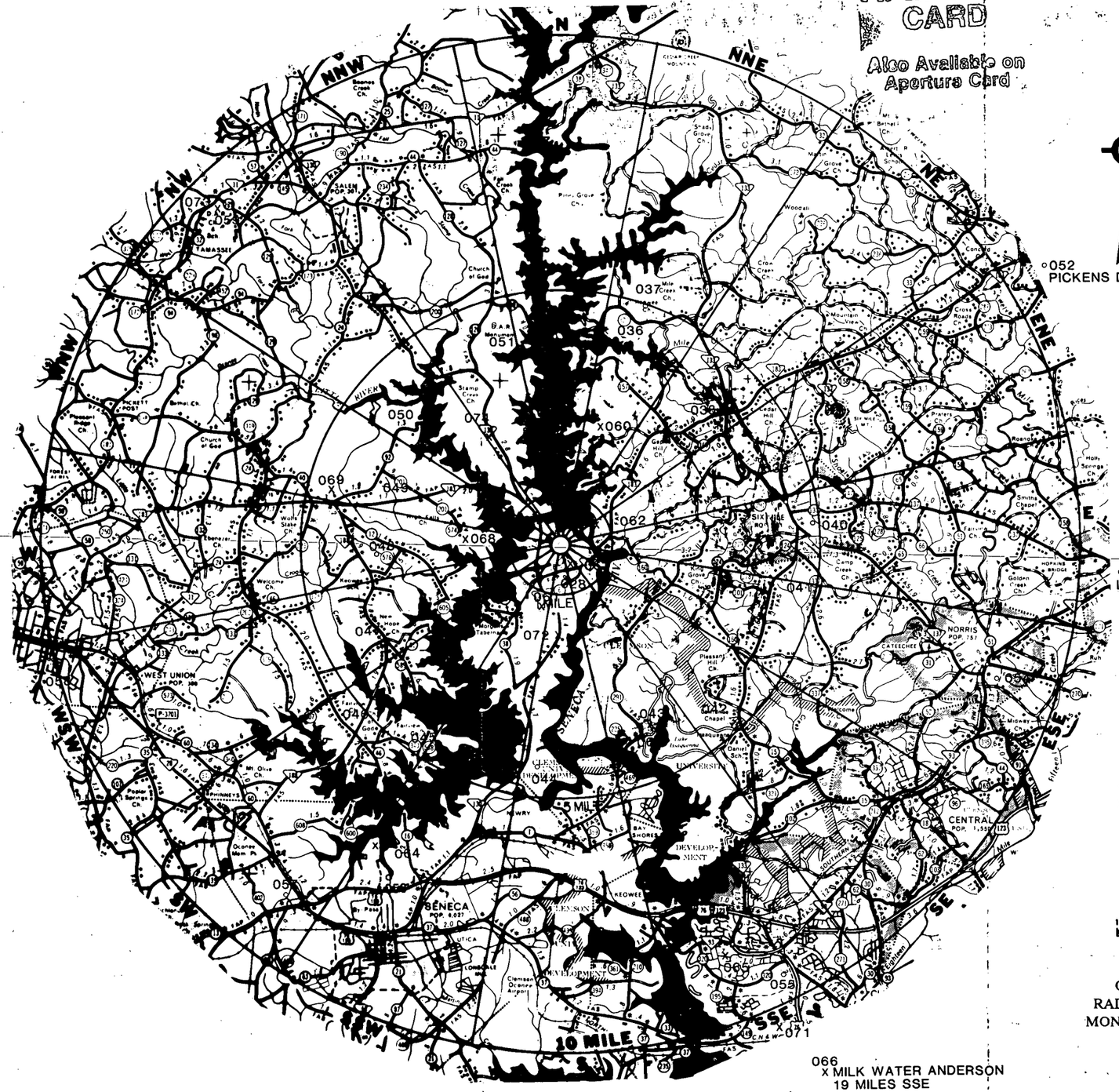


LEGEND

CITIES & TOWNS
COUNTY SEAT
OTHER CITIES & VILLAGES

CULTURAL FEATURES
DWELLING
BARN OR OUTBUILDING
HOUSE TRAILER
TRAILER PARK
SERVICE STATION
REST AREA & PARK
BUSINESS ESTABLISHMENT
POST OFFICE
FACTORY OR INDUSTRIAL PLANT
CHURCH
CHURCH & CEMETERY
CEMETERY
SCHOOL
HOTEL
MOTEL OR TOURIST COURT
HOSPITAL
REST HOME
COMMUNITY HALL
CAMP OR LODGE
SAWMILL
TURPENTINE STILL
HWY MAINTENANCE SHOP
CORRECTIONAL INSTITUTION
AIRBORNE
TENT
OUT TO INDICATE LOCATION OF ANY CULTURAL FEATURE SHOWN
OUT OF HORIZONTAL
GROUP OF MIXED CULTURAL FEATURES (SMALL SCALE)

DRAINAGE
DRAINAGE DITCH
NARROW STREAM
WIDE STREAM OR RIVER
POND
FERRY

BOUNDARIES
COUNTY LINE
STATE LINE
CORPORATE LIMITS
OUTLINE OF ENLARGED URBAN/CORP. AREAS
NAT'L & STATE FOREST
STATE PARK

ROAD SYSTEMS
INTERSTATE
U.S. NUMBERED HIGHWAY
STATE HIGHWAY - PRIMARY
STATE HIGHWAY - SECONDARY
FEDERAL AID PRIMARY SYSTEM
FEDERAL AID SECONDARY SYSTEM

ROAD TYPES
PRIVATE
PRIMITIVE
COUNTY ROADS
SECONDARY SYSTEM
PAVED
UNPAVED

STRUCTURES
RAILROAD TUNNEL (One or More)
RAILROAD OVERHEAD (One or More)
TRUSS (Or Vigid If Short)
SUSPENSION (If Over 1/2 Mi.)
ARCH BRIDGE (One or More)
BRIDGES TOO CLOSE TO SYMBOLIZE SEPARATELY

RAILROADS
RAILROAD
ELECTRIC R.R.
R.R. STATION
GRADE CROSSING
OVERPASS
UNDERPASS

AIRWAYS
AIRPORT
MILITARY AIR FIELD
AIRPORT COMPLETE FACILITIES
LIGHTED LIGHTER
LIGHTED STRIP
AIRPORT BEACON LIGHT

MISC SYMBOLS
GAME PRESERVE (Ex Over 2.5 Sq.)
GAME FARM
BIRD SANCTUARY
FISH HATCHERY
GOVT RANGER STATION
LOOKOUT TOWER
WATER SUPPLY
SURFACE AND RUBBISH
JUNK YARD - AUTO
JUNK YARD - SCRAP METAL
POWER HOUSE OR SUB STATION
PUMPING STATION
TRANSMISSION PIPE LINE
TRANSMISSION LINE
TELEGRAPH & TELEPHONE LINES
QUARRY
GRAVEL SAND OR CLAY PIT
MINE, GAS OR VERTIC.
TANK
HARBOR BASIN
RADIO STATION
CAP. INTERN. MERIDIAN
RADIO TOWER

MISC STRUCTURES
CANAL
LOCK CANAL
DOCK PIER OR LANDING
BOARDING STATION
DAM WITH LOCK
DAM WITH ROAD
RESERVOIR POND OR LAKE
LEVEE
INTERMITTENT STREAM
HEAD OF NAVIGATION
LIGHT NAUTICAL
LIGHTHOUSE

RECREATIONAL
DRIVE-IN THEATRE
SCENIC SITE
PICNIC GROUNDS
BATHING BEACH
PLAY GROUND - BALL FIELDS ETC
CAMP
RECREATIONAL AREA
FAIR GROUNDS - RACE COURSE OR SPEEDWAY
GOLF COURSE OR COUNTRY CLUB
SMALL PARK (Ex 5 Min)
W.P. Boundary (Ex 5 Min)
SMALL MONUMENT OR POINT OF HISTORICAL INTEREST

o TLD LOCATIONS
x ALL OTHER LOCATIONS

SCALE OF MILES
0 1 2 3

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

9405030334-01

SECTION 3.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

DISCUSSION, INTERPRETATION AND TRENDING OF RESULTS

Data from the 1993 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 1993, this included Ag-110m and Sb-125 in shoreline sediment.

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. Graphs are also drawn for a radionuclide whenever linear regression analysis shows high probability of a positive trend. Only Mn-54 in shoreline sediment showed a high positive trend in 1993. This is discussed in Section 3.6.

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 1993. 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 1993. 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 260 fiber filters and 260 charcoal cartridges collected during 1993. No radionuclides, other than those that occur naturally in the environment, were detected in the air samples collected in 1993 and also in 1992.

Visual inspection of tabular data taken from previous environmental report summaries and the 1993 summary did not reveal any increasing trends. Tables 3.1-1 and 3.1-2 summarize the data used and the results of the linear regression analysis. Cs-134 had a poor probability of an increasing trend, while all other radionuclides had decreasing trends based on the linear regression analysis.

K-40 and Be-7 are the naturally occurring radionuclides that were observed in the air samples.

TABLE 3.1-1
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	5.56E-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	1.56E-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	6.07E-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
1992	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
1993	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	-3.20E-01	-1.93E-01	-3.89E-01	-4.88E-01	-5.84E-03	-3.39E-01	-3.56E-01	-7.01E-01	5.02E-02	-8.27E-01	-1.59E-01
Trend Probability	Moderate	Poor	Moderate	Moderate	Poor	Moderate	Moderate	High	Poor	High	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.

TABLE 3.1-2
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	BaLa-140 INDICATOR
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	1.56E-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	6.07E-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	8.57E-04	5.66E-04	1.55E-03	6.77E-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
1992	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
1993	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	-1.77E-01	-2.02E-01	-3.63E-01	-2.83E-01	-3.31E-01	-3.45E-01	-3.53E-01	-7.57E-01	-3.35E-02	-7.04E-01	-1.81E-01
Trend Probability	Poor	Poor	Moderate	Poor	Moderate	Moderate	Moderate	High	Poor	High	Poor
Type Trend	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	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.

The only analysis with detectable results was the gross beta analysis. Table 3.2-1 summarizes the results. No ONS related radionuclides were identified by other analyses.

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

Isotope	1992 Highest Mean	1993 **Highest** Mean	1993 %Reporting Level	1993 **Control** Mean	1993 %Reporting Level
Gross Beta	3.20E0(6/13)	2.1E0(11/13)	NS	1.9E0(11/13)	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 1993 did not show any significant increasing trends. Linear regression analysis data and results are contained in Table 3.2-2. Total Beta results had moderate probability of an increasing trend. H-3, which is a major dose contributor based on effluent dose calculations, had a moderate probability of a decreasing trend. The possibility of a decreasing trend is probably due to the change in sampling locations described in the following.

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 analyzed for H-3 and gamma emitting radionuclides. The results are used in evaluation of any activity detected in the nearest downstream drinking water supply, Anderson Drinking Water Plant, location number 066. The Clemson site was typically the high mean location when the plant was in operation. Only H-3 and K-40 have been detected in the raw water samples since the plant closure. A H-3 concentration of 1.083E3 pCi/liter was detected in one of the 1993 samples. The other samples had concentrations less than detectable levels. This 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 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	1.79E+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+00	1.44E+00	7.30E-01	4.92E-01	9.21E-01	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	3.20E-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+00	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	2.00E+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	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
1992	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	3.23E+00
1993	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	2.10E+00
Correlation Coefficient	-2.62E-01	-2.07E-01	-2.39E-01	-4.42E-01	-2.43E-02	-2.98E-01	-1.38E-01	-7.58E-01	-7.63E-02	-9.48E-02	-4.08E-01	5.49E-01
Trend Probability	Poor	Poor	Poor	Moderate	Poor	Poor	Poor	High	Poor	Poor	Moderate	Moderate
Type Trend	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Increasing

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

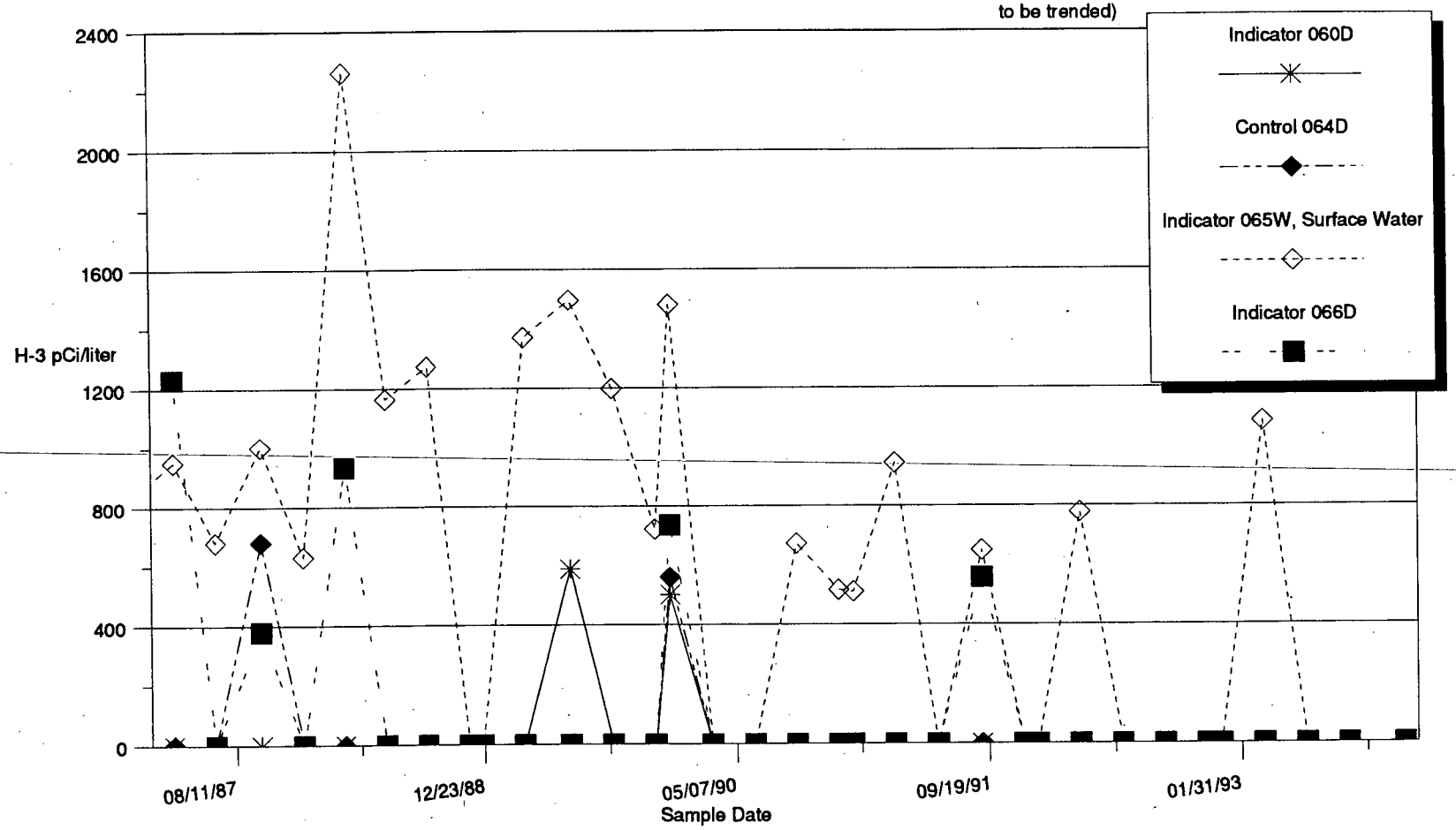
TABLE 3.2-2
DRINKING WATER
TREND ANALYSIS OF MEAN ANNUAL CONCENTRATIONS
CONCENTRATION (pCi/liter)

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	1.24E+03
1987	8.15E+02
1988	1.57E+03
1989	1.35E+03
1990	0.00E+00
1991	5.58E+02
1992	0.00E+00
1993	0.00E+00
Correlation Coefficient	-4.86E-01
Trend Probability	Moderate
Type Trend	Decreasing

Oconee Nuclear Station Radiological Environmental Monitoring

H-3 in Drinking Water Samples

(reporting level = 20,000pCi/liter. 065 is no longer a source of drinking water, but continues to be trended)



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.

Only Tritium was detected in the samples. Table 3.3-1 summarizes the results of the analyses. The indicator location is near the liquid effluent release point and differences between the indicator and control samples are expected. Comparison of 1992 and 1993 highest mean annual concentrations show there is no significant change in concentrations. Observed surface water concentrations were below any reporting levels.

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

Isotope	1992 Highest Mean	1993 **Highest** Mean	%Reporting Level	1993 **Control** Mean	%Reporting Level
H-3	6.22E3(5/5)	8.62E3(5/5)	43.1%*	8.45E2(1/5)	4.23%*

Value in parenthesis is the fraction of detectable measurements.
* Reporting Level used is for Drinking Water. None specified for Surface Water.

Visual inspection of tabular data covering the preoperational period through 1993 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 1993, and for the past fifteen years for the remaining radionuclides. The data used and the results are in Table 3.3-2. Co-58, Ag-110m, and Sb-125 had positive correlation coefficients, which indicates an increasing trend. However, none of these radionuclides were detected in 1993 samples.

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

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	3.88E+00	1.93E+00	4.85E+00	1.25E+00	0.00E+00	0.00E+00
1983	9.97E-01	6.99E-01	2.86E+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	1.03E+00	1.44E-01	1.00E+00	9.90E-01	0.00E+00	0.00E+00	7.89E+01
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	0.00E+00
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
1992	0.00E+00	2.49E+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	4.59E+00	3.27E+01
1993	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	0.00E+00	0.00E+00
Correl. Coeff.	-6.62E-01	1.22E-01	-8.75E-01	-2.69E-01	-6.53E-01	-4.27E-01	-8.51E-01	-7.87E-01	-3.31E-01	-6.30E-01	-5.42E-01	3.41E-01	1.81E-01
Trend Prob.	Moderate	Poor	High	Poor	Moderate	Moderate	High	High	Moderate	Moderate	Moderate	Moderate	Poor
Type Trend	Decreasing	Increasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Increasing	Increasing

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
1992	6.22E+03
1993	8.62E+03
Correlation Coefficient	-5.32E-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 1993. Only naturally occurring K-40 was detected in milk samples. Cs-137 is often observed in milk samples, but was not detected in 1993 samples. Cs-137 in milk is not unusual. It is a constituent of fallout and has been observed in samples from indicator and control locations in previous years.

Visual inspections of tabular data taken from previous environmental report summaries and the 1993 summary did not reveal any significant increasing trends. Cs-137 concentrations have remained relatively constant over the past several years. Linear regression analysis data and results are found in Table 3.4-1. All radionuclides had negative (decreasing) correlation coefficients.

TABLE 3.4-1
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	4.63E-01	0.00E+00	1.08E+00	8.34E-01	3.72E-02	1.16E+00	2.79E+00	2.96E-02
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	4.99E+00	0.00E+00
1992	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	6.63E+00	0.00E+00
1993	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	-1.61E-01	-1.94E-01	-7.67E-01	-1.03E-01	-6.85E-02	-2.19E-01	-2.63E-01	-4.81E-01	-8.56E-02	-1.28E-01	-1.24E-01
Trend Probability	Poor	Poor	High	Poor	Poor	Poor	Poor	Moderate	Poor	Poor	Poor
Type Trend	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	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 1993. No radionuclides, other than those occurring naturally, were observed in indicator location samples. Cs-137 and Mn-54 were reported in control location samples. It is not unusual for Cs-137 to be present in vegetation. It is a constituent of fallout and has been observed in samples from indicator and control locations in previous years. Mn-54 at the control location is thought to be reported due to the presence of Ac-228. Ac-228 emits a photon very close to the energy of the single counting line used to identify Mn-54. 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	1992 Highest Mean	1993 **Highest** Mean	%Reporting Level	1993 **Control** Mean	%Reporting Level
Mn-54	---(0/13)---	---(0/13)---		1.3E1(1/13)	NS
Cs-137	---(0/13)---	---(0/13)---		1.49E2(11/13)	7.5%

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

Visual inspection of tabular data taken from previous environmental report summaries and the 1993 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 poor 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	Nb-95 INDICATOR	Zr-95 INDICATOR	I-131 INDICATOR	Cs-134 INDICATOR	Cs-137 INDICATOR	BaLa-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	4.16E+01	1.48E+01	3.21E+00	1.45E+01	1.45E+01	3.59E+00	0.00E+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	2.99E+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	9.10E+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	1.23E+01	7.44E+00	5.30E+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
1992	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
1993	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	-6.71E-01	-7.45E-01	-6.29E-01	-6.03E-01	-6.86E-01	-3.55E-01	-3.76E-01	-3.15E-01	-2.22E-01	1.06E-01	-2.21E-01
Trend Probability	Moderate	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Poor	Poor	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 1992 and 1993 highest annual means are very similar in the radionuclides detected and their concentrations.

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

Isotope	1992 Highest Mean	1993 **Highest** Mean	%Reporting Level	1993 **Control** Mean	%Reporting Level
Mn-54	8.8E1(1/4)	8.2E1(1/4)	NS	---(0/4)---	
Co-58	1.79E2(1/4)	8.2E1(2/4)	NS	---(0/4)---	
Co-60	1.12E2(1/4)	6.5E1(2/4)	NS	---(0/4)---	
Cs-134	5.6E1(2/4)	3.2E1(3/4)	NS	---(0/4)---	
Cs-137	3.31E2(3/4)	1.36E2(4/4)	NS	5.6E1(2/4)	NS
Ag-110m	1.69E2(1/4)	5.63E1(1/4)	NS	---(0/4)---	
Sb-125	2.08E2(1/4)	1.11E2(1/4)	NS	---(0/4)---	

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

Visual inspection of tabular data from previous environmental report summaries and the 1993 summary indicated increases in shoreline sediment concentrations have occurred since station operations began. Linear regression analysis data and results are found in Table 3.6-2.

The possibility of a high positive trend resulted for Mn-54. A moderate positive trend resulted for Sb-125. Co-58, Co-60, and Ag-110m had poor positive trends.

Graphs of individual sample results can be found in Figures 3.6-1 through 3.6-6. The period plotted begins when shoreline sediment sampling was initiated in 1984. Co-58, Co-60, Ag-110m, Sb-125, and Cs-137 were graphed because they were detected in 1993 samples and are major shoreline sediment dose contributors in effluent calculations. Fluctuations in the graphed results are large and no trends are apparent. Detectable concentrations of Ag-110m and Sb-125 were not reported until after 1986. An increase in the number of samples with detectable Co-58 and Co-60 also occurs after 1986. This activity may be due to the Reactor Coolant Pump and associated fuel damage that occurred on Unit 3 in 1986.

Mn-54 was graphed because it showed a high positive trend when linear regression analysis was performed. Activity reported as Mn-54 may be contributed by the presence of Ac-228. Ac-228 emits a photon very close to the energy of the single counting line used to identify Mn-54. Mn-54 has been reported in samples from both indicator and control locations in the past. Co-58, Co-60 and Mn-54 are forms of crud (activated corrosion products). A review of indicator shoreline sediment sample results since 1984 showed that over 50% of the samples with Mn-54 did not contain either Co-58 or Co-60. This is also the case with the two elevated points in the graph (Figure 3.6-3). The possibility of a high positive trend is due to these two samples that did not contain either cobalt isotope or any other plant related radionuclide. The two samples were reported to contain only Mn-54, K-40, and Be-7. It is concluded that Ac-228 is the major contributor to the activity reported as Mn-54 based on the absence of other corrosion products.

The 1993 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.

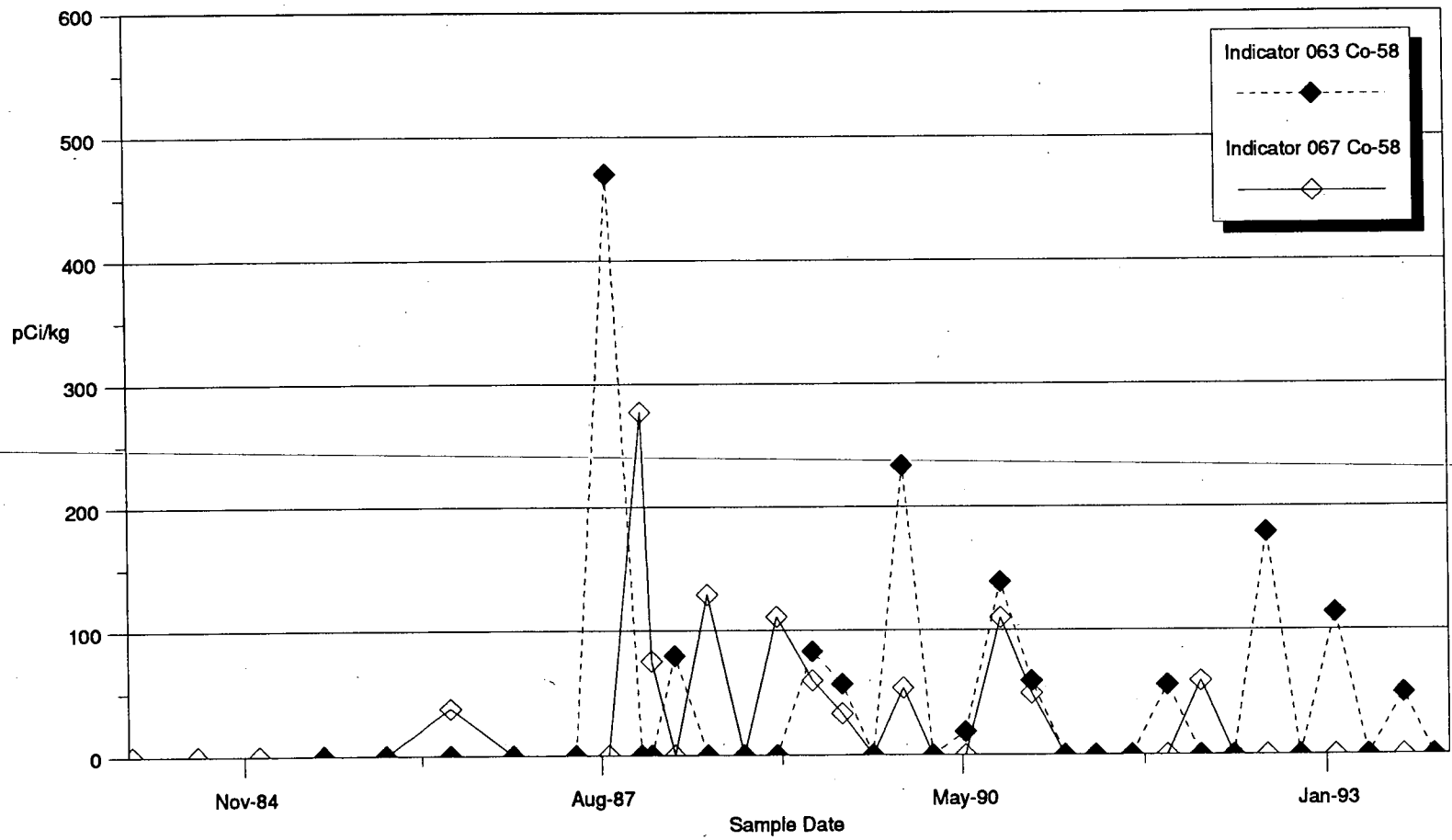
TABLE 3.6-2
SHORELINE SEDIMENT
TREND ANALYSIS OF MEAN ANNUAL CONCENTRATIONS
CONCENTRATION (pCi/kg)

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	2.28E+00	0.00E+00	2.63E+01	5.61E+00	2.62E+01	3.21E+01	2.68E+01	1.19E+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	1.20E+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	9.00E+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
1992	8.79E+01	1.79E+02	0.00E+00	1.12E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.60E+01	3.31E+02	0.00E+00	1.69E+02	2.08E+02
1993	8.20E+01	8.20E+01	0.00E+00	6.50E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.20E+01	1.36E+02	0.00E+00	5.63E+01	1.11E+02
Correl. Coeff.	7.78E-01	1.31E-01	-4.06E-01	9.47E-02	-8.28E-02	-6.21E-01	-6.72E-01	-6.33E-01	-6.99E-01	-4.28E-03	-5.27E-01	2.69E-01	5.15E-01
Trend Prob.	High	Poor	Moderate	Poor	Poor	Moderate	Moderate	Moderate	Moderate	Poor	Moderate	Poor	Moderate
Type Trend	Increasing	Increasing	Decreasing	Increasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Increasing	Increasing

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

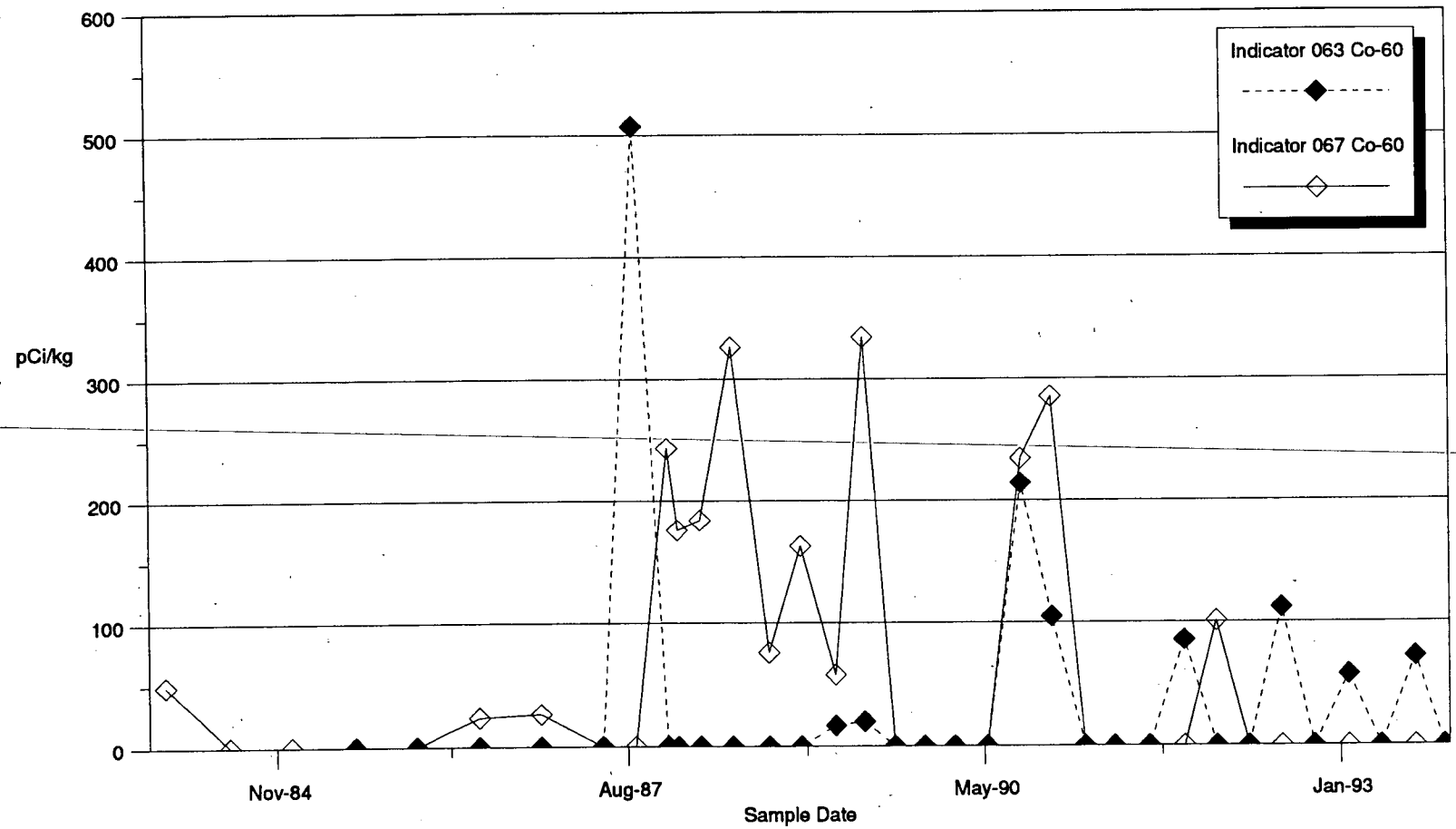
Oconee Nuclear Station Radiological Environmental Monitoring

Shoreline Sediment Co-58 Activity



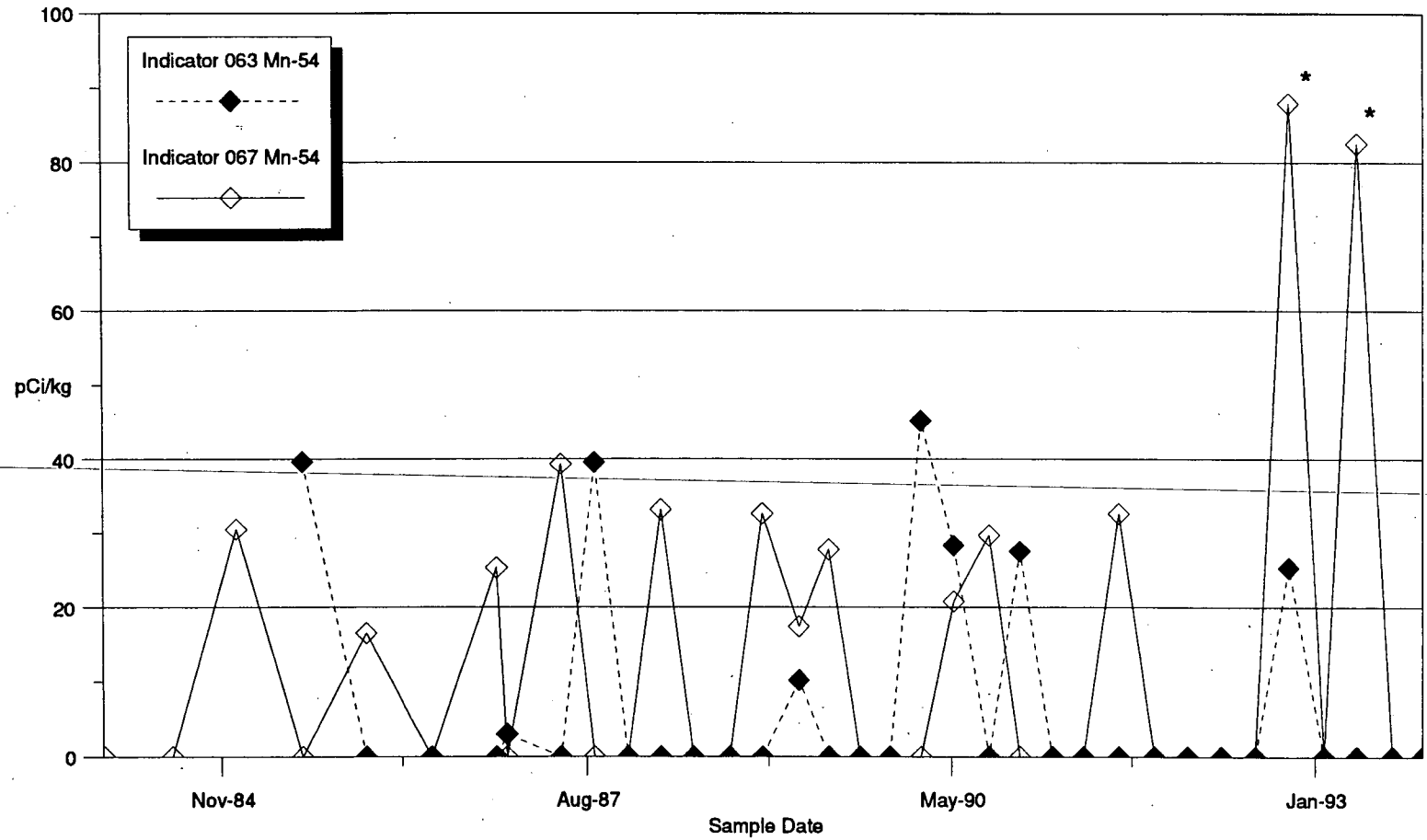
Oconee Nuclear Station Radiological Environmental Monitoring

Shoreline Sediment Co-60 Activity



Oconee Nuclear Station Radiological Environmental Monitoring

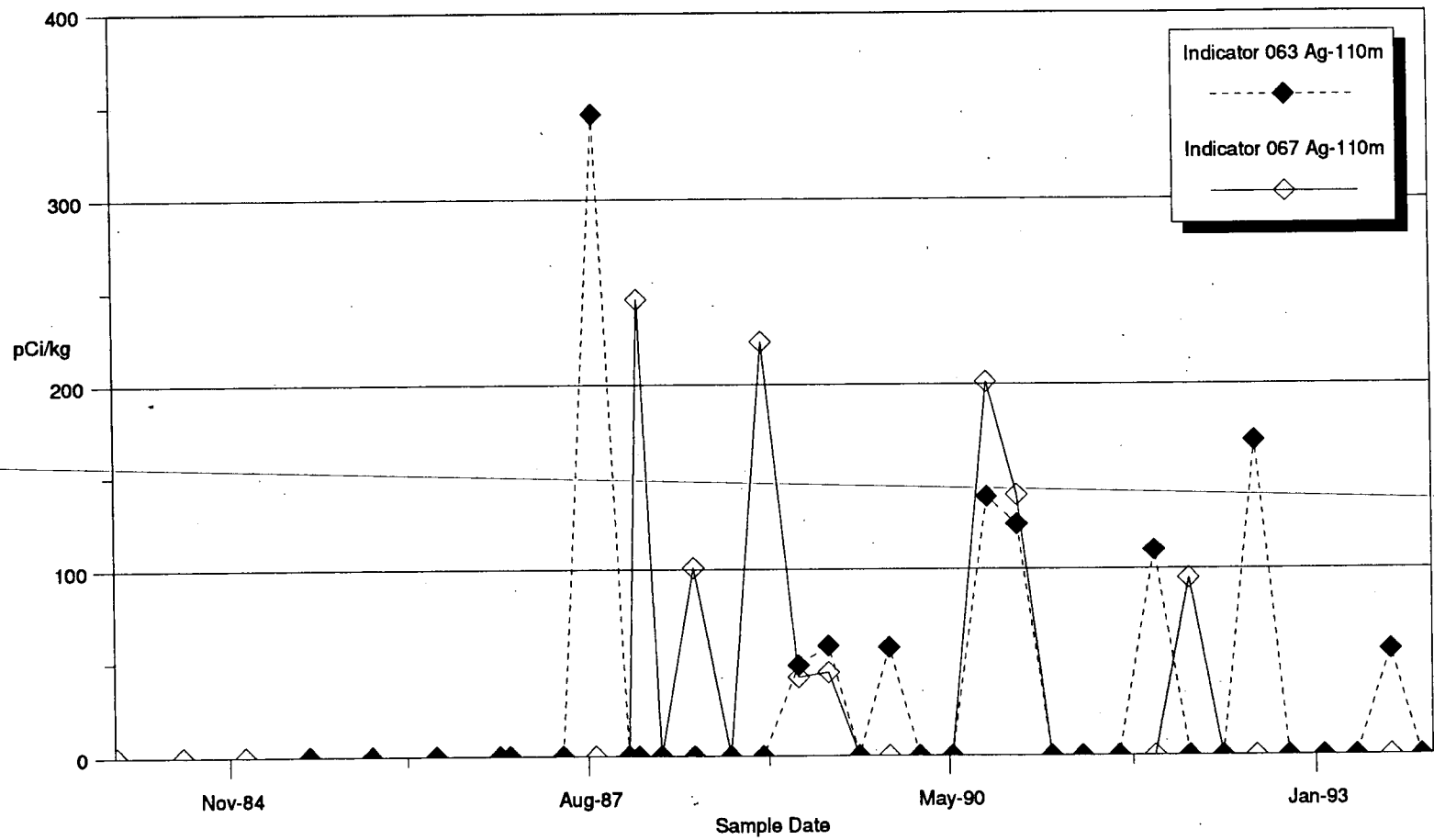
Shoreline Sediment Mn-54 Activity



* No other plant related radionuclides identified in sample-Mn-54 reported activity contributed by Ac-228

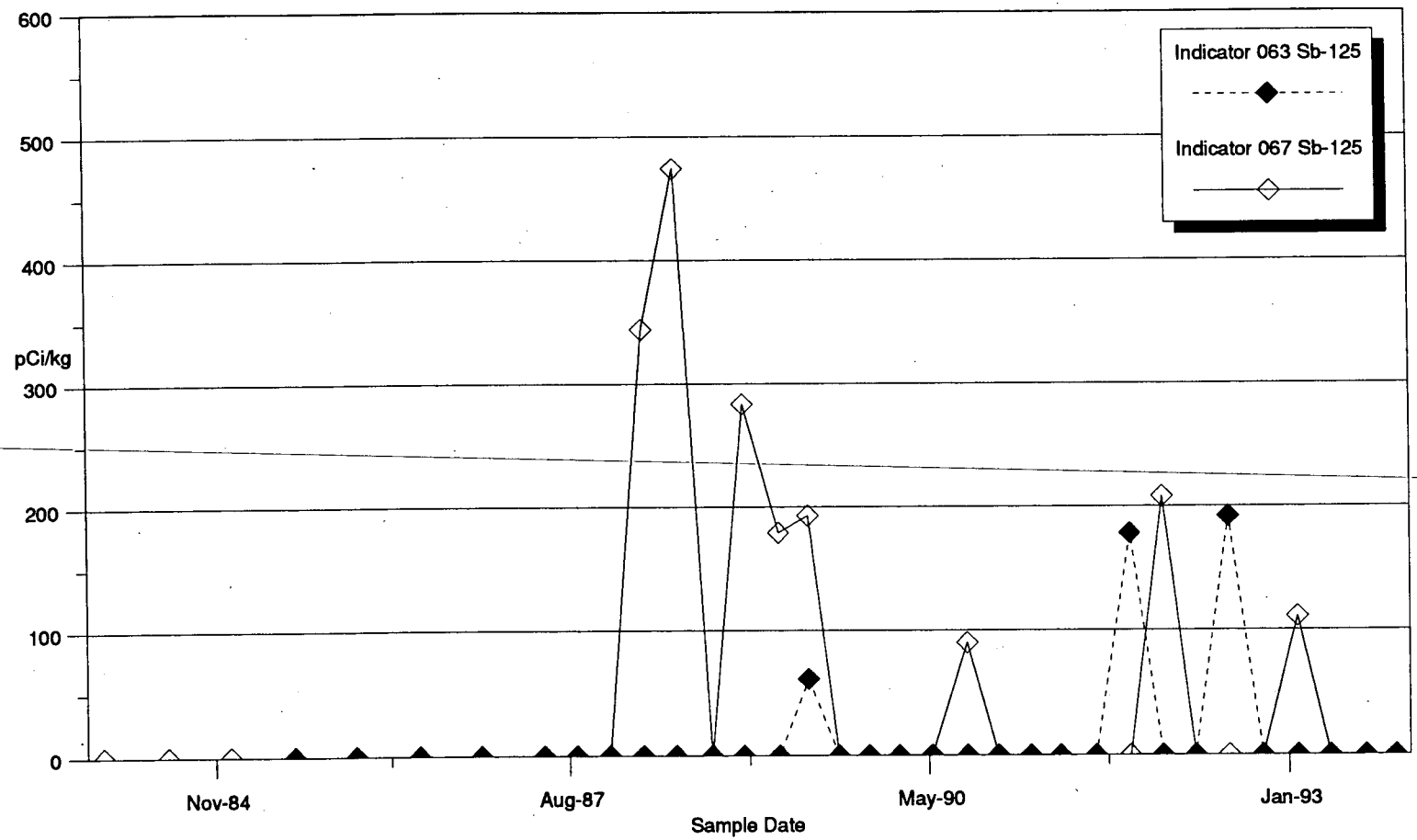
Oconee Nuclear Station Radiological Environmental Monitoring

Shoreline Sediment Ag-110m Activity



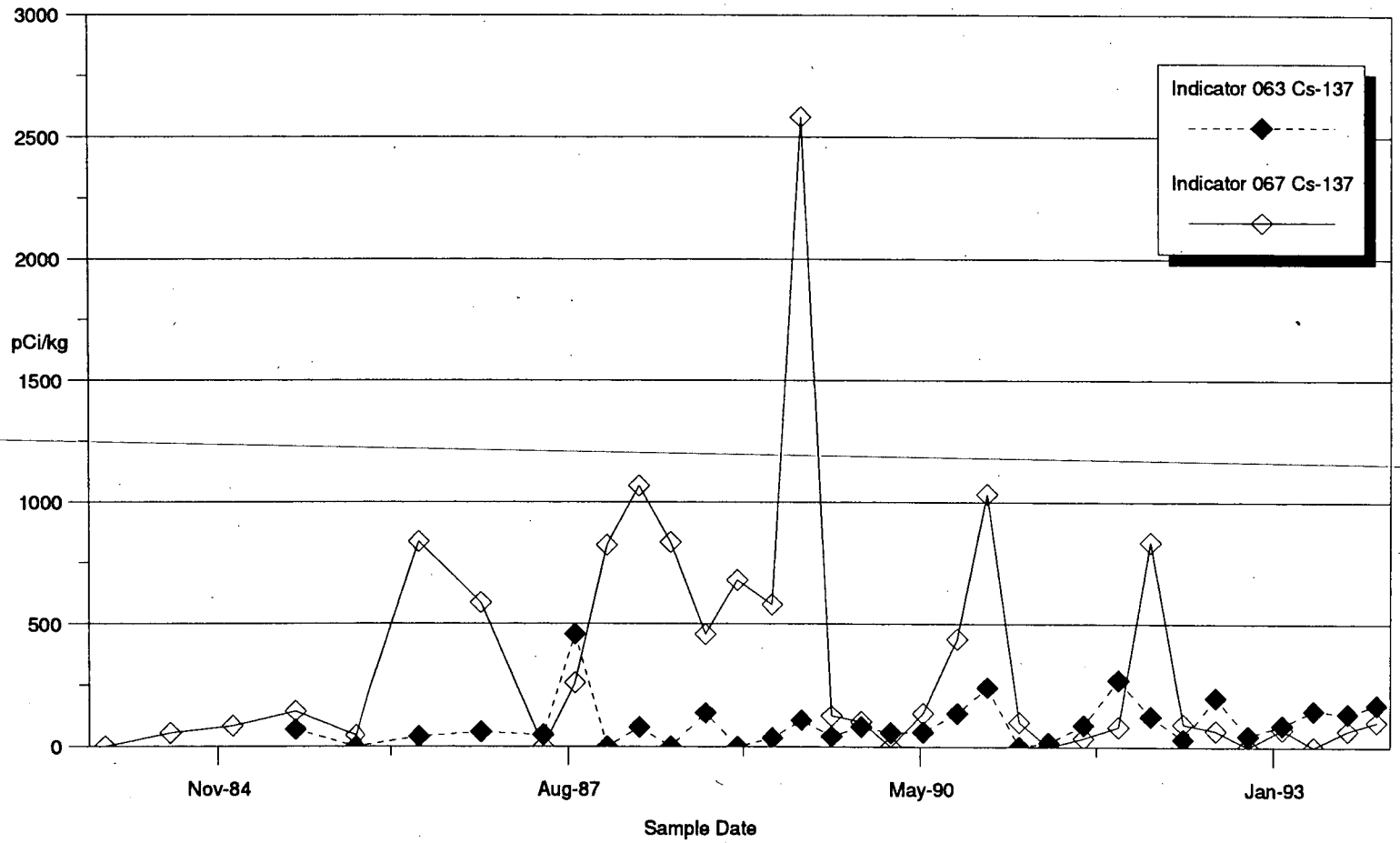
Oconee Nuclear Station Radiological Environmental Monitoring

Shoreline Sediment Sb-125 Activity



Oconee Nuclear Station Radiological Environmental Monitoring

Shoreline Sediment Cs-137 Activity



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 increases in concentrations. There were no 1993 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	1992 Highest Mean	1993 **Highest** Mean	%Reporting Level	1993 **Control** Mean	%Reporting Level
Cs-134	4.8E1(3/4)	2.1E1(1/4)	2.1%	---(0/4)---	
Cs-137	1.36E2(4/4)	1.10E2(4/4)	5.5%	3.1E1(2/4)	1.55%

Value in parenthesis is the fraction of detectable measurements.

Radioactivity concentrations in downstream fish samples are higher than those reported in preoperational fish samples, however, visual inspection of tabular data from previous environmental report summaries and the 1993 summary did not reveal any continued increasing trends. Linear regression analysis was applied to radionuclides routinely evaluated in fish samples. Table 3.7-2 lists the data used. None of the radionuclides indicated a high probability of an increasing trend. Mn-54, Co-58, Cs-134 and Cs-137 had positive correlation coefficients. All but Cs-134 had poor possibilities of an increasing trend. Cs-134 had a moderate probability. 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
1992	0.00E+00	6.10E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1993	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	2.38E-02	1.83E-01	-3.05E-01	-2.87E-01	-3.42E-01	-5.69E-01	-6.63E-01	-6.70E-01	-2.57E-01
Trend Probability	Poor	Poor	Moderate	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.

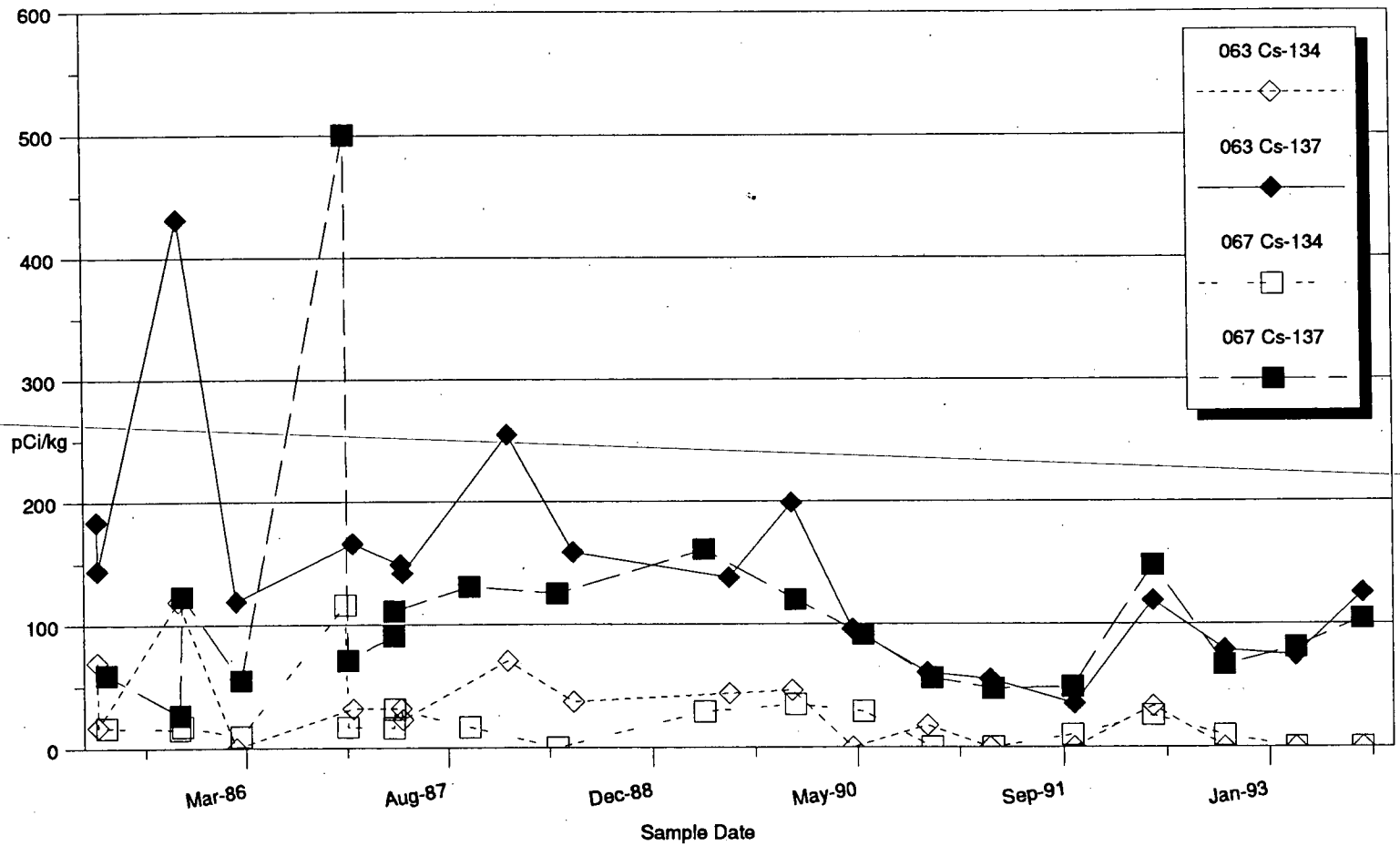
TABLE 3.7-2
FISH
TREND ANALYSIS OF MEAN ANNUAL CONCENTRATIONS

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	3.23E+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
1992	4.81E+01	1.36E+02
1993	2.10E+01	1.10E+02
Correlation Coefficient	3.31E-01	1.68E-01
Trend Probability	Moderate	Poor
Type Trend	Increasing	Increasing

Oconee Nuclear Station Radiological Environmental Monitoring

Cs-134 and Cs-137 in Bass

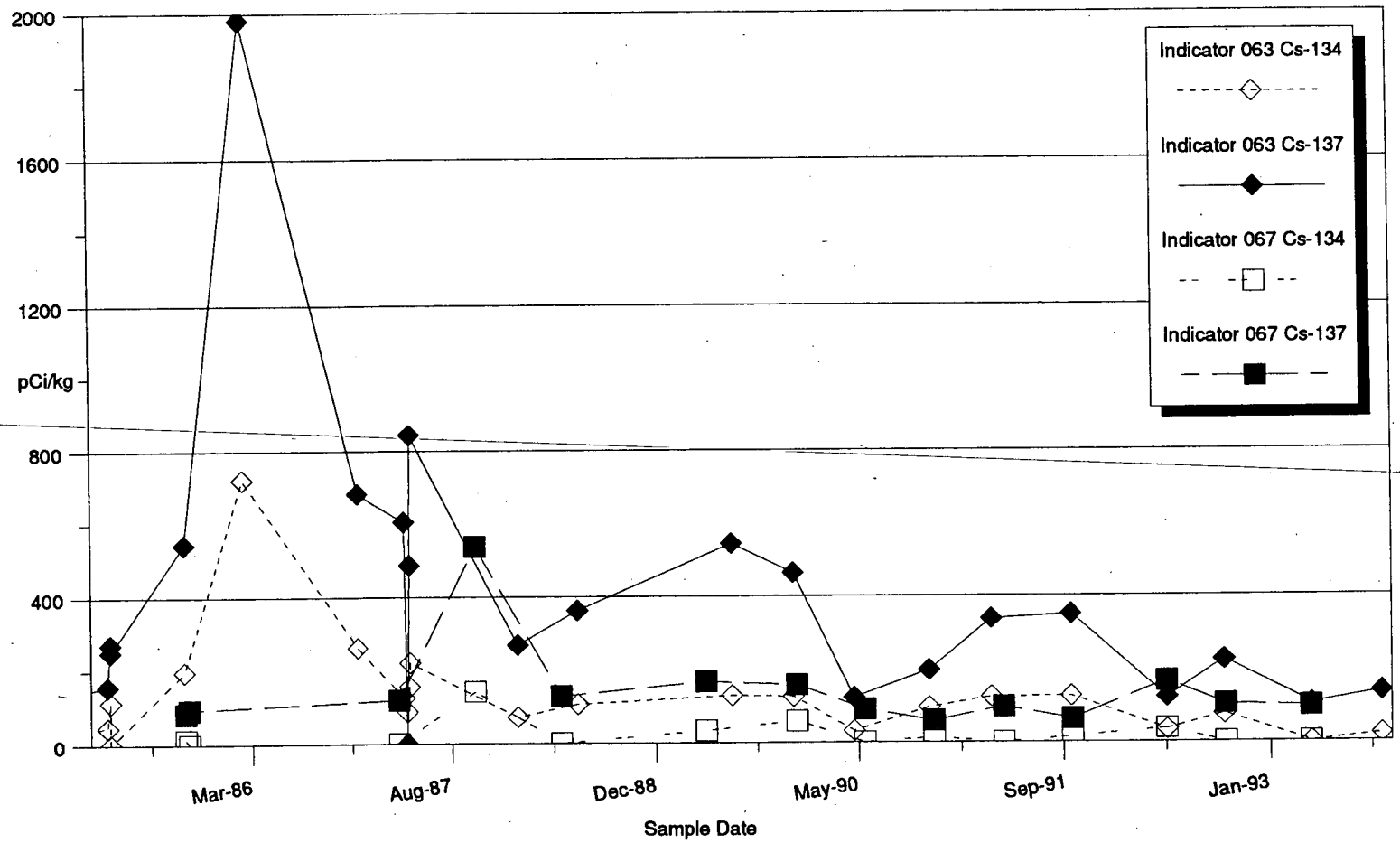
(Cs-134 reporting level = 1000pCi/kg
Cs-137 reporting level = 2000pCi/kg)



Oconee Nuclear Station Radiological Environmental Monitoring

Cs-134 and Cs-137 in Catfish

(Cs-134 reporting level = 1000pCi/kg
Cs-137 reporting level = 2000pCi/kg)



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. All 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 034, at the site boundary fence. The annual mean for the control location was 24 millirem per quarter. A graph showing the average quarterly TLD doserate is found in Figure 3.8-1.

The test statistic, or t-test discussed in Section 2, was used to compare the TLD measurements taken during preoperation to those taken during 1993. In this case, the ratios of results from the site boundary 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 1993. As shown in Table 3.8-1 the t-value was -0.4981. This compared well to the expected value of the t-statistic, -2.030 (based on 37 measurements and 95% confidence in the result), and statistically demonstrates there is not a significant difference between preoperational and 1993 measurements.

A value of the t-statistic was also calculated by comparing 1984 to 1993 results. The TLD locations were standardized in 1984. Standard

locations provide a more direct indicator of significant change. As shown in Table 3.8-1, the value of the t-statistic was 0.6212. This compares favorably with the allowable result of -2.042 (based on 32 measurements and 95% confidence in the result) and demonstrates there is not a significant difference between the 1984 and 1993 measurements.

Therefore, it can be concluded that the doserates measured around Oconee during 1993 do not differ significantly with those existing in previous years.

Further review of the data in Figure 3.8-1 shows doserates around Oconee have decreased steadily from 1986 to 1990. An investigation into the cause of the downward trends was completed by the General Office Radwaste Processing and Dosimetry Groups in 1993 (References 15 and 16). The investigation consisted of an evaluation of TLD readout control parameters, an intercomparison study with environmental TLD's from two other utilities and a statistical comparison of Duke Power Company TLD results to colocated NRC TLD results. Based on the review it was concluded that the downward trend appeared to be caused by TLD readout parameters used and the manner in which controls were evaluated. This problem was corrected with the implementation of a new TLD reader in 1989 and a better QC program. The results of the statistical evaluation showed the results do not differ significantly form colocated NRC results. No further corrective actions were taken.

TABLE 3.8-1

COMPARISON OF INNER RING/OUTER RING TLD RESULTS

	1993	Preop	1984
Inner Ring mrad/qtr	18.71	28.27	21.87
Outer Ring mrad/qtr	20.15	30.98	20.65
Ratio Average	0.94	0.91	1.00
Ratio Variance	0.043	0.03	0.10

1993 vs. Preop t-value = -0.4981

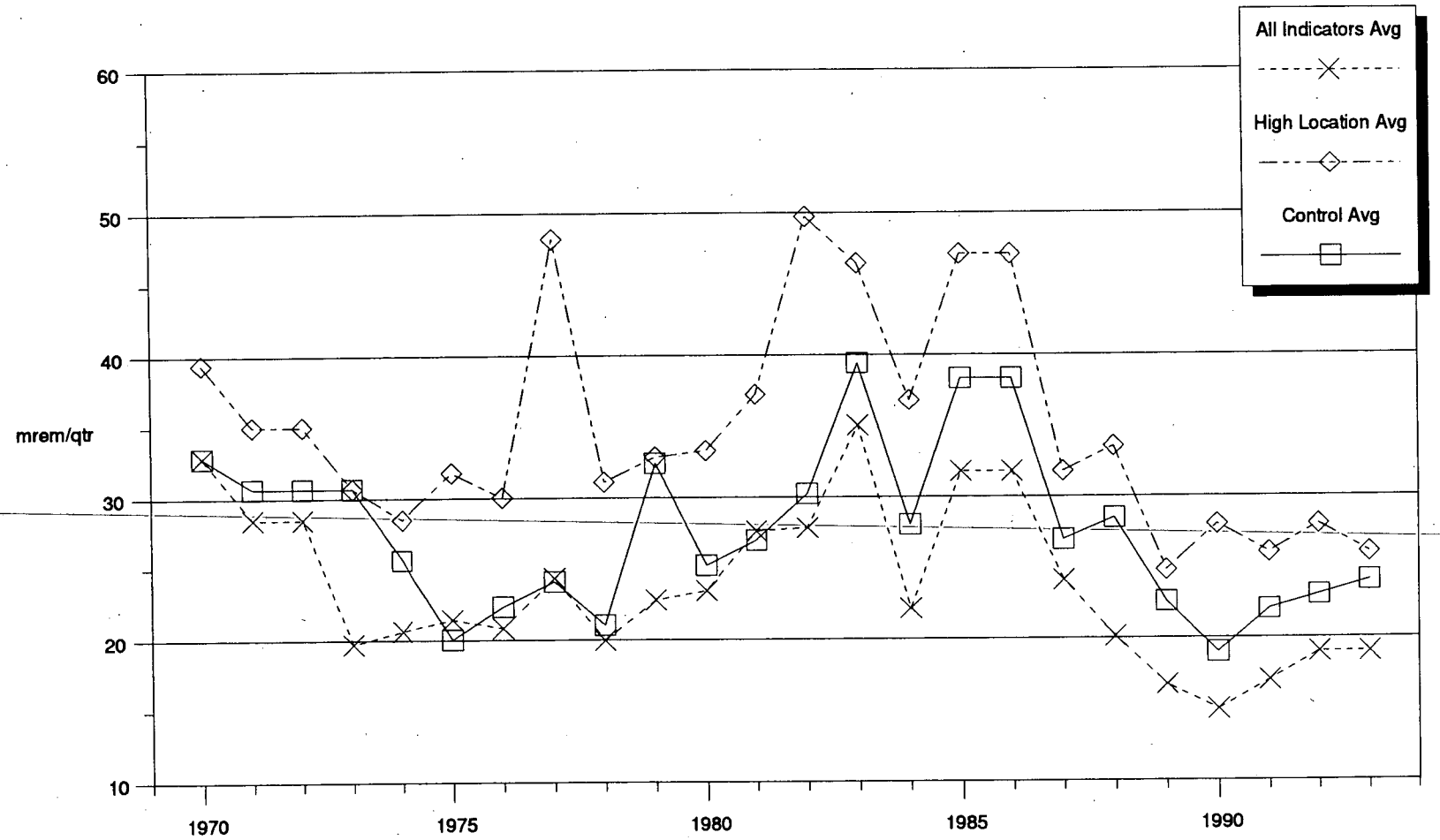
1993 vs. Preop Expected t-statistic = -2.030

1993 vs. 1984 t-value = 0.6212

1993 vs. 1984 Expected t-statistic = -2.042

Oconee Nuclear Station Radiological Environmental Monitoring

Annual Average Environmental Doserates



Data from 5/2/90,OS778.00 and AREOP

3.9 LAND USE CENSUS

The Land Use Census was conducted during June and July in 1993. The census results are contained in Table 3.9-1. No program changes were required based on the results of the census.

TABLE 3.9-1

LAND USE CENSUS DATA SHEET

Dates(s) Performed: 6-01-93 through 7-29-93

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	1.5
	Nearest Meat Animal	-		Nearest Meat Animal	-
	Nearest Cow	-		Nearest Cow	-
	Nearest Goat	-		Nearest Goat	-
NE	Nearest Residence	1.25	SW	Nearest Residence	1.5
	Nearest Meat Animal	4.25		Nearest Meat Animal	-
	Nearest Cow	-		Nearest Cow	-
	Nearest Goat	-		Nearest Goat	-
ENE	Nearest Residence	1.0	WSW	Nearest Residence	1.8
	Nearest Meat Animal	3.5		Nearest Meat Animal	3.75
	Nearest Cow	-		Nearest Cow	-
	Nearest Goat	-		Nearest Goat	-
E	Nearest Residence	1.0	W	Nearest Residence	1.75
	Nearest Meat Animal	3.0		Nearest Meat Animal	4.0
	Nearest Cow	-		Nearest Cow	-
	Nearest Goat	-		Nearest Goat	-
ESE	Nearest Residence	1.0	WNW	Nearest Residence	1.75
	Nearest Meat Animal	2.25		Nearest Meat Animal	-
	Nearest Cow	-		Nearest Cow	4.5
	Nearest Goat	-		Nearest Goat	-
SE	Nearest Residence	1.75	NW	Nearest Residence	1.0
	Nearest Meat Animal	2.5		Nearest Meat Animal	-
	Nearest Cow	-		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	-

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 critical age 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.

In calculations based on effluent measurements, drinking water is conservatively the controlling dose path since essentially no dilution is assumed. No plant related radionuclides were detected in environmental drinking water samples leaving fish as the predominant dose path based on environmental samples.

The environmental data doses for the Bone, Liver, and Total Body are higher than the effluent doses due to concentrations reported in fish samples. This was also observed in the 1992 Annual Report. A thorough review of the fish pathway dose calculation methodology was performed in 1987 (Reference 12). Variables and limitations of the effluent dose calculation model were evaluated. The current model was found acceptable. However, it was noted in the model evaluation that cesium concentration factors in fish are highly variable. Freshwater fish concentration factors referenced for cesium range from 40 to 15,000 l/kg and is assumed to be 2,000 l/kg in Reg. Guide 1.109. The high variability in concentration factors is explained by the number of factors which influence radionuclide uptake and elimination by aquatic animals and plants. These factors include dietary patterns, radionuclide turnover rate through the food chain, trophic level of the organism, stable element concentration in the water, temperature, pH, and organism size, age, and metabolic rate. Therefore, to ensure that the model is conservative, the cesium concentration factor will be increased from 2,000 l/kg to 10,000 l/kg for 1994 effluent dose calculations.

No plant related radionuclides were detected in gaseous pathway samples resulting in no environmental data dose calculated for this pathway.

Doses from all sampled paths were summed. The doses calculated do not exceed the 40CFR190 dose commitment limits for members of the public.

TABLE 4.1

1993 ENVIRONMENTAL AND EFFLUENT DOSES

Liquid Release Pathway

Organ	Environmental or Effluent Data	Critical Age	Critical Pathway	Maximum Dose (mrem)
Skin	Environ.	Teen	Shoreline Sediment	2.65E-3
Skin	Effluent	Teen	Shoreline Sediment	2.18E-3
Bone	Environ.	Child	Fish	2.12E-1
Bone	Effluent	Child	Fish	5.87E-2
Liver	Environ.	Teen	Fish	2.68E-1
Liver	Effluent	Child	Drinking	1.74E-1
T.Body	Environ.	Adult	Fish	1.87E-1
T.Body	Effluent	Adult	Drinking	1.30E-1
Thyroid	Environ.	Adult	Fish	1.58E-2
Thyroid	Effluent	Infant	Drinking	1.58E-1
Kidney	Environ.	Teen	Fish	9.93E-2
Kidney	Effluent	Child	Drinking	1.33E-1
Lung	Environ.	Teen	Fish	4.71E-2
Lung	Effluent	Child	Drinking	1.21E-1
GI-LLI	Environ.	Adult	Fish	2.05E-2
GI-LLI	Effluent	Adult	Drinking	1.55E-1

1993 ENVIRONMENTAL AND EFFLUENT DOSES

Gaseous Release Pathway

Noble Gas Exposure

Organ	Environmental or Effluent Data	Critical Age	Critical Pathway	Maximum Dose (mrem)
Skin	Environ.	-	-	Noble Gas Not Sampled
Skin	Effluent	N/A	Noble Gas Exposure	8.80E-3
T.Body	Environ.	-	-	Noble Gas Not Sampled
T.Body	Effluent	N/A	Noble Gas Exposure	3.31E-3

Iodine, Particulate, and Tritium Exposure

Organ	Environmental or Effluent Data	Critical Age	Critical Pathway	Maximum Dose (mrem)
Bone	Environ.	-	-	0.00E0
Liver	Environ.	-	-	0.00E0
T.Body	Environ.	-	-	0.00E0
Thyroid	Environ.	-	-	0.00E0
Thyroid	Effluent	Infant	Goat Milk	2.49E-2
Kidney	Environ.	-	-	0.00E0
Lung	Environ.	-	-	0.00E0
GI-LLI	Environ.	-	-	0.00E0

Table 4.2
Maximum Individual Dose for 1992 based on Environmental Measurements (mrem)

Age	Sample Medium	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Skin
Infant	Airborne	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Drinking Water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Milk	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	TOTAL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Age	Sample Medium	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Skin
Child	Airborne	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Drinking Water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Milk	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Broadleaf Vegetation	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Fish	2.12E-01	2.36E-01	4.67E-02	9.80E-03	8.26E-02	3.60E-02	1.12E-02	0.00E+00
	Shoreline Sediment	4.74E-04	4.74E-04	4.74E-04	4.74E-04	4.74E-04	4.74E-04	4.74E-04	5.53E-04
	TOTAL	2.12E-01	2.36E-01	4.72E-02	1.03E-02	8.31E-02	3.65E-02	1.17E-02	5.53E-04

Age	Sample Medium	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Skin
Teen	Airborne	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Drinking Water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Milk	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Broadleaf Vegetation	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Fish	1.70E-01	2.66E-01	1.08E-01	1.19E-02	9.70E-02	4.48E-02	1.54E-02	0.00E+00
	Shoreline Sediment	2.27E-03	2.27E-03	2.27E-03	2.27E-03	2.27E-03	2.27E-03	2.27E-03	2.65E-03
	TOTAL	1.72E-01	2.68E-01	1.10E-01	1.42E-02	9.93E-02	4.71E-02	1.77E-02	2.65E-03

Age	Sample Medium	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Skin
Adult	Airborne	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Drinking Water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Milk	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Broadleaf Vegetation	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Fish	1.60E-01	2.62E-01	1.87E-01	1.54E-02	9.79E-02	4.29E-02	2.01E-02	0.00E+00
	Shoreline Sediment	4.06E-04	4.06E-04	4.06E-04	4.06E-04	4.06E-04	4.06E-04	4.06E-04	4.74E-04
	TOTAL	1.60E-01	2.62E-01	1.87E-01	1.58E-02	9.83E-02	4.33E-02	2.05E-02	4.74E-04

Table 4.2 (continued)

Infant Dose from Inhalation Pathway (mrem/yr) = Breathing rate (m3/yr) x Dose Factor (mrem/pCi inhaled) x Concentration (pCi/m3)

Breathing rate = 1400 m3/yr

Radionuclide	Infant Inhalation Dose Factor (mrem per pCi inhaled) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Location Dist/ Direction	Conc. in Air (pCi/m3)	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 DAT	NO DAT	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 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 DAT	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

Table 4.2 (continued)

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

Usage (intake rate) = 330 l/yr

	Infant Ingestion Dose Factor (mrem per pCi ingested)							Location Dist/	Conc. in Water	Dose (mrem/yr)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Direction	(pCi/l)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	1.99E-05	4.51E-06	NO DATA	4.41E-06	NO DATA	7.31E-06	ALL	0.00E+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
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	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)

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

Usage (intake rate) = 330 l/yr

Radionuclide	Infant Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	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
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
								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)

Child Dose from Inhalation Pathway (mrem/yr) = Breathing rate (m3/yr) x Dose Factor (mrem/pCi inhaled) x Concentration (pCi/m3)

Breathing rate = 3700 m3/yr

	Child Inhalation Dose Factor (mrem per pCi inhaled)							Location Dist/	Conc. in Air	Dose (mrem/yr)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Direction	(pCi/m3)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54 Particulate	NO DATA	1.16E-05	2.57E-06	NO DATA	2.71E-06	4.26E-04	6.19E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-58 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	3.60E-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 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	2.45E-04	2.23E-04	3.47E-05	NO DATA	7.63E-05	2.81E-05	9.78E-07	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BaLa-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

Table 4.2 (continued)

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

Usage (intake rate) = 510 l/yr

Radionuclide	Child Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Location Dist/ Direction	Conc. in Water (pCi/l)	Dose (mrem/yr) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	1.07E-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
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	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)

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

Usage (intake rate) = 330 l/yr

Radionuclide	Child Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Location Dist/ Direction	Conc. in Milk (pCi/l)	Dose (mrem/yr) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	1.07E-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
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) =		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)

Child Dose from Broadleaf Veg. Pathway (mrem/yr) = Usage (kg/yr) x Dose Factor (mrem/pCi ingested) x Concentration (pCi/kg)

Usage (intake rate) = 26 kg/yr

	Child Ingestion Dose Factor (mrem per pCi ingested)							Location Dist/	Conc. in Vegetation	Dose (mrem/yr)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Direction	(pCi/kg)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	1.07E-05	2.85E-06	NO DATA	3.00E-06	NO DATA	8.98E-06	ALL	0.00E+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
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)=		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)

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

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
= 7.78E+03 pCi/L x 0.9 = 7.00E+03 pCi/kg

	Child Ingestion Dose Factor (mrem per pCi ingested)							Highest Ann. Mean Conc.		Dose (mrem/yr)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Location Dist/ Direction	in Fish (pCi/kg)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	1.07E-05	2.85E-06	NO DATA	3.00E-06	NO DATA	8.98E-06	ALL	0.00E+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	063 0.8mi/ESE	2.10E+01	3.39E-02	5.56E-02	1.17E-02	0.00E+00	1.72E-02	6.19E-03	3.00E-04
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	7.90E+01	1.78E-01	1.71E-01	2.52E-02	0.00E+00	5.56E-02	2.00E-02	1.07E-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	7.00E+03	0.00E+00	9.80E-03	9.80E-03	9.80E-03	9.80E-03	9.80E-03	9.80E-03
								Total Dose (mrem/yr) =		2.12E-01	2.36E-01	4.67E-02	9.80E-03	8.26E-02	3.60E-02	1.12E-02

Table 4.2 (continued)

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

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	Conc. in Sediment (pCi/kg)	Dose (mrem/yr) T. Body	Skin
Mn-54	5.80E-09	6.80E-09	067 4.2mi/SSE	8.20E+01	5.33E-05	6.25E-05
Co-58	7.00E-09	8.20E-09	063 0.8mi/ESE	8.20E+01	6.43E-05	7.53E-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	6.50E+01	1.24E-04	1.46E-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	3.20E+01	4.30E-05	5.02E-05
Cs-137	4.20E-09	4.90E-09	063 0.8mi/ESE	8.00E+01	3.76E-05	4.39E-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	5.63E+01	1.14E-04	1.32E-04
Sb-125	3.10E-09	3.50E-09	067 4.2mi/SSE	1.11E+02	3.85E-05	4.35E-05
			Total Dose (mrem/yr) =		4.74E-04	5.53E-04

Table 4.2 (continued)

Teen Dose from Inhalation Pathway (mrem/yr) = Breathing rate (m3/yr) x Dose Factor (mrem/pCi inhaled) x Concentration (pCi/m3)

Breathing rate = 8000 m3/yr

Radionuclide	Teen Inhalation Dose Factor (mrem per pCi inhaled) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Location Dist/ Direction	Conc. in Air (pCi/m3)	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 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
BaLa-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

Table 4.2 (continued)

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

Usage (intake Rate) = 510 l/yr

	Teen Ingestion Dose Factor (mrem per pCi ingested)							Location Dist/	Conc. in Water	Dose (mrem/yr)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Direction	(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	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)

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

Usage (intake rate) = 400 l/yr

Radionuclide	Teen Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	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-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
								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)

Teen Dose from Broadleaf Veg. Pathway (mrem/yr) = Usage (kg/yr) x Dose Factor (mrem/pCi ingested) x Concentration (pCi/kg)

Usage (intake rate) = 42 kg/yr

	Teen Ingestion Dose Factor (mrem per pCi ingested)							Location Dist/	Conc. in Vegetation	Dose (mrem/yr)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Direction	(pCi/kg)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	5.90E-06	1.17E-06	NO DATA	1.76E-06	NO DATA	1.21E-05	ALL	0.00E+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
								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)

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

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
= 7.78E+03 pCi/L x 0.9 = 7.00E+03 pCi/kg

	Teen Ingestion Dose Factor (mrem per pCi ingested)							Highest Ann. Mean Conc. in		Dose (mrem/yr)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Location Dist/ Direction	Fish (pCi/kg)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	5.90E-06	1.17E-06	NO DATA	1.76E-06	NO DATA	1.21E-05	ALL	0.00E+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	063 0.8mi/ESE	2.10E+01	2.81E-02	6.62E-02	3.07E-02	0.00E+00	2.10E-02	8.03E-03	8.23E-04
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	7.90E+01	1.42E-01	1.88E-01	6.56E-02	0.00E+00	6.41E-02	2.49E-02	2.68E-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 0.8mi/ESE	7.00E+03	0.00E+00	1.19E-02	1.19E-02	1.19E-02	1.19E-02	1.19E-02	1.19E-02
								Total Dose (mrem/yr) =		1.70E-01	2.66E-01	1.08E-01	1.19E-02	9.70E-02	4.48E-02	1.54E-02

Table 4.2 (continued)

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

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	Conc. in Sediment (pCi/kg)	Dose (mrem/yr) T. Body	Skin
Mn-54	5.80E-09	6.80E-09	067 4.2mi/SSE	8.20E+01	2.55E-04	2.99E-04
Co-58	7.00E-09	8.20E-09	063 0.8mi/ESE	8.20E+01	3.08E-04	3.60E-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	063 0.8mi/ESE	6.50E+01	5.92E-04	6.97E-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	3.20E+01	2.06E-04	2.40E-04
Cs-137	4.20E-09	4.90E-09	063 0.8mi/ESE	8.00E+01	1.80E-04	2.10E-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	5.63E+01	5.43E-04	6.34E-04
Sb-125	3.10E-09	3.50E-09	067 4.2mi/SSE	1.11E+02	1.84E-04	2.08E-04
			Total Dose (mrem/yr) =		2.27E-03	2.65E-03

Table 4.2 (continued)

Adult Dose from Inhalation Pathway (mrem/yr) = Breathing rate (m3/yr) x Dose Factor (mrem/pCi inhaled) x Concentration (pCi/m3)

Breathing rate = 8000 m3/yr

Radionuclide	Adult Inhalation Dose Factor (mrem per pCi inhaled) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Location Dist/ Direction	Conc. in Air (pCi/m3)	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	1.08E-04	6.68E-06	ALL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nb-95 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 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
BaLa-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

Table 4.2 (continued)

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

Usage (intake rate) = 730 l/yr

Radionuclide	Adult Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	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	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-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
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	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)

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

Usage (intake rate) = 310 l/yr

Radionuclide	Adult Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Location Dist/ Direction	Conc. in Milk (pCi/l)	Dose (mrem/yr) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	4.57E-06	8.72E-07	NO DATA	1.36E-06	NO DATA	1.40E-05	ALL	0.00E+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
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

Table 4.2 (continued)

Adult Dose from Broadleaf Veg. Pathway (mrem/yr) = Usage (kg/yr) x Dose Factor (mrem/pCi ingested) x Concentration (pCi/kg)

Usage (intake rate) = 64 kg/yr

Radionuclide	Adult Ingestion Dose Factor (mrem per pCi ingested) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Location Dist/ Direction	Conc. in Vegetation (pCi/kg)	Dose (mrem/yr) Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	4.57E-06	8.72E-07	NO DATA	1.36E-06	NO DATA	1.40E-05	ALL	0.00E+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
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

Table 4.2 (continued)

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

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
= 7.78E+03 pCi/L x 0.9 = 7.00E+03 pCi/kg

	Adult Ingestion Dose Factor (mrem per pCi ingested)							Highest Ann. Mean Conc.		Dose (mrem/yr)						
Radionuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI	Location Dist/ Direction	in Fish (pCi/kg)	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Mn-54	NO DATA	4.57E-06	8.72E-07	NO DATA	1.36E-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-06	063 0.8mi/ESE	2.10E+01	2.74E-02	6.53E-02	5.34E-02	0.00E+00	2.11E-02	7.01E-03	1.14E-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	7.90E+01	1.32E-01	1.81E-01	1.18E-01	0.00E+00	6.14E-02	2.04E-02	3.50E-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	7.00E+03	0.00E+00	1.54E-02	1.54E-02	1.54E-02	1.54E-02	1.54E-02	1.54E-02
							Total Dose (mrem/yr) =			1.60E-01	2.62E-01	1.87E-01	1.54E-02	9.79E-02	4.29E-02	2.01E-02

Table 4.2 (continued)

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

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	Conc. in Sediment (pCi/kg)	Dose (mrem/yr) T. Body	Skin
Mn-54	5.80E-09	6.80E-09	067 4.2mi/SSE	8.20E+01	4.57E-05	5.35E-05
Co-58	7.00E-09	8.20E-09	063 0.8mi/ESE	8.20E+01	5.51E-05	6.46E-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	6.50E+01	1.06E-04	1.25E-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	3.20E+01	3.69E-05	4.30E-05
Cs-137	4.20E-09	4.90E-09	063 0.8mi/ESE	8.00E+01	3.23E-05	3.76E-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	5.63E+01	9.73E-05	1.14E-04
Sb-125	3.10E-09	3.50E-09	067 4.2mi/SSE	1.11E+02	3.30E-05	3.73E-05
			Total Dose (mrem/yr) =		4.06E-04	4.74E-04

SECTION 5.0

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 Radiation Dosimetry & Records group 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

The ONS Chemistry and Radiation Protection Sections responsible for environmental monitoring were evaluated by Quality Verification in 1993. No findings or recommendations were identified.

Radiological and Environmental Services was audited by the Quality Verification Department in 1993. One finding, two follow-up items, one observation, and three recommendations were identified during this audit. Based on these items, actions were taken to enhance laboratory operations.

5.1.5.2 DUKE POWER'S NUCLEAR PRODUCTION INTERCOMPARISON PROGRAM

Radiological and Environmental Services participated in the Duke Power Nuclear Generation Department Intercomparison Program during 1993. Interlaboratory cross-check standards, including 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

The Radiological and Environmental Monitoring Program was inspected by the NRC in 1993. No problems were identified by the inspection. Radiological and

Environmental Services was not audited by the NRC in 1993.

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 (1 time per year), gamma in air filters (1 time per year), iodine in milk (1 time per year), tritium in water (2 times per year), iodine in water (2 times per year), gross beta in air filters (1 time per year), and gross beta in water (3 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 1993 is documented in Table 5.1. Of the twenty-six (26) analyses performed in 1993, none were out of EPA acceptance limits.

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 (DHEC) 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 collocated 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 Radiation Dosimetry & Records group routinely participate with the State of North Carolina Department of Environmental Health and Natural Resources (DEHNR) in an intercomparison program. Radiological and Environmental Services 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 collocated 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 Radiation Dosimetry & Records group for analysis of the unknown estimated delivered exposure. A summary of the State of North Carolina Environmental Dosimetry Intercomparison Report for 1993 is documented in Table 5.2. The Radiation Dosimetry & Records group results were within 1.51% of the State of North Carolina results (excluding Standard Deviation values) for the July and November 1993 cross-checks.

5.1.5.7 U.S. DEPARTMENT OF ENERGY INTERCOMPARISON PROGRAM

There was no DOE intercomparison program during calendar year 1993.

TABLE 5. (Page 1 of 2)

U.S. ENVIRONMENTAL PROTECTION AGENCY INTERLABORATORY COMPARISON PROGRAM
1993 CROSS-CHECK RESULTS FOR THE RADIOLOGICAL AND ENVIRONMENTAL SERVICES LABORATORY

ANALYSIS	COLLECTION DATE	NUCLIDE(S)	KNOWN VALUE	CONTROL LIMITS 3 SIGMA; N=3	REPORTED VALUE
Gamma in Water	06/11/93	Ba-133	99.0 pCi/l	81.7 - 116.3 pCi/l	103.0 pCi/l
		Co-60	15.0 pCi/l	6.3 - 23.7 pCi/l	15.7 pCi/l
		Zn-65	103.0 pCi/l	85.7 - 120.3 pCi/l	112.7 pCi/l
		Ru-106	119.0 pCi/l	98.2 - 139.8 pCi/l	100.7 pCi/l
		Cs-134	5.0 pCi/l	0.0 - 13.7 pCi/l	5.7 pCi/l
		Cs-137	5.0 pCi/l	0.0 - 13.7 pCi/l	5.0 pCi/l
	10/19/93	Co-60	10.0 pCi/l	1.3 - 18.7 pCi/l	10.7 pCi/l
		Cs-134	12.0 pCi/l	3.3 - 20.7 pCi/l	10.3 pCi/l
		Cs-137	10.0 pCi/l	1.3 - 18.7 pCi/l	10.3 pCi/l
	11/12/93	Ba-133	79.0 pCi/l	65.1 - 92.9 pCi/l	80.3 pCi/l
		Co-60	30.0 pCi/l	21.3 - 38.7 pCi/l	31.0 pCi/l
		Zn-65	150 pCi/l	124.0 - 176.0 pCi/l	162.0 pCi/l
		Ru-106	201.0 pCi/l	166.3 - 235.7 pCi/l	190.3 pCi/l
		Cs-134	59.0 pCi/l	50.3 - 67.7 pCi/l	54.7 pCi/l
		Cs-137	40.0 pCi/l	31.3 - 48.7 pCi/l	41.3 pCi/l

TABLE 5. (Page 2 of 2)

U.S. ENVIRONMENTAL PROTECTION AGENCY INTERLABORATORY COMPARISON PROGRAM
1993 CROSS-CHECK RESULTS FOR THE RADIOLOGICAL AND ENVIRONMENTAL SERVICES LABORATORY

ANALYSIS	COLLECTION DATE	NUCLIDE(S)	KNOWN VALUE	CONTROL LIMITS (3 SIGMA; N=3)	REPORTED VALUE
Gamma in Water	02/02/93	I-131	100.0 pCi/l	82.7 - 117.3 pCi/l	103.0 pCi/l
	10/08/93	I-131	117.0 pCi/l	96.2 - 137.8 pCi/l	118.0 pCi/l
Air Filter	08/27/93	Cs-137	9.0 pCi/l	0.3 - 17.7 pCi/l	11.0 pCi/l
		Gross Beta	47.0 pCi/l	38.3 - 55.7 pCi/l	48.0 pCi/l
H-3 in Water	06/07/93	H-3	9844.0 pCi/l	8136.8 - 11551.2 pCi/l	9267.3 pCi/l
	11/05/93	H-3	7398.0 pCi/l	6114.1 - 8681.9 pCi/l	6787.0 pCi/l
Gamma in Milk	09/24/93	I-131	120.0 pCi/l	99.2 - 140.8 pCi/l	122.0 pCi/l
		Cs-137	49.0 pCi/l	40.3 - 57.7 pCi/l	48.0 pCi/l
Beta in Water	01/29/93	Gross Beta	44.0 pCi/l	35.3 - 52.7 pCi/l	39.0 pCi/l
	07/23/93	Gross Beta	43.9 pCi/l	31.0 - 55.0 pCi/l	37.3 pCi/l
	10/19/93	Gross Beta	58.0 pCi/l	40.7 - 75.3 pCi/l	46.3 pCi/l
	10/29/93	Gross Beta	15.0 pCi/l	6.3 - 23.7 pCi/l	17.0 pCi/l

TABLE 5.2

STATE OF NORTH CAROLINA
DEPARTMENT OF ENVIRONMENTAL
HEALTH AND NATURAL RESOURCES

ENVIRONMENTAL DOSIMETER CROSS-CHECK - 1993

STATE OF NORTH CAROLINA ESTIMATED VALUE			RADIATION DOSIMETRY AND RECORDS ESTIMATED VALUE	
Date of Cross-Check	Exposure (mrem)	Estimated Uncertainty (1 S.D mrem)	Exposure (mrem)	Estimated Uncertainty (1 S.D mrem)
Jul-93	60.0	± 1.81	57.66	± 2.20
Nov-93	40.0	± 1.91	39.58	± 0.82

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. Radiological and Environmental Services, Radioanalysis Laboratory Procedures
5. ONS Final Safety Analysis Report
6. ONS Preoperational Environmental Radioactivity Monitoring Reports and Annual Radiological Environmental Operating Reports, 1969-1992
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 1993 Annual Liquid and Gaseous Effluent Report, 2/10/94
11. Probability and Statistics in Engineering and Management Science, Hines and Montgomery, 1969, Pages 287-293
12. 4/17/87 Letter to US NRC concerning elevated levels of radionuclides in fish, OS-801.01, 801.02
13. 1/25/94 Memorandum to File: Use of Global Positioning System to Map Radiological Environmental Monitoring Program Locations, OS-778.00
14. Practical Statistics for the Physical Sciences, Havilcek and Crain, 1988, Pages 83-93
15. 8/12/93 Letter, Radiological Environmental Monitoring Program Evaluation of Downward TLD Trends, File GS-778.05

16. 2/18/94 Letter, Radiological Environmental Monitoring Program Evaluation of Downward TLD Trends Statistical Comparison of Collocated Oconee/NRC TLDs, OS-778.05

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 1993. 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 Radiation Dosimetry & Records group. 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 were no changes in sampling procedures for the calendar year 1993.

The distance and direction of many of the sampling locations were measured using a Global Positioning System (GPS) unit in October of 1993 (Reference 13). This technology provides location coordinates accurate to within 10

meters. Tables 2.1-1 and 2.1-2 have been revised with the results of the GPS work. The distance of several of the locations changed with the largest change found to be 0.6 mile. TLD 032, located at the site boundary, was thought to be in the West sector, but was found to lie in the WNW sector by the Global Positioning System. A new TLD, number 076, was located in the West sector on 12/08/93.

CHANGE OF ANALYSIS PROCEDURES

There were no changes in analysis procedures for the calendar year 1993.

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. An appropriate amount 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. An appropriate amount of sample is 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. Fish are collected until the required sample size is met (500 grams each species). Fish samples are prepared using just the fillets. A gamma spectroscopy analysis is performed on each species of fish after it is 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 (where milk is used for human consumption), 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 having 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 : Oconee Nuclear Station
Loca[redacted]of Facility : Oconee County, S.C.
Tim[redacted]t Generated : 25-JAN-1994 16:35:05
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1993 through 31-DEC-1993
Database Name : $DISK1:[USER.ASC]ONS93.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.
PARTICULATE (I/M3)							
						073 (9.2 Mi NW)	
Locations	MN-54 260	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	CO-58 260	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	FE-59 260	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	CO-60 260	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	ZN-65 260	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	NB-95 260	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	ZR-95 260	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	I-131 260	7.00E-02	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	CS-134 260	5.00E-02	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	CS-137 260	6.00E-02	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	BALA-140 260	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0

n and range based upon detectable measurements only
ction of detectable measurements at specified locations is indicated in parentheses, (Fraction)
o range indicates no detectable activity measurements
LLD is equal to 0, then LLD is not required by Selected Licensee Commitments

ati[redacted]= Greenville Water Intake
cation [redacted] = Old Highway 183
ation 072 = Highway 130
ation 073 = Tamassee DAR School
cation 074 = Keowee Key Resort

Name of Facility : Oconee Nuclear Station
Loc[illegible]of Facility : Oconee County, S.C.
Tim[illegible]t Generated : 25-JAN-1994 16:35:05
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1993 through 31-DEC-1993
Database Name : $DISK1:[USER.ASC]ONS93.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.
RADIOIODINES I/M3)						
					073 (9.2 Mi NW)	
ocations	MN-54 260	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	CO-58 260	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	FE-59 260	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	CO-60 260	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	ZN-65 260	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	NB-95 260	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	ZR-95 260	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	I-131 260	7.00E-02	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	CS-134 260	5.00E-02	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	CS-137 260	6.00E-02	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0
	BALA-140 260	0.00E+00	0.00E+00(0/ 208) 0.00E+00-- 0.00E+00		0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00	0

n and range based upon detectable measurements only
tion of detectable measurements at specified locations is indicated in parentheses, (Fraction)
o range indicates no detectable activity measurements
LLD is equal to 0, then LLD is not required by Selected Licensee Commitments

ati[illegible]= Greenville Water Intake
ation 081 = Old Highway 183
ation 072 = Highway 130
ation 073 = Tamassee Dar School
ation 074 = Keowee Key Resort

Name of Facility : Oconee Nuclear Station
Location of Facility : Oconee County, S.C.
Time Report Generated : 25-JAN-1994 16:35:05
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1993 through 31-DEC-1993
Database Name : $DISK1:[USER.ASC]ONS93.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: Name, Distance and Direction — Mean (Fraction) Range	Control Locations Mean (Fraction) Range	No. of Non-Routine Report Meas.
DAD LEAF VEGET							
CI/WET/KG)							
						073 (9.2 Mi NW)	
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	13. (1/ 13) 13. -- 13.	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
	CS-137 39	80.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00		0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	1.49E+02(11/ 13) 75. -- 2.19E+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

n and range based upon detectable measurements only
ction of detectable measurements at specified location is indicated in parentheses, (Fraction)
o range indicates no detectable activity measurements
LLD is equal to 0, then LLD is not required by Selected Licensee Commitments

ati = Site Boundary
ation 080 = Greenville Water Intake Road
ation 073 = Tamassee DAR School

Name of Facility : Oconee Nuclear Station
Location of Facility : Oconee County, S.C.
Time Report Generated : 25-JAN-1994 16:35:05
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1993 through 31-DEC-1993
Database Name : $DISK1:[USER.ASC]ONS93.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.
NKING WATER						
CI/LITER)						
					064 (6.7 Mi SW)	
Locations	ANAL1-LL 39	1.0	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	MN-54 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	CO-58 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	FE-59 39	30.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	CO-60 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	ZN-65 39	30.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	NB-95 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	ZR-95 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	I-131 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	CS-134 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	CS-137 39	18.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	BALA-140 39	15.	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0

n and range based upon detectable measurements only
ctio detectable measurements at specified location is indicated in parentheses, (Fraction)
o r dicates no detectable activity measurements
LLD is equal to 0, then LLD is not required by Selected Licensee Commitments

ation 060 = Greenville Water Intake
ation 064 = Seneca, SC
ation 066 = Anderson, SC

Name of Facility : Oconee Nuclear Station
Loca[redacted]of Facility : Oconee County, S.C.
Tim[redacted]t Generated : 25-JAN-1994 16:35:05

Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1993 through 31-DEC-1993
Database Name : $DISK1:[USER.ASC]ONS93.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.
NKING WATER							
I/LITER)							
				066 (19.0 Mi SSE)		064 (6.7 Mi SW)	
ocations	BETA 39	4.0	1.8 (20/26)		2.1 (11/ 13)	1.9 (11/ 13)	0
			0.68 -- 4.0		1.0 -- 4.0	0.71 -- 5.7	
TRITIUM							
I/LITER)							
						064 (6.7 Mi SW)	
ocations	H-3 15	2.00E+03	0.00E+00(0/ 10)		0.00E+00(0/ 5)	0.00E+00(0/ 5)	0
			0.00E+00-- 0.00E+00		0.00E+00-- 0.00E+00	0.00E+00-- 0.00E+00	

n and range based upon detectable measurements only
ction of detectable measurements at specified location is indicated in parentheses, (Fraction)
o range indicates no detectable activity measurements
LLD is equal to 0, then LLD is not required by Selected Licensee Commitments

ati[redacted] Greenville Water Intake
ation 064 = Seneca, SC
ation 066 = Anderson, SC

Name of Facility : Oconee Nuclear Station
Location of Facility : Oconee County, S.C.
Time Report Generated : 25-JAN-1994 16:35:05
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1993 through 31-DEC-1993
Database Name : $DISK1:[USER.ASC]ONS93.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.
H							
I/WET/KG)							
						060 (2.6 Mi NNE)	
ocations	MN-54 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
	CO-58 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
	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
				063 (0.8 Mi ESE)			
	CS-134 12	1.30E+02	21. (1/ 8) 21. -- 21.		21. (1/ 4) 21. -- 21.	0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0
				063			
	CS-137 12	1.50E+02	1.06E+02(8/ 8) 74. -- 1.36E+02		1.10E+02(4/ 4) 74. -- 1.36E+02	31. (2/ 4) 19. -- 42.	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

n and range based upon detectable measurements only
tion of detectable measurements at specified location is indicated in parentheses, (Fraction)
b range indicates no detectable activity measurements
LLD is equal to 0, then LLD is not required by Selected Licensee Commitments

tio = Greenville Water Intake
ation = Lake Hartwell - Highway 183 Bridge
ation 067 = Highway 27 - Lawrence Ramsey Bridge

Name of Facility : Oconee Nuclear Station
Docket Number : 50-269,270,287
Location of Facility : Oconee County, S.C.
Reporting Period : 1-JAN-1993 through 31-DEC-1993
Time Report Generated : 25-JAN-1994 16:35:05
Database Name : $DISK1:[USER.ASC]ONS93.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.
LK							
CI/LITER)							
						066 (19.0 Mi SSE)	
Locations	MN-54 78	0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00		0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	CO-58 78	0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00		0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	FE-59 78	0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00		0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	CO-60 78	0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00		0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	ZN-65 78	0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00		0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	NB-95 78	0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00		0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	ZR-95 78	0.00E+00	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00		0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	I-131 78	15.	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00		0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	LLI-131 78	1.0	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00		0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	CS-134 78	15.	0.00E+00(0/ 52) 0.00E+00-- 0.00E+00		0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0.00E+00(0/ 26) 0.00E+00-- 0.00E+00	0
	CS-137 78	18.	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
	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

n and range based upon detectable measurements only
ction detectable measurements at specified location is indicated in parentheses, (Fraction)
p ra dicates no detectable activity measurements
LLD is equal to 0, then LLD is not required by Selected Licensee Commitments

ation 066 = Garrison Dairy
ation 069 = Orr Dairy
ation 071 = Clemson Dairy

Name of Facility : Oconee Nuclear Station
Location of Facility : Oconee County, S.C.
Time Report Generated : 25-JAN-1994 16:35:05
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1993 through 31-DEC-1993
Database Name : $DISK1:[USER.ASC]ONS93.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.
IMENT							
I/DRY/KG)							
				067 (4.2 Mi SSE)		068 (2.0 Mi W)	
ocations	MN-54 12	0.00E+00	82. (1/ 8) 82. -- 82.		82. (1/ 4) 82. -- 82.	0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0
				063 (0.8 Mi ESE)			
	CO-58 12	0.00E+00	82. (2/ 8) 49. -- 1.14E+02		82. (2/ 4) 49. -- 1.14E+02	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			
	CO-60 12	0.00E+00	65. (2/ 8) 57. -- 72.		65. (2/ 4) 57. -- 72.	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			
	CS-134 12	1.50E+02	32. (3/ 8) 22. -- 51.		32. (3/ 4) 22. -- 51.	0.00E+00(0/ 4) 0.00E+00-- 0.00E+00	0
				063			
	CS-137 12	1.80E+02	1.11E+02(7/ 8) 65. -- 1.72E+02		1.36E+02(4/ 4) 88. -- 1.72E+02	56. (2/ 4) 42. -- 69.	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

n and range based upon detectable measurements only
ction of detectable measurements at specified location is indicated in parentheses, (Fraction)
o range indicates no detectable activity measurements
LLD is equal to 0, then LLD is not required by Selected Licensee Commitments

ati = Lake Hartwell - Highway 183 Bridge
ation = Highway 27 - Lawrence Ramsey Bridge
ation 068 = High Falls County Park

Name of Facility : Oconee Nuclear Station
Location of Facility : Oconee County, S.C.
Time Report Generated : 25-JAN-1994 16:35:05
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1993 through 31-DEC-1993
Database Name : $DISK1:[USER.ASC]ONS93.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.
RFACE WATER (I/LITER)							
Locations						062 (0.8 Mi ENE)	
	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	0.00E+00(0/ 13) 0.00E+00-- 0.00E+00	0
	CO-58 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
	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
TRITIUM (I/LITER)							
Locations	H-3 10	2.00E+03	8.62E+03(5/ 5) 3.60E+03-- 1.28E+04	063 (0.8 Mi ESE)	8.62E+03(5/ 5) 3.60E+03-- 1.28E+04	8.45E+02(1/ 5) 8.45E+02-- 8.45E+02	0

n an[illegible]e based upon detectable measurements only
ctio[illegible]etectable measurements at specified locations is indicated in parentheses, (Fraction)
o range indicates no detectable activity measurements
LLD is equal to 0, then LLD is not required by Selected Licensee Commitments

ation 062 = Lake Keowee/Hydro Intake
ation 063 = Lake Hartwell - Highway 183 Bridge

Name of Facility : Oconee Nuclear Station
Location of Facility : Oconee County, S.C .
Time Report Generated : 25-JAN-1994 14:44:57
Docket Number : 50-269,270,287
Reporting Period : 1-JAN-1993 through 31-DEC-1993
Database Name : $DISK1:[USER.ASC]ONS93.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.
RECT RAD-TLD R/HOUR/hr)							
	MR/HOUR 160	0.00E+00	19. (156/ 156)	034 (0.2 Mi NW)	26. (4/ 4)	058 (10.0 Mi WSW) 24. (4/ 4)	0
			9.6 -- 29.		21. -- 29.	22. -- 26.	

an and range based upon detectable measurements only
action of detectable measurements at specified locations is indicated in parentheses, (Fraction)
ro range indicates no detectable activity measurements
LLD is equal to 0, then LLD is not required by Selected Licensee Commitments

cation 020 = Site Boundary Fence (0.1 Mi N)
cation 021 = Site Boundary Fence (0.3 Mi NNE)
cation 022 = Site Boundary Fence (0.5 Mi NE)
cation 023 = Site Boundary Fence (0.9 Mi ENE)
cation 024 = Site Boundary Fence (0.8 Mi E)
cation 025 = Site Boundary Fence (0.4 Mi ESE)
cation 026 = Site Boundary Fence (0.3 Mi SE)
cation 027 = Site Boundary Fence (0.4 Mi SSE)
cation 028 = Site Boundary Fence (0.5 Mi S)
cation 029 = Site Boundary Fence (0.6 Mi SSW)
cation 030 = Site Boundary Fence (0.4 Mi SW)
cation 031 = Site Boundary Fence (0.3 Mi WSW)
cation 032 = Site Boundary Fence (0.2 Mi WNW)
cation 033 = Site Boundary Fence (0.2 Mi WNW)
cation 034 = Site Boundary Fence (0.2 Mi NW)
cation 035 = Site Boundary Fence (0.2 Mi NNW)
cation 036 = Mile Creek Landing (4.0 Mi N)
cation 037 = Keowee Church, Hwy 327 (4.5 Mi NNE)
cation 038 = Durham Convenience Mart, Junction Hwy 183 and 133 (4.0 Mi NE)
cation 039 = Hwy 133;~1 Mi E of Hwy 183 and 133 junction (4.0 Mi ENE)
cation 040 = Microwave Tower, Six Mile (4.5 Mi E)
cation 041 = Junction Hwy 101 and 133;~1.5 Mi S of Microwave Tower (4.0 Mi ESE)
cation 042 = Lawrence Chapel Church, Hwy 133 (5.0 Mi SE)
cation 043 = Hwy 291 at entrance to Issaqueena Park (4.0 Mi SSE)
cation 044 = Hwy 130 at Little River Dam (4.0 Mi S)
cation 045 = Terminus of Hwy 588 into Lake Keowee (5.0 Mi SSW)
cation 046 = Hwy 188 at Crooked Creek Bridge (4.5 Mi SW)
cation 047 = New Hope Church - Hwy 188 (4.0 Mi WSW)
cation 048 = Junction Hwy 175 and 188;~0.5 Mi N of Keowee School (4.0 Mi W)
cation 049 = Junction Hwy 201 and 92 (4.0 Mi WNW)
cation 050 = Stamp Creek Landing - End of Hwy 92 (4.0 Mi NW)

Location 051 = Hwy 128; 1 Mi N of Hwy 130 (4.5 Mi NNW)
Location 052 = Duke Power Branch Office - Pickens, SC (12.0 Mi ENE)
Location 053 = Duke Power Branch Office - Liberty, SC (11.0 Mi E)
Location 054 = Post Office - Hwy 93 - Norris, SC (9.5 Mi ESE)
Location 055 = Clemson Meteorology Plot (9.5 Mi SSE)
Location 056 = Water Tower - Seneca, SC (8.4 Mi SSW)
Location 057 = Oconee Memorial Hospital - Seneca, SC (9.0 Mi SW)
Location 058 = Branch Road Substation - Walhalla, SC (9.4 Mi WSW)
Location 059 = Tamassee DAR School (9.2 Mi NW)

APPENDIX C

SAMPLING DEVIATIONS AND UNAVAILABLE ANALYSES FOR 1993

I. SAMPLING DEVIATIONS

The following deviations from sampling requirements occurred during 1993.

SAMPLE TYPE	LOCATION	SCHEDULED COLLECTION DATES	ACTUAL COLLECTION DATES	DEVIATION	REASON	ACTIONS TAKEN
Air Particulate & Air Radioiodines	060	3/30-4/06/93	3/30-4/06/93	Power was off about 16 hrs. Discovered on 3/31/93.	Electrical storm.	Reset breaker.
	074	9/14-9/21/93	9/14-9/19/93	Power was off at collection.	Electrical storm.	Changed fuses and reset breaker.
		9/21-9/28/93	9/21-9/27/93	Power was off at collection.	Defective receptacle.	Replaced and restarted. Issued work request for total rewiring.
	072	10/19-10/26/93	10/19-10-19/93	Power was off at collection (20.9hr run time).	Defective receptacle.	Rerouted plug and restarted sampler. Issued work request for total rewiring.
Surface Water	062	2/16-3/16/93	2/16-3/15/93	Sampler did not collect for entire collection period.	Sampler shut down during last 24 hours of collection; probably due to freezing temps.	Restarted sampler and checked operability.
		10/26-11/23/93	11/23/93	Sampler did not collect for entire collection period.	Breaker tripped approximately 2 days into sampling period.	Collected grab sample to obtain sufficient volume. Had breaker reset.
	063	2/16-3/16/93	3/16/93	Sampler did not collect for entire collection period.	Sampler lost power during sampling period.	Reprogrammed sampler. Collected grab sample to obtain sufficient volume.
		9/28-10/26/93	9/28-10/26/93	Sampler did not collect for entire collection period.	Pump supplying water to sampler became inoperable due to low lake levels. Failure occurred close to end of sampling period based on amount composited.	Lowered composite sampler off of bridge with cable so that sampler could pull directly out of lake until lake level increases.

II. UNAVAILABLE ANALYSES

There were no Unavailable Analyses to be reported in 1993.

The majority of samples scheduled were successfully collected and analyzed. Of those sample types having deviations, 98.5% of the air samples, and 73.3% of the surface water samples were available without any deviations associated with them.

APPENDIX D

ANALYTICAL DEVIATIONS

I. ANALYTICAL DEVIATIONS

An analytical deviation occurred with 4th quarter drinking water and surface water tritium composites dated 31AUG to 23NOV93. The following year end composite dated 23NOV to 21DEC93 was inadvertently added to the 4th quarter composites. However, review of the data shows no measurable statistical effects to the 4th quarter data. Modifications of lab practices have been implemented to prevent further reoccurrences.

Note: No lower limits of detection were exceeded for any analyses performed for 1993.

APPENDIX E

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM RESULTS

This appendix includes all of the sample analysis reports generated from each sample medium for 1993.

Appendix E is located separately from this report and is archived at Duke Power Company's Environmental Center environmental data master file, located at Huntersville, NC at the McGuire Nuclear Station site.

DUKE POWER