VIRGINIA ELECTRIC POWER COMPANY

Surry Power Station

RADIOLOGICAL ENVIRONMENTAL MONITORING

Annual Report

1981

Submitted by

EBERLINE INSTRUMENT CORPORATION
Midwest Facility
West Chicago, Illinois

SURRY POWER STATION

OPERATIONAL ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE PROGRAM

Annual Report

JANUARY 1 - DECEMBER 31, 1981

Prepared for

VIRGINIA ELECTRIC POWER COMPANY

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SECTION I

PREFACE

ABSTRACT

This report presents the data obtained from the analyses of environmental samples collected through the Virginia Electric Power Company Surry Station Environmental Radiological Surveillance Program for the period 01 January 1981 through 31 December 1981.

The activity present above detection limits in the routinely collected sample media was observed to be of natural and atmospheric fallout origin. The results show that the radiation dose to a member of the general population did not exceed the technical specifications of 1% of the 10 CFR 20 limit during 1981.

INTRODUCTION

The Surry Power Station of Virginia Electric and Power Company consists of two Westinghouse pressurized water reactors each with a generating capacity of 788 MWE. The station is located on a peninsula in the James River approximately 25 miles upstream of the Chesapeake Bay. Cooling water is taken in downstream of the site and discharged 5.7 miles upstream of the intake. The Surry Power Station has been designed to minimize radioactive releases and insure that radiation doses attributed to the operation of the station will be "as low as reasonably achievable".

Various environmental samples are collected at indicator and control or background locations and analyzed to determine if changes in radioactivity levels may be attributable to the operation of the station. This environmental radiological monitoring program provides surveillance to assure compliance with the NRC Regulations and the Surry Power Station Technical Specifications.

The program outlined in Tables 1 and 2 has in some cases more frequent collection and analysis of certain samples than called for in the Technical Specifications. The accompanying map shows the plant environs. Table 4 summarizes the results of the radiological environmental surveillance measurements during calendar year 1981.

SUMMARY

1981

Environmental monitoring results showed that the radiation dose to a member of the general population did not exceed Technical Specifications of 1% of the 10 CFR 20 limit during 1981.

Radionuclides released to the air and water from Surry Station may contribute to the radiation background through both external and internal exposure.

The most significant environmental dose pathways are direct dose from the gaseous effluent and thyroid dose due to ingestion of milk. The area contains only a very small milk shed which limits general population dose potential from this source and since James River water is not used for drinking, dose potential from this source is also minimal.

Table 4 summarizes the range and average concentrations for measurements at the indicator and control locations, and the location with the highest annual mean. Complete information is given in the Sample Data Tables. (Appendix I)

Specific findings for various environmental media are discussed in Section 4.

SECTION 2

SAMPLING PROGRAM

All samples are collected by VEPCO Environmental Services Personnel and shipped to the Eberline laboratory in West Chicago, Illinois.

Upon receipt of the samples, the laboratory staff enters the samples in a log book identifying them as to sample type, collection date, and sample code number or location, then verifies the specific analyses to be performed on each sample. The samples are then stored, awaiting analysis, on shelves expressly for this purpose to assure accountability through the laboratory processes.

Table 1 lists the sampling locations and frequencies. Figure 1 shows the locations of the various sampling environs.

TABLE 1

Monitoring or Sampling Locations and Frequencies

	Air Particulate	Ambient Radiation	Precipitation	Milk	Well Water	Surface Water	Soil
Surry Station	W	(a)	M		SA		A
Hog Island Reserve	W				SA		
Bacon's Castle	W			M(2 ea.)	SA		A
Chippokes Creek						SA	
Alliance	W						A
Colonial Parkway	W			M			A
Williamsburg						SA	
Jamestown					SA		
Dow	W						A
Fort Eustis	W						A
Newport News	W		M			SA	
Scotland Wharf							
Lee Hall				M			
Routes 10 and 676							
Smithfield				M		SA	
Guard Booth							
Station Intake							
Kings Mill							
Budweiser							
Station Discharge							

BW - Bi-weekly
BM - Bi-monthly
SA - Semi-annually
M - Monthly
Q - Quarterly
A - Annually
A(3) - Annually corn, peanuts, and soybeans
SM - Summer Months (two Samplings: July - September)

(a) Thermoluminescent dosimeters (TLDs) are monitored quarterly. A full listing of the 43 locations is shown on page 47.

TABLE 1 (continued)

	Crops	Fowl	James River Water	Silt	Oyster	Clams	Fish	Crab
Bacon's Castle	A(3)							
Hog Island Reserve		SA						
Jamestown						BM		
Newport News			BM	SA	BM			
Chickahominy			BM	SA		BM		
Station Discharge			BM	SA		BM		
Hog Island Point			BM	SA		BM		
Station Intake			BM	SA			SA	SM
Lawnes Creek						BM		
Deep Water Shoals					BM			
Point of Shoals				SA	BM			

BW - Bi-weekly

BM - Bi-monthly

SA-Semi-annually

M - Monthly

Q - Quarterly

A - Annually

A(3) - Annually corn, peanuts, and soybeans

SM - Summer Months (three Samplings: July - August - September)

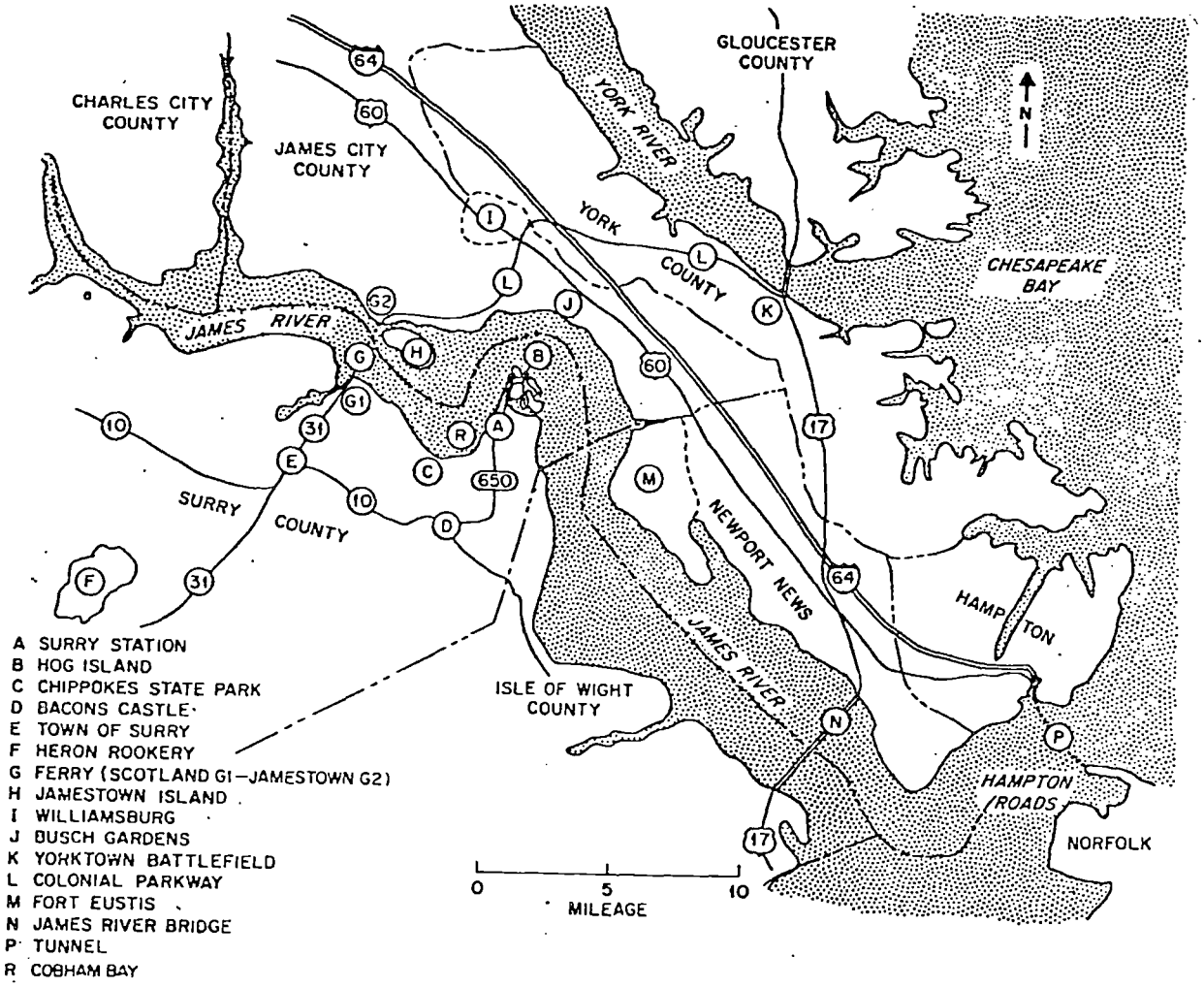

Figure 1: Environs of Surry Power Station.

SECTION 3

ANALYSIS PROGRAM

Table 2 lists the sample analysis program - sample class, frequency, and the type of analysis required.

Table 3 lists the LLD's (Lower Limits of Detection) for the analytical program. These LLD's are based on Regulatory Guide 4.8. For analyses not required in Regulatory Guide 4.8, Federal EPA, former requirements for similar programs, or other appropriate guides are used. The LLD's are calculated as per RG 4.8 at the 3σ level.

The Guide specifically states that the LLD's are a priori NOT a posteriori (after the fact) limit for a particular measurement. When, however, RG 4.8 or other LLD's have not been achieved, a footnote giving a brief explanation has been inserted.

TABLE 2

Environmental Measurement
and
Sample Analysis Program

Sample Class	Frequency	Analysis
Air Particulate	Weekly Quarterly Comp.	Gross alpha and beta (1) Gamma Isotopic (2)
Airborne Iodine	Weekly	Iodine-131
Thermoluminiscent Dosimetry (TLD)	Quarterly	Radiation Dose
Precipitation	Monthly Quarterly Comp.	Gross beta (3) Tritium Gross beta Tritium
Milk	Monthly	Iodine-131 Sr-89/90 Gamma Isotopic Stable Calcium
Soil	Annually	Gamma Isotopic
Crops	Annually	Gamma Isotopic Sr-89/90
Surface Water	Semi-annually	Gross alpha and beta Tritium
Well Water	Semi-annually	Gross alpha and beta Tritium
Fowl	Semi-annually	Gamma Isotopic (4)
James River Water	Bi-monthly Semi-annual Comp.	Gamma Isotopic Tritium
Oysters and Clams	Bi-monthly	Gamma Isotopic (4)
Crabs	3 summer months	Gamma Isotopic
Silt	Semi-annually	Gamma Isotopic
Fish	Semi-annually	Gamma Isotopic

NOTES TO TABLE 2

(1) Gamma isotopic analysis if gross beta exceeds 10 pCi/m^3.

(2) Quarterly composites of weekly air particulate samples will be analyzed for gamma emitters in three groups as follows:

Stations SS and HIR analyzed as one sample.
Stations BC, ALL, CP, DOW, and FE analyzed as one sample.
Station NN analyzed as one sample.

Strontium-90 determined radiochemically if significant amounts of fission products attributable to the Station are detected by the gamma isotopic analysis.

(3) Perform gamma isotopic analysis if gross beta exceeds 15 nCi/m^2.

(4) Entire sample analyzed for gamma emitters. Sr-90 to be determined if a significant amount of fission products attributable to the Station are noted in the gamma analysis.

Table 3

Lower Limits of Detection
(LLD's)

Sample Class	Analysis	LLD 3σ	Units
Airborne Particulates	Gross Beta	0.01	pCi/m^3
	Gross Alpha	0.01	pCi/m^3
	Gamma Isotopic	0.01	pCi/m^3
	Iodine-131	0.07	pCi/m^3
Background Radiation (TLD)	Gamma dose	0.5	mR/wk
Precipitation	Gross Beta	5	nCi/m^2
	LS Tritium	500	pCi/l
	Enriched Tritium	330	pCi/l
Other Waters	Gross Beta	2	pCi/l
	Gross Alpha	1	pCi/l
	LS Tritium	500	pCi/l
	Enriched Tritium	330	pCi/l
	Gamma Isotopic		
	Cs-134/137	15	pCi/l
	La/Ba-140	15	pCi/l
	Co-58/60	15	pCi/l
	Mn-54	15	pCi/l
	Zr/Nb-95	10	pCi/l
	Fe-59, Zn-65	30	pCi/l
	Strontium-89	5	pCi/l
	Strontium-90	2	pCi/l
Milk	Iodine-131	1	pCi/l
	Strontium-89	5	pCi/l
	Strontium-90	2	pCi/l
	Cs-137	15	pCi/l
	La/Ba-140	15	pCi/l
Oysters, Clams, Crabs, Fish	Cs-134/137	130	pCi/kg wet
	Mn-54	130	pCi/kg wet
	Co-58/60	130	pCi/kg wet
	Fe-59, Zn-65	260	pCi/kg wet
	Strontium-89	20	pCi/kg wet
	Strontium-90	10	pCi/kg wet
Silt, Soil	Cs-134/137	150	pCi/kg dry
Fowl	Cs-134/137	80	pCi/kg wet
Vegetation	Cs-134/137	80	pCi/kg wet
	Strontium-89	20	pCi/kg wet
	Strontium-90	10	pCi/kg wet

ANALYTICAL PROCEDURES

Samples received at the laboratory are analyzed for the various radioactive components by standard radiochemical methods. These methods are equal to, and in most cases, identical with, those of the U.S.D.O.E.[1] or those of the Federal E.P.A.[2]

Brief descriptions of analytical procedures are available in the Laboratory Procedures Manual available at Surry Station and the radioanalytical contractor's laboratory.

Air Particulate Filters

Gross Beta - Exposed air particulate filters are counted in low background Geiger or proportional flow beta counters using anti-coincidence background suppression after the short-lived naturally-occuring radon and thoron daughters have decayed. Filters are counted long enough to ensure that the required sensitivity (LLD) will be met

Gamma Isotopic - Quarterly composites of air particulate filters are counted in high resolution (GeLi) gamma spectrometers for periods of time long enough to ensure that the required program sensitivity (LLD) is met. (See also introduction to data tables, Section 5.)

Water Samples (Includes Surface, Well, Precipitation, James River)

Gross Beta - A measured aliquot of sample is digested, "wet-ashed", evaporated, transferred to a tared 47mm stainless steel planchet, dried, and weighed. The planchetted sample is counted long enough in a low background beta counter to ensure that the LLD of the program will be met.

(1) HASL Procedures Manual, edited by John H. Harley, Health and Safety Laboratory, US Atomic Energy Commission, 1972 edition, revised annually.

(2) National Environmental Research Center, Environmental Protection Agency; Handbook of Radiochemical Analytical Methods. Program Element 1HA 325. Office of Research and Development, Las Vegas, Nevada 89114.

Gamma Isotopic - a measured aliquot of the sample is evaporated to a small controlled volume and counted in a standard geometry in a high resolution (GeLi) gamma spectrometer long enoungh to ensure meeting the sensitivity requirements of the program. See also the Introduction to Data Tables.

Strontium-89 and Strontium-90 - carrier strontium is added to a measured aliquot of sample. The strontium is then separated and purified by either ion exchange chromatography (EPA method) or straight wet chemistry (HASL method). The chemical yield for strontium is determined by atomic adsorption spectrometry or gravimetric methods. After a suitable period (usually 14 days) to allow for ingrowth of Y-90 the sample is counted in a low background beta counter (equilibrim or total Sr count). The strontium is next put into solution, carrier yttrium added, and the strontium and yttrium fractions separated. The yttrium is counted and from the Y-90 (Sr-90 daughter) count, the Sr-90 concentration can be determined. The difference between the total strontium concentration as determined by the equilibrium count and the Sr-90 concentration as determined from the Y-90 count is the Sr-89 concentration. Equations are available to permit calculation of Sr-89 and Sr-90 by counting the purified Sr fraction at two points during ingrowth of the Sr-90 daughter Y-90. While either method is acceptable, we find the former method to provide more consistent results.

Tritium - tritium as tritiated water is analyzed by liquid scintillation counting after distillation. If high sensitivity is not required (ie. LLD $\sim$500 pCi/l) the sample is distilled, mixed with the appropriate counting phosphors and counted with no further treatment. If higher sensitivity is required (ie. $<\sim$300 pCi/l) the sample is isotopically enriched in tritium concentration prior to liquid scintillation counting.

Isotopic enrichment is done by the classical method of Ostlund which involves alkaline electrolysis of a purified aliquot of sample under controlled conditions of temperature and electrode current density.

Milk Samples

I-131 - measured amounts of carrier iodide are added to a known volume of milk and the iodine extracted on anion exchange resin. The iodine is recovered and purified by classical iodine chemistry methods which are similar to those given in former Regulatory Guide 4.3. The yield or recovery of iodine is measured gravimetrically and the precipitated sample is mounted and counted in a low level beta detector for a long enough period to ensure that the required LLD is met.

Gamma Isotopic - a measured aliquot of sample is evaporated and oven dried to a standard volume and counted in a fixed geometry in a high resolution (GeLi) gamma spectrometer for a long enough period to ensure that the required LLD's are reached (see also Introduction to data Tables).

Sr-89 and Sr-90 - Stable strontium carrier is added to an aliquot of the sample which is then dried and ashed at high temperature (>700°c). The ash is dissolved and the solution treated from this point on in the same manner as are water samples (Q.V.).

Organic Samples (including Clams, Oysters, Fish, Crabs, Food Crops and Fowl).

Gamma Isotopic Analysis - a measured aliquot of sample is oven dried or ashed as appropriate, placed in a controlled geometry and counted in a high resolution (GeLi) gamma spectrometer for a period long enough to ensure that the LLD's of the program will be met (see also intro. to Data Tables).

In the case of samples such as fish and fowl, the edible flesh is separated from bones and entrails prior to drying.

Sr-89 and Sr-90 - stable strontium carrier is added to a weighed aliquot of the sample and the sample is ashed at high temperature (>700°c). The ashed sample is then dissolved and processed in the same manner as are water or milk samples.

Soil and Silt Samples

Gamma Isotopic Analysis - the sample is oven dried to facilitate handling and then sieved to remove pieces of stone and/or other large pieces of material. An appropriate sized, weighed aliquot of the sample is then transferred into a standard geometry container and counted for a period long enough to ensure that the LLD of the program will be met. (See also Introduction to Data Tables).

Thermoluminescent Dosimeters (TLD)

Environmental radiation doses are measured using badges comprizing five chips sealed in plastic protective holders having a density of 50 mg/cm^2. The TLD chips are 1/8" x 1/8" x 1/32 LiF (thallium activated) known commercially as Harshaw-100. The chips are all selected to provide uniform response to within 5% of the mean for the batch.

Prior to installation, the chips are annealed by a standard cycle of 60 minutes at 400°c and immediate cooling to ambient temperature by placing the tray containing the annealed chips on an aluminum block 12" x 12" x 1".

After exposure the chips are read on an Eberline Instrument Corporation Model TLR-6 reader. The system employs a preheat cycle which removes low temperature peaks and integrates and digitizes only the light output in a selected temperature range.

The dose is calculated from the average light output for the five chips and the statistical uncertainty is the standard deviation of the five readings. Control badges are used to detect any unusual exposure to the badge which might occur during shipment.

QUALITY ASSURANCE PROGRAM

A. Design of Plan

Quality of product or service has always been a primary key to increase is sales, customer satisfaction, and profit. The management of Eberline Instrument Corporation recognizes the ever increasing demand for higher quality and reliability for services related to protection of workers and the environment. It is our firm belief that in order to judge the worth of a support service, one must know the philosophy behind it. Eberline will provide only those services for which it is qualified and these will be provided in a manner that is reliable, with a quality assurance program that maintains a high degree of client confidence. This quality assurance program has been prepared consistent with the following specifications, per the Technical and Quality Assurance Requirements for Special Purposes.

ANSI-N45.2, American National Standards Institute

NRC Branch Technical Position of November 1979

NRC Regulatory Guide 4.15, Revision 1 of February 1979.

B. Intercomparison Program

Results of Eberline's Midwestern Facility participation in the USEPA's Crosscheck Program will be included in the monthly reports provided to the client. Other intercomparisons in which we routinely participate include:

Environmental Protection Agency
Environmental Measurement Lab DOE Quality Assessment Program
Battelle Northwest Laboratories
IAEA Analytical Quality Control Service
US National Bureau of Standards
Eberline's Albuquerque Laboratory.

Each of the laboratory managers is responsible for preparing spikes and blanks to be run routinely. Every tenth sample is a spike, a blank, or a split sample.

Regular QC reports are prepared by the laborary manager on a monthly

schedule and forwarded to each client. Each report routinely includes:

results from EIC interlaboratory comparison,
results from EPA Crosscheck program, and
results from other intercomparison programs.

Results are reviewed by the laboratory manager. If a problem is indicated by the data, the nature of the problem is investigated and corrective steps taken immediately. A copy of each report is also provided to the Quality Assurance Manager of the Nuclear Services Division.

C. Quality Assurance Plan

The Quality Assurance Program follows the requirments of Company and Division Manuals. The discussion below outlines Quality Assurance Programs as conducted in the laboratory and as required in our QA Manual.

Procedure Approval

Each procedure goes through a vigorous evaluation and review process before it is incorporated into the EIC Procedures Manual. Established procedures of the Environmental Protection Agency (EPA) or the Environmental Measurements Laboratory of the US Department of Energy (EML) are used unless thorough testing has demonstrated that an alternate procedure is equal to or better than the EPA or EML procedure. Uniform procedures are used at both laboratories to the fullest extent possible, except when deviations are necessary to meet the specific requirements of the client. The manager of each laboratory and the quality assurance manager review and approve significant procedural changes before they are implemented.

Equipment Calibration and Maintenance

Equipment used for qualitative or quantitative measurements is carefully calibrated and maintained with records of each calibration or maintenance action kept in appropriate logbooks. To the extent possible, certified standards are used for all primary calibrations. The following standards are used for the application indicated:

Measurement	Calibration Standard
Gross Beta	Solution of Standard ^{137}Cs certified by NBS or Amersham Searle
Tritium	Solution standard of ^{3}H certified by NBS
Gamma Spectrometry	Solution standards of various gamma emitters certified by NBS or Amersham Searle. Standards are used to calibrate each counting geometry used.
Strontium-89 and 90	Solution standards of ^{90}Sr certified by Amersham Searle or NBS
Gross Alpha	Solution standards of ^{239}Pu certified by NBS or Amersham Searle.
Radiation Dose	^{137}Cs gamma source cross-referenced with NBS using R-meters. ^{226}Ra is used for some special application.

When suitable standards are not available for a specific gamma emitter, quantitative gamma isotopic analysis is based on an energy calibration of the gamma spectrometer and the gamma energy and abundance information provided in Table of Isotopes, Sixth Edition by Ledrer, Hollander, and Perlman.

The results of the Quality Control Programs are summarized in Section 6.

SECTION 4

RESULTS AND DISCUSSION

Table 4

Environmental Radiological Monitoring Program

Name of Facility: Surry Power Station

Docket Number: 50-280, 50-281

Location of Facility: Surry (County) Virginia (State)

Reporting Period: January 01 - December 31, 1981

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean[1] (Range)	Location with Highest Mean: Name, Distance and Direction	Location with Highest Mean: Mean (Range)	Control Locations Mean[1] (Range)	Number of Non-routine Reported Measurements
Air Particulates (pCi/m³)	Gross β 414	0.01	0.18 (360/362) 0.02-0.70	Colonial Parkway	0.19 (52/52) 0.02-0.63	0.18 (52/52) 0.02-0.60	0
	Gross α 414	0.01	All LLD	Not Applicable		All LLD	0
	Ce-144 12	0.01	0.06 (6/8) 0.02-0.16	Composite (SS-HIR)	0.09 (3/4) 0.05-0.16	0.11 (3/4) 0.06-0.15	0
	Be-7 12	0.01	0.13 (8/8) 0.03-0.22	Composite (SS-HIR)	0.17 (4/4) 0.14-0.22	0.13 (4/4) 0.11-0.14	0
	Zr-95 12	0.01	0.03 (6/8) 0.01-0.07	Composite (BC-ALL-CP-DOW-FE)	0.03 (3/4) 0.01-0.07	0.06 (2/4) 0.06	0
	Nb-95 12	0.01	0.09 (6/8) 0.02-0.17	Composite (SS-HIR)	0.09 (3/4) 0.02-0.17	0.09 (3/4) 0.03-0.18	0
	Ce-141 12	0.01	0.04 (4/8) 0.01-0.06	Composite (SS-HIR)	0.05 (2/4) 0.04-0.06	0.05 (2/4) 0.02-0.07	0
	Ru-103 12	0.01	0.02 (4/8) 0.01-0.02	Composite (SS-HIR)	0.02 (2/4) 0.02	0.02 (2/4) 0.01-0.03	0
	Ru-106 12	0.01	0.03 (3/8) 0.02-0.03	Composite (BC-ALL-CP-DOW-FE)	0.03 (2/4) 0.02-0.03	0.03 (1/4) 0.03	0
	Other γ 12	0.01	All LLD	Not Applicable		All LLD	0
Airborne Iodine (pCi/m³)	I-131 414	0.07	All LLD	Not Applicable		All LLD	0

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean[1] (Range)	Location with Highest Mean		Control Locations Mean[1] (Range)	Number of Non-routine Reported Measurements
				Name, Distance and Direction	Mean (Range)		
Background Radiation (TLD) (mR/wk)	γ Dose	0.5	1.3 (161/164) 0.3-9.8	Surry Station	6.5 (4/4) 3.8-9.8	0.9 (12/12) 0.3-1.6	0
Precipitation (nCi/m^2) β (pCi/l) HTO	Gross β 32	5.0	All LLD	Not Applicable		All LLD	0
	LS HTO 24	500	727 (6/12) 500-1500	Surry Station	727 (6/12) 500-1500	548 (5/12) 380-820	0
	Enr. HTO 8	330	395 (4/4) 260-550	Surry Station	395 (4/4) 395	360 (4/4) 240-600	0
Milk (pCi/l)	I-131 59	1.0	All LLD	Not Applicable		All LLD	0
	Sr-89 60	5.0	All LLD	Not Applicable		All LLD	0
	Sr-90 60	2.0	4.1 (37/48) 1.0-9.0	Bacon's Castle	4.7 (7/12) 1.0-9.0	3.5 (11/12) 1.0-9.0	0
	Cs-137 60	15.0	All LLD	Not Applicable		All LLD	0
	Ba-La-140 60	15.0	All LLD	Not Applicable		All LLD	0
River Water (pCi/l)	La-Ba-140 Cs-134-137 Co-58-60 Mn-54 56	15.0	All LLD	Not Applicable		All LLD	0
	Zr-Nb-95 56	10.0	All LLD	Not Applicable		All LLD	0
	Fe-59 Zn-65 56	30.0	All LLD	Not Applicable		All LLD	0
	Sr-89 26	5.0	All LLD	Not Applicable		All LLD	0

[1] Mean and range based on detectable measurements only. Fractions indicated in parentheses.

Table 4 (continued)

Facility: Surry Power Station

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean[1] (Range)	Location with Highest Mean: Name, Distance and Direction	Location with Highest Mean: Mean (Range)	Control Locations Mean[1] (Range)	Number of Non-routine Reported Measurements
River Water (pCi/1)	Sr-90 26	2.0	2 (1/13) 2	Station Discharge	2 (1/13) 2	All LLD	0
	LS HTO 26	500	848 (5/13) 500-1000	Station Discharge	848 (5/13) 500-1000	768 (5/13) 500-1700	0
	Enr. HTO 4	330	All LLD	Not Applicable		370 (2/2) 260-480	0
Clams (pCi/kg)	Cs-134-137 Mn-54 30 Co-58	130	All LLD	Not Applicable		All LLD	0
	Co-60 30	130	210 (1/24) 210	Hog Island Point	210 (1/6) 210	All LLD	0
	Fe-59 Zn-65 30	260	All LLD	Not Applicable		All LLD	0
	Sr-89 5	20	All LLD	Not Applicable		Not Measured	0
	Sr-90 5	10	40 (2/5) 30-50	Station Discharge	40 (2/5) 30-50	Not Measured	0
Oysters	Cs-134-137 Mn-54 18 Co-58-60	130	All LLD	Not Applicable		Not Measured	0
	Fe-59 Zn-65 18	260	All LLD	Not Applicable		Not Measured	0
Fish (pCi/kg)	Cs-134-137 Mn-54 4 Co-58-60	130	All LLD	Not Applicable		Not Measured	0
	Fe-59 Zn-65 4	260	All LLD	Not Applicable		Not Measured	0

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean[1] (Range)	Location with Highest Mean Name, Distance and Direction	Mean (Range)	Control Locations Mean[1] (Range)	Number of Non-routine Reported Measurements
Crabs (pCi/kg)	Cs-134-137 Mn-54 Co-58-60 3	130	All LLD	Not Applicable		Not Measured	0
	Fe-59 Zn-65 3	260	All LLD	Not Applicable		Not Measured	0
Silt (pCi/kg)	Cs-134 7	150	245 (2/6) 220-270	Hog Island Point	270 (1/1) 270	All LLD	0
	Cs-137 7	150	610 (4/6) 200-890	Point of Shoals	890 (1/1) 890	850 (1/1) 850	0
	Co-60 7	150	590 (3/6) 100-960	Station Discharge	960 (1/2) 960	All LLD	0
Soil (pCi/kg)	Cs-134 6	150	All LLD	Not Applicable		Not Measured	0
	Cs-137 6	150	710 (4/6) 130-1600	Bacon's Castle	1600 (1/1) 1600	Not Measured	0
Fowl (pCi/kg	Cs-134 Cs-137 2	80	All LLD	Not Applicable		Not Measured	0
Food Crops (pCi/kg)	Cs-134 Cs-137 8	80	All LLD	Not Applicable		Not Measured	0
	Sr-89 8	20	All LLD	Not Applicable		Not Measured	0
	Sr-90 8	10	125 (6/8) 50-310	Poole	310 (1/1) 310	Not Measured	0
Well Water (pCi/1	Gross β 8	2	6 (6/6) 4-8	Bacon's Castle	8 (2/2) 8	7 (2/2) 4-9	0
	Gross α 8	1	3 (2/6) 2-4	Bacon's Castle	3 (2/2) 2-4	All LLD	0
	Enr. HTO 8	330	All LLD	Not Applicable		All LLD	0

[1] Mean and range based on detectable measurements only. Fractions indicated in parentheses.

Table 4 (continued)

Facility: Surry Power Station

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean[1] (Range)	Location with Highest Mean		Control Locations Mean[1] (Range)	Number of Non-routine Reported Measurements
				Name, Distance and Direction	Mean (Range)		
Surface Water (pCi/l)	Gross β 8	2	10 (5/6) 3-21	Williamsburg 21 Reserve 21	(1/2)	8 (2/2) 7-8	0
	Gross α 8	1	4 (5/6) 1-13	Williamsburg 7 Reserve 1-13	(2/2)	4 (1/2) 4	0
	LS HTO 8	500	487 (3/6) 430-550	Williamsburg 550 Reserve 550	(1/2)	350 (1/2) 350	0

Results of all the analyses for January through December 1981 are presented in full in Section 5, Data Tables pages

Table 4 summarizes the range and average concentrations for measurements at the indicator and control locations with the highest annual mean. Environmental monitoring results showed that the radiation dose to a member of the general population did not exceed Technical Specifications of 1% of the 10 CFR 20 limit during 1981.

Specific findings for the various environmental media are discussed below:

AIR PARTICULATE SAMPLES

Atmospheric particulate matter at a field location is accumulated for a one-week period on a glass fiber filter using a low-volume air sampler at a collection rate of one cubic foot per minute. This particulate matter contained on the filter is counted for beta activity in a low-background counting system after the short-lived naturally-occurring radon and thoron daughters have decayed.

The gross beta particulate data obtained during the first six-month period of 1981 are higher than the data obtained during the latter half. According to P. K. Kuroda et al[1], concentrations of Sr-89 and Sr-90 in rain and snow at Fayetteville, Arkansas, showed a spectacular increase during the spring months of 1981 due to the 25th Chinese nuclear test explosion of October 1980. It is therefore suggested that these higher

[1] P. K. Kuroda, "Recent Atmospheric Injections of Nuclear Debris: Fallout from the 16 October 1980 Nuclear Explosion", unpublished manuscript, 1981.

levels are attributable to the stratospheric fallout from this test.

The average gross beta concentration for the year for all indicator stations was 0.18 pCi/m^3. and for the control location it was also 0.18 pCi/m^3. Data for analyses of individual filters are given on pages 40 through 45 in Section 5.

The gross alpha concentrations for the indicator and background stations remained at or below the detection limit 0.01 pCi/m^3.

The gamma spectrometry data of quarterly composites of air particulate filters begins on page 46. Traces of Ce-144, Be-7, Zr-95, Nb-95, Ce-141, Ru-103, and Ru-106 were detected at both indicator and background stations and are attributable to cosmogenic origin and to the statospheric fallout from the Chinese nuclear test.

ENVIRONMENTAL DOSIMETRY

Measurements of environmental dose rates were made at 43 locations on a quarterly basis using thermoluminiscent dosimeters (TLDs). The results are tabulated on pages 47 through 48 of Section 5.

As observed in previous years, the Surry Station location displays clearly elevated dose rates throughout the year. Other on-site locations appear to be only very slightly above nearby locations and the badges located near the station intake and discharges consistently give some of the lowest readings observed. The major fraction of the dose at the Surry Station location is undoubtedly due to operation of the station. The doses at other on-site locations may be partially due to the station, but only by a few tenths of a millirem per week at most. Doses due to the plant at locations away from the site, if they exist, are masked by doses from the natural environmental sources such as uranium, thorium, and their daughters, and possibly worldwide fallout.

PRECIPITATION SAMPLES

Precipitation samples collected at the Surry Station and at Newport News are analyzed on a monthly basis and as quarterly composites for gross beta depositions and tritium concentrations. Data are summarized on page 50 of Section 5.

Gross beta measurements, the only measurement other than tritium required on these samples, are not capable of indicating whether the differences are due to station operations or not. For both the control and the indicator location, the gross beta data obtained during the first six-month period of 1981 are higher than the data obtained during the latter half. These higher levels can be explained by the stratospheric fallout from the Chinese test. The levels in general were in the range to be expected from measurements of these nuclides in this medium and there are no indications they are attributable to releases from Surry Station.

The tritium levels were comparable at both the indicator and control location throughout the year, and were generally in the range to be expected from measurements of this nuclide in this medium. Nevertheless, an unusually high concentration of tritium was found in the sample from Surry Station during November. It is possible that this tritium level was a result of plant operation. However, the measured concentration was still less than 0.1 percent of the maximum permissible concentration.

MILK SAMPLES

Radionuclides Cs-137 and I-131 were below the detection limits (15 pCi/l for Cs-137 and 1 pCi/l for I-131) for all milk samples collected during the year. Sr-90 was detected in most of the milk samples in the usual low and variable concentrations to be expected. Sr-89 and Ba-La-140

were below the detection limits (5 pCi/l for Sr-89 and 15 pCi/l for Ba-La-140) in all samples collected. Radioactivity attributable to operation of Surry Station was not detected in any milk samples collected during the year.

Comparisons of the average concentrations for all nuclides assayed and other statistical information are given in Table 4 and the data summary on each sample by location are given on pages 51 through 53 of Section 5.

JAMES RIVER WATER SAMPLES

Samples of water from the James River are collected bi-monthly from five locations including the station inlet and discharge and are analyzed for gamma emitters. Semi-annual composites of the collections from the Chickahominy and Newport News locations are also analyzed for tritium.

Samples collected monthly from the discharge and Scotland Wharf are split with a state agency and are analyzed for tritium, Sr-89/90, and gamma emitters.

Analytical data are presented on pages 54 through 57 of Section 5.

Gamma emitters were below the detection limits of this program in all samples collected.

Barely detectable concentrations of Sr-90 were found in two of the State Split discharge samples and were due to the recent Chinese bomb test.

The monthly tritium concentrations for the year for discharge samples ranged from 500 to 1000 pCi/l, the average being 848 pCi/l. The tritium concentrations for Scotland Wharf ranged from 500 to 1700 pCi/l, the average concentration being 768 pCi/l. There was no statistically significant difference in average concentrations between indicator and control locations.

Tritium levels in the semi-annual composites for Chickahominy and Newport News were slightly above the detection limit of 330 pCi/l. These levels were in the range to be expected from measurements of this nuclide in this medium.

CLAM SAMPLES

Clam samples are collected bi-monthly from five locations near the station including the station discharge and are analyzed for gamma emitters. Samples from the station discharge are frequently designated as "State Split Samples" and such samples are analyzed for Sr-89 and Sr-90 as well as gamma emitters.

Co-60 was detected at low concentration in one sample from Hog Island Point during gamma spectroscopy analysis and could be due to plant operations. However, the measured concentration is still less than 0.1 percent of the maximum permissible concentration.

Analysis of state split clam samples for radiostrontium revealed the presence of only Sr-90 at levels attributable to world wide fallout in two samples.

Analytical data are presented on pages 58 and 59 of Section 5.

OYSTER SAMPLES

Samples of oysters are collected from Deep Water Shoal, Point of Shoal, and Newport News on a bi-monthly basis and analyzed for gamma emitters. Analytical data are presented on page 60 of Section 5.

Gamma emitters were below the detection limits of the program in all samples collected throughout the year.

FISH SAMPLES

Fish samples are collected in the vicinity of the station twice a year and analyzed for gamma emitters. Data are presented on page 61 of Section 5.

Gamma emitters were below the detection limits of the program specifications.

CRAB SAMPLES

Samples of crab from the vicinity of Surry Station are collected during the summer months and analyzed for gamma emitters. The gamma emitters were below the detection limits of the program and are listed on page 61 of Section 5.

SILT SAMPLES

Silt samples were collected three times during 1981 from six locations (five indicator and one control location) and analyzed for gamma emitters. Silt is one of the few environmental media in which radioactive effluents from nuclear power stations are usually detected.

Traces of Cs-137 were found in most samples. The presence of this nuclide is attributed to world wide fallout from atmospheric nuclear tests. Several indicator samples also contained Co-60, Cs-134, Zr-95, Nb-95, Co-58, and Mn-54 above the detection limit. Their presence could be due to station operations. Data are summarized on page 62 of Section 5.

SOIL SAMPLES

Soil samples are collected annually from six locations and analyzed by gamma spectrometry for gamma emitters.

The only nuclide detected at concentrations greater than the detection

limit for the program was Cs-137. The concentrations of Cs-137 have been quite variable throughout the years as is illustrated in the table below. This is probably due to the well-recognized difficulty of obtaining truly representative samples of soil. Modified sampling techniques by station personnel appear to have eliminated this problem from 1978 to the present. There are no clear trends and the origin of the cesium is unclear.

Cs-137 Concentrations in Soil Samples

	10^2pCi/kg*							
	1975	1976	1977	1978 (Aug)	1978 (Sept)	1979	1980	1981
Surry Station	35	1	17	<2	4	2	2	<2
Fort Eustis	--	18	10	17	18	2	4	16
Dow	10	2	2	<2	3	<2	2	1
Bacon's Castle	8	24	2	23	9	11	10	8
Alliance	2	3	2	<2	3	3	6	4
Colonial Pkwy.	--	15	12	22	7	<2	4	<2

* Data rounded to nearest whole unit, statistical errors omitted.

Long and short term world wide fallout are probably the major factors but contributions to the total by the station cannot be ruled out. If, however, the major fraction were due to the station, significant amounts of Cs-137 and Co-60 might be expected in the samples, but this is not the case. Detailed analytical data are presented on page 63 of Section 5.

FOWL SAMPLES

A coot from the Hog Island Reserve was collected in March and a goose was obtained from the same area in September. They were analyzed for gamma emitters, specifically for Cs-134 and Cs-137. Concentrations of these nuclides were below the detection limit of 80 pCi/kg for both samples. Data are given on page 63 of Section 5.

CROP SAMPLES

Samples of food crops (kale, cabbage, corn, peanuts, and soybeans) were collected from four area farms in 1981 and analyzed from gamma emitters, Sr-89, and Sr-90. Gamma emitters and Sr-89 were below the detection limits of the program.

Sr-90 was detected in most of the samples in low and variable concentrations. Long and short term world wide fallout deposits are probably the reason for this.

The results are tabulated on page 63 of Section 5.

WELL WATER SAMPLES

Samples of water were collected from each of four wells (three indicator and one control location) once in April and once in October. These were analyzed for gross alpha, gross beta, and tritium.

Gross alpha and beta activity were detected in most of the samples at the usual low levels encountered in environmental media. There was no statistically significant difference in concentrations, which were similar to those measured previously, between indicator and background stations and the activity is attributable to naturally occurring nuclides.

Tritium concentrations were at or below the detection limits in samples collected during the year.

Analytical data are given on page 64 of Section 5.

SURFACE WATER SAMPLES

Surface water samples were collected in April and October from each of four locations. They were analyzed for gross alpha, gross beta, and tritium.

Gross alpha and gross beta levels were all at the low concentrations usually expected to be found in environmental surface water, with no significant differences between indicator and background stations or concentrations measured in the previous years.

Tritium concentrations were at the detection limits of the program in spring collections, and below the detection limits in the fall. The levels of tritium measured were comparable at both indicator and background locations, and were generally in the range to be expected from measurements of this nuclide in this medium.

Data are presented on page 64 in Section 5.

SECTION 5

DATA TABLES

INTRODUCTION TO THE DATA TABLES

The following information will be helpful in understanding the presentation of the data in the tables in this section.

Wet Weight	a reporting unit used with organic tissue samples such as vegetation and animal samples in which the amount of sample is taken to be the weight as received from the field with no moisture removed.
Dry Weight	a reporting unit used for soil and sediment in which the amount of sample is taken to be the weight of the sample after removal of moisture by drying in an oven at about 110^{o} for about 15 hours.
pCi/m^3	a reporting unit used with air particulate and radioiodine data which refers to the radioactivity content expressed in picocuries of the volume of air expressed in cubic meters passed through the filter and/or the charcoal trap. Note that the volumes are not corrected to standard conditions.
Gamma Emitters or Gamma Isotopic	samples were analyzed by high resolution (GeLi) gamma spectrometry. The resulting spectrum is analyzed by a computer program which scans from about 50 to 2000 kev and lists the energy peak of any nuclides present in concentrations exceeding the sensitivity limits set for that particular experiment.
NA, NS, NR	used in place of a concentration when a sample was not available (NS), or when a sample was not analyzed for some specific measurement (NA), or when an analysis is not required (NR).
Error Terms	figures following "±" are error terms based on counting uncertainties at the 2σ (95% confidence) level. Values preceded by the "<" symbol were below the stated concentration at the 3σ (99% confidence) level.
Exponents	Exponents necessary to prevent data tables from being cumbersome are handled in the conventional manner of including them in the column headings.
Sensitivity	In general, all analyses meet the sensitivity requirements of the program as given in Table 3. For the few samples that do not (because of inadequate sample quantities, analytical interferences, etc.) the sensitivity actually obtained in the analysis is given.
Comment	when all analyses of a particular type during the period resulted in concentrations below the sensitivity limits, a statement is made on the appropriate table rather than presenting a whole page of "<" data. If all but one or two data points are below the sensitivity limits, the previously mentioned convention is followed and the finite data are given as footnotes.

VEPCO

AIRBORNE IODINE-131, GROSS ALPHA and BETA in AIR PARTICULATE FILTERS
(Weekly Collections)

10^{-2} pCi/m^3

Collection Date	SS (I) SURRY STATION Volume (m^3)	Gross Alpha	Gross Beta	I-131	HIR (I) HOG ISLAND RESERVE Volume (m^3)	Gross Alpha	Gross Beta	I-131	BC (I) BACON'S CASTLE Volume (m^3)	Gross Alpha	Gross Beta	I-131
01/06/81	245	<1	11±1	<7	255	<1	13±1	<7	270	<1	10±1	<7
01/13/81	255	<1	10±1	<7	275	<1	8±1	<7	265	<1	16±1	<7
01/20/81	275	<1	22±2	<7	260	<1	18±2	<7	310	<1	16±2	<7
01/27/81	230	<1	33±3	<7	205	<1	32±3	<7	255	<1	31±3	<7
02/03/81	230	<1	13±1	<7	250	<1	12±1	<7	290	<1	24±2	<7
02/10/81	250	<1	17±2	<7	235	<1	17±2	<7	300	<1	18±2	<7
02/17/81	225	<1	25±3	<7	235	<1	22±2	<7	285	<1	28±3	<7
02/24/81	250	<1	27±3	<7	250	<1	21±2	<7	290	<1	28±3	<7
03/03/81	245	<1	24±2	<7	250	<1	21±2	<7	285	<1	26±3	<7
03/10/81	235	<1	30±3	<7	240	<1	36±4	<7	290	<1	18±2	<7
03/17/81	235	<1	43±4	<7	240	<1	41±4	<7	295	<1	40±4	<7
03/24/81	225	<1	21±2	<7	230	<1	18±2	<7	280	<1	24±2	<7
03/31/81	240	<1	48±5	<7	255	<1	27±3	<7	285	<1	52±5	<7
04/07/81	240	<1	44±4	<7	250	<1	47±5	<7	270	<1	70±7	<7
04/14/81	225	<1	41±4	<7	255	<1	40±4	<7	305	<1	40±4	<7
04/21/81	220	<1	38±4	<7	245	<1	36±4	<7	300	<1	36±4	<7
04/28/81	235	<1	36±2	<7	240	<1	36±2	<7	275	<1	44±2	<7
05/05/81	235	<1	35±5	<7	235	<1	36±4	<7	280	<1	37±4	<7
05/13/81	255	<1	28±3	<7	260	<1	27±3	<7	335	<1	27±3	<7
05/21/81	245	<1	40±4	<7	275	<1	37±4	<7	345	<1	39±4	<7
05/26/81	145	<1	66±7	<7	160	<1	58±6	<7	190	<1	62±6	<7
06/02/81	230	<1	37±4	<7	290	<1	24±2	<7	280	<1	32±3	<7
06/09/81	195	<1	19±2	<7	235	<1	26±3	<7	280	<1	18±2	<7
06/16/81	205	<1	20±2	<7	245	<1	17±2	<7	285	<1	22±2	<7
06/23/81	195	<1	25±3	<7	215	<1	11±2	<7	280	<1	17±2	<7
06/30/81	280	<1	21±2	<7	265	<1	20±2	<7	290	<1	22±2	<7

AIRBORNE IODINE-131, GROSS ALPHA and BETA in AIR PARTICULATE FILTERS
(Weekly Collections)

10^{-2} pCi/m^3

Collection Date	SS (I) SURRY STATION Volume (m^3)	Gross Alpha	Gross Beta	I-131	HIR (I) HOG ISLAND RESERVE Volume (m^3)	Gross Alpha	Gross Beta	I-131	BC (I) BACON'S CASTLE Volume (m^3)	Gross Alpha	Gross Beta	I-131
07/07/81	250	<1	15±2	<7	190	<1	7±1	<7	280	<1	15±2	<7
07/14/81	285	<1	28±3	<7	220	<1	28±3	<7	265	<1	24±2	<7
07/21/81	225	<1	18±2	<7	215	<1	14±1	<7	255	<1	14±1	<7
07/28/81	305	<1	13±1	<7	220	<1	13±1	<7	245	<1	13±1	<7
08/04/81	280	<1	9±1	<7	235	<1	8±1	<7	235(a)	<1	7±1	<7
08/11/81	315	<1	6±1	<7	225	<1	7±1	<7	320	<1	6±1	<7
08/18/81	305	<1	9±1	<7	220	<1	10±1	<7	315	<1	7±1	<7
08/25/81	285	<1	10±1	<7	225	<1	11±1	<7	300	<1	8±1	<7
09/01/81	285	<1	7±1	<7	290	<1	7±1	<7	300	<1	6±1	<7
09/08/81	260	<1	6±1	<7	285	<1	6±1	<7	305	<1	6±1	<7
09/15/81	250	<1	8±1	<7	280	<1	7±1	<7	300	<1	7±1	<7
09/22/81	245	<1	6±1	<7	285	<1	4±1	<7	280	<1	5±1	<7
09/30/81	285	<1	5±1	<7	315	<1	5±1	<7	345	<1	5±1	<7
10/06/81	205	<1	4±1	<7	245	<1	5±1	<7	250	<1	4±1	<7
10/13/81	240	<1	3±1	<7	290	<1	3±1	<7	305	<1	3±1	<7
10/20/81	245	<1	5±1	<7	305	<1	3±1	<7	305	<1	3±1	<7
10/27/81	245	<1	5±1	<7	305	<1	4±1	<7	290	<1	3±1	<7
11/03/81	225	<1	6±1	<7	310	<1	3±1	<7	290	<1	5±1	<7
11/10/81	235	<1	5±1	<7	290	<1	4±1	<7	305	<1	5±1	<7
11/17/81	235	<1	9±1	<7	300	<1	5±1	<7	300	<1	5±1	<7
11/24/81	230	<1	5±1	<7	300	<1	5±1	<7	300	<1	5±1	<7
12/02/81	260	<1	3±1	<7	350	<1	7±1	<7	350	<1	3±1	<7
12/11/81	370	<1	4±1	<7	390	<1	6±1	<7	390	<1	5±1	<7
12/15/81	165	<1	3±1	<7	180	<1	3±1	<7	170	<1	2±1	<7
12/22/81	285	<1	3±1	<7	295	<1	4±1	<7	305	<1	5±1	<7
12/29/81	300	<1	4±1	<7	300	<1	3±1	<7	295	<1	3±1	<7

(a) Calculations based on average volume.

VEPCO

AIRBORNE IODINE-131, GROSS ALPHA and BETA in AIR PARTICULATE FILTERS
(Weekly Collections)

10^{-2} pCi/m^3

Collection Date	ALL (I) ALLIANCE Volume (m^3)	Gross Alpha	Gross Beta	I-131	CP (I) COLONIAL PARKWAY Volume (m^3)	Gross Alpha	Gross Beta	I-131	DOW (I) Volume (m^3)	Gross Alpha	Gross Beta	I-131
01/06/81	280	<1	10±1	<7	270	<1	11±1	<7	285	<1	11±1	<7
01/13/81	285	<1	14±1	<7	290	<1	13±1	<7	300	<1	8±1	<7
01/20/81	300	<1	15±1	<7	210	<1	24±2	<7	260	<1	18±2	<7
01/27/81	285	<1	28±3	<7	270	<1	30±3	<7	265	<1	26±3	<7
02/03/81	305	<1	17±2	<7	275	<1	15±2	<7	265	<1	12±1	<7
02/10/81	300	<1	13±1	<7	275	<1	20±2	<7	270	<1	17±2	<7
02/17/81	295	<1	23±2	<7	265	<1	22±2	<7	255	<1	22±2	<7
02/24/81	280	<1	23±2	<7	250	<1	30±3	<7	255	<1	34±3	<7
03/03/81	285	<1	20±2	<7	255	<1	20±2	<7	265	<1	18±2	<7
03/10/81	280	<1	17±2	<7	250	<1	27±3	<7	260	<1	17±2	<7
03/17/81	290	<1	35±4	<7	260	<1	41±4	<7	265	<1	44±4	<7
03/24/81	290	<1	18±2	<7	255	<1	23±2	<7	265	<1	23±2	<7
03/31/81	280	<1	40±4	<7	275	<1	25±3	<7	275	<1	37±4	<7
04/07/81	300	<1	60±6	<7	280	<1	62±6	<7	305	<1	49±5	<7
04/14/81	315	<1	34±3	<7	270	<1	35±4	<7	360	<1	39±4	<7
04/21/81	320	<1	28±3	<7	250	<1	46±5	<7	290	<1	34±3	<7
04/28/81	290	<1	33±2	<7	245	<1	49±2	<7	320	<1	29±2	<7
05/05/81	295	<1	23±2	<7	240	<1	41±4	<7	300	<1	31±3	<7
05/13/81	345	<1	21±2	<7	295	<1	27±3	<7	345	<1	26±3	<7
05/21/81	345	<1	33±3	<7	290	<1	41±4	<7	355	<1	32±3	<7
05/26/81	205	<1	50±5	<7	170	<1	63±6	<7	200	<1	58±6	<7
06/02/81	295	<1	23±2	<7	235	<1	28±3	<7	290	<1	24±2	<7
06/09/81	290	<1	19±2	<7	235	<1	26±3	<7	290	<1	3±1	<7
06/16/81	295	<1	14±1	<7	230	<1	22±2	<7	285	<1	17±2	<7
06/23/81	295	<1	15±2	<7	235	<1	18±2	<7	300	<1	8±1	<7
06/30/81	300	<1	17±2	<7	250	<1	21±2	<7	310	<1	19±2	<7

AIRBORNE IODINE-131, GROSS ALPHA and BETA in AIR PARTICULATE FILTERS
(Weekly Collections)

10^{-2} pCi/m^3

Collection Date	ALL (I) ALLIANCE Volume (m^3)	Gross Alpha	Gross Beta	I-131	CP (I) COLONIAL PARKWAY Volume (m^3)	Gross Alpha	Gross Beta	I-131	DOW (I) Volume (m^3)	Gross Alpha	Gross Beta	I-131
07/07/81	300	<1	12±1	<7	245	<1	12±1	<7	290	<1	9±1	<7
07/14/81	240	<1	28±3	<7	235	<1	25±3	<7	280	<1	24±2	<7
07/21/81	275	<1	17±2	<7	230	<1	15±2	<7	285	<1	14±1	<7
07/28/81	265	<1	15±2	<7	225	<1	13±1	<7	285	<1	12±1	<7
08/04/81	290	<1	6±1	<7	225	<1	9±1	<7	300	<1	7±1	<7
08/11/81	295	<1	7±1	<7	205	<1	8±1	<7	290	<1	6±1	<7
08/18/81	290	<1	8±1	<7	235	<1	9±1	<7	300	<1	8±1	<7
08/25/81	275	<1	10±1	<7	250	<1	9±1	<7	285	<1	9±1	<7
09/01/81	290	<1	6±1	<7	245	<1	7±1	<7	280	<1	6±1	<7
09/08/81	295	<1	6±1	<7	240	<1	6±1	<7	285	<1	7±1	<7
09/15/81	285	<1	7±1	<7	240	<1	10±1	<7	270	<1	7±1	<7
09/22/81	300	<1	5±1	<7	240	<1	5±1	<7	260	<1	5±1	<7
09/30/81	345	<1	6±1	<7	295	<1	6±1	<7	295	<1	5±1	<7
10/06/81	260	<1	5±1	<7	205	<1	6±1	<7	225	<1	5±1	<7
10/13/81	300	<1	3±1	<7	255	<1	2±1	<7	260	<1	2±1	<7
10/20/81	310	<1	3±1	<7	270	<1	4±1	<7	260	<1	3±1	<7
10/27/81	295	<1	4±1	<7	250	<1	4±1	<7	250	<1	9±1	<7
11/03/81	300	<1	3±1	<7	245	<1	4±1	<7	255	<1	4±1	<7
11/10/81	305	<1	6±1	<7	255	<1	7±1	<7	255	<1	5±1	<7
11/17/81	310	<1	7±1	<7	265	<1	7±1	<7	260	<1	6±1	<7
11/24/81	295	<1	6±1	<7	225	<1	5±1	<7	245	<1	4±1	<7
12/02/81	350	<1	5±1	<7	295	<1	5±1	<7	275	<1	5±1	<7
12/11/81	390	<1	5±1	<7	320	<1	5±1	<7	330	<1	2±1	<7
12/15/81	170	<1	5±1	<7	145	<1	2±1	<7	155	<1	<1	<7
12/22/81	305	<1	5±1	<7	250	<1	10±1	<7	(a)	-	-	-
12/29/81	300	<1	3±1	<7	250	<1	3±1	<7	(a)	-	-	-

(a) Sampling unit out of order.

AIRBORNE IODINE-131, GROSS ALPHA and BETA in AIR PARTICULATE FILTERS
(Weekly Collections)

10^{-2} pCi/m^3

Collection Date	FE (I) FORT EUSTIS Volume (m^3)	Gross Alpha	Gross Beta	I-131	NN (C) NEWPORT NEWS Volume (m^3)	Gross Alpha	Gross Beta	I-131
01/06/81	300	<1	11±1	<7	275	<1	10±1	<7
01/13/81	305	<1	11±1	<7	265	<1	10±1	<7
01/20/81	300	<1	<1(a)	<7	260	<1	24±2	<7
01/27/80	275	<1	34±3	<7	265	<1	27±3	<7
02/03/81	305	<1	7±1	<7	260	<1	19±2	<7
02/10/81	290	<1	14±1	<7	260	<1	18±2	<7
02/17/81	300	<1	18±2	<7	245	<1	43±4	<7
02/24/81	300	<1	27±3	<7	250	<1	29±3	<7
03/03/81	305	<1	20±2	<7	255	<1	17±2	<7
03/10/81	300	<1	24±2	<7	245	<1	20±2	<7
03/17/81	305	<1	19±2	<7	240	<1	39±4	<7
03/24/81	310	<1	20±2	<7	250	<1	20±2	<7
03/31/81	290	<1	44±4	<7	255	<1	48±5	<7
04/07/81	295	<1	44±4	<7	255	<1	60±6	<7
04/14/81	305	<1	39±4	<7	95	<1	45±5	<7
04/21/81	310	<1	39±4	<7	175	<1	36±4	<7
04/28/81	305	<1	33±2	<7	235	<1	38±2	<7
05/05/81	390	<1	37±4	<7	240	<1	32±3	<7
05/13/81	345	<1	27±3	<7	280	<1	26±3	<7
05/21/81	355	<1	33±3	<7	280	<1	40±4	<7
05/26/81	205	<1	56±6	<7	155	<1	53±5	<7
06/02/81	300	<1	18±2	<7	295	<1	25±3	<7
06/09/81	110	<1	41±4	<7	285	<1	19±2	<7
06/16/81	205	<1	19±2	<7	280	<1	19±2	<7
06/23/81	250	<1	12±2	<7	270	<1	12±2	<7
06/30/81	275	<1	24±2	<7	285	<1	21±2	<7

(a) Sample appeared to have little, if any, particulate matter on it.

AIRBORNE IODINE-131, GROSS ALPHA and BETA in AIR PARTICULATE FILTERS
(Weekly Collections)

10^{-2} pCi/m^3

Collection Date	FE (I) FORT EUSTIS Volume (m^3)	Gross Alpha	Gross Beta	I-131	NN (C) NEWPORT NEWS Volume (m^3)	Gross Alpha	Gross Beta	I-131
07/07/81	255	<1	13±1	<7	275	<1	9±1	<7
07/14/81	245	<1	26±3	<7	270	<1	23±2	<7
07/21/81	250	<1	14±1	<7	260	<1	12±1	<7
07/28/81	250	<1	15±2	<7	265	<1	10±1	<7
08/04/81	265	<1	4±1	<7	265	<1	7±1	<7
08/11/81	245	<1	3±1	<7	185	<1	3±1	<7
08/18/81	225	<1	9±1	<7	245	<1	8±1	<7
08/25/81	230	<1	10±1	<7	260	<1	7±1	<7
09/01/81	230	<1	6±1	<7	270	<1	9±1	<7
09/08/81	230	<1	7±1	<7	250	<1	6±1	<7
09/15/81	235	<1	8±1	<7	235	<1	7±1	<7
09/22/81	235	<1	5±1	<7	250	<1	5±1	<7
09/30/81	260	<1	6±1	<7	285	<1	6±1	<7
10/06/81	190	<1	4±1	<7	210	<1	5±1	<7
10/13/81	230	<1	3±1	<7	260	<1	3±1	<7
10/20/81	190	<1	2±1	<7	255	<1	3±1	<7
10/27/81	210	<1	3±1	<7	250	<1	3±1	<7
11/03/81	210	<1	6±1	<7	240	<1	4±1	<7
11/10/81	215	<1	5±1	<7	255	<1	6±1	<7
11/17/81	180	<1	5±1	<7	230	<1	7±1	<7
11/24/81	215	<1	6±1	<7	250	<1	5±1	<7
12/02/81	250	<1	4±1	<7	280	<1	5±1	<7
12/11/81	290	<1	5±1	<7	305	<1	5±1	<7
12/15/81	130	<1	2±1	<7	140	<1	2±1	<7
12/22/81	225	<1	5±1	<7	230	<1	5±1	<7
12/29/81	210	<1	5±1	<7	250	<1	5±1	<7

GAMMA EMITTERS IN AIR PARTICULATE FILTER COMPOSITE
(Quarterly Composites of Weekly Collections)

10^{-2}pCi/m^3	Stations in Composite		
	SS-HIR	BC-ALL-CP-DOW-FE	NN
FIRST QUARTER			
Ce-144	5±1	2±1	6±2
Be-7	16±3	3±1	11±4
Zr-95	3±1	2±1	6±1
Nb-95	17±2	8±1	18±2
Ce-141	6±2	3±1	7±3
Ru-103	2±1	1±1	3±1
Ru-106	-	2±1	-
Other gamma	<1	<1	<1
SECOND QUARTER			
Ce-144	16±2	7±1	15±1
Be-7	15±3	11±2	14±5
Zr-95	4±1	7±1	6±1
Nb-95	9±1	12±1	6±1
Ce-141	4±1	1±1	2±1
Ru-103	2±1	2±1	1±1
Ru-106	3±1	3±1	<2
Other gamma	<1	<1	<1
THIRD QUARTER			
Ce-144	5±2	3±1	13±3
Be-7	22±3	19±2	14±3
Zr-95	2±1	1±1	<1
Nb-95	2±1	2±1	3±1
Other gamma	<1	<1	<1
FOURTH QUARTER			
Be-7	14±2	7±1	11±3
Other γ	<1	<1	<1

VEPCO - Surry

GAMMA RADIATION
TOTAL mR/QTR. USING THERMOLUMINISCENT DOSIMETERS

VEPCO-ENVIRONMENTAL TLD'S 1981

		1st Quarter		2nd Quarter	
Date Annealed:		12/23/80		03/20/81	
Date Read:		04/16/81		07/13/81	
Location		ΣmR	mR/wk	ΣmR	mR/wk
(C) Control (Site)	-00	5.4±0.4	0.3±0.1	7.6±0.8	0.5±0.1
Surry Station	-01	73.1±7.5	4.5±0.5	62.2±6.2	3.8±0.4
WNW	-02	16.1±3.1	1.0±0.2	16.7±1.7	1.0±0.1
Discharge Canal	-03	12.2±1.1	0.8±0.1	10.2±1.0	0.6±0.1
NNW	-04	15.9±2.9	1.0±0.2	17.1±1.7	1.0±0.1
North	-05	15.6±0.9	1.0±0.1	13.2±2.5	0.8±0.2
NNE	-06	16.0±1.9	1.8±0.1	17.4±1.7	1.1±0.1
NE	-07	15.6±1.2	1.0±0.1	17.2±1.7	1.1±0.1
ENE	-08	17.2±1.1	1.1±0.1	14.3±1.9	0.9±0.1
East exclusion area	-09	19.6±0.6	1.2±0.1	17.7±1.8	1.1±0.1
WEST	-10	15.7±1.0	1.0±0.1	13.2±1.3	0.8±0.1
WSW	-11	5.6±2.4	1.0±0.1	15.2±2.2	0.9±0.1
SW	-12	18.7±2.2	1.1±0.1	16.1±1.6	1.0±0.1
SSW	-13	16.5±1.6	1.0±0.1	16.5±1.7	1.0±0.1
South	-14	17.7±1.6	1.1±0.1	14.0±1.4	0.9±0.1
SSE	-15	15.8±0.8	1.0±0.1	15.8±1.6	1.0±0.1
SE	-16	16.4±1.2	1.0±0.1	15.2±1.5	0.9±0.1
East	-17	15.9±1.9	1.0±0.1	13.8±1.4	0.8±0.1
Intake Canal	-18	10.5±1.0	0.6±0.1	missing	missing
Hog Island Reserve	-19	14.9±1.7	0.9±0.1	23.0±2.3	1.4±0.1
Bacons Castle	-20	14.3±2.0	0.9±0.1	13.9±1.4	0.8±0.1
Route 633	-21	14.7±1.3	0.9±0.1	16.9±1.7	1.0±0.1
Alliance	-22	12.1±1.3	0.7±0.1	12.1±2.0	0.7±0.1
Surry	-23	15.8±2.1	1.0±0.1	13.3±2.1	0.8±0.1
Routes 637 & 635	-24	13.4±2.2	0.8±0.1	13.3±1.3	0.8±0.1
Scotland Wharf	-25	15.7±1.4	1.0±0.1	16.2±1.6	1.0±0.1
Jamestown	-26	17.8±1.5	1.1±0.1	14.4±1.4	0.9±0.1
Colonial Parkway (NW)	-27	12.2±0.3	0.7±0.1	20.7±2.1	1.3±0.1
Route 617 & 618	-28	14.1±1.0	0.9±0.1	12.7±1.8	0.8±0.1
Kingsmill (North)	-29	12.1±2.2	0.7±0.1	14.4±1.4	0.9±0.1
Williamsburg	-30	13.4±1.0	0.8±0.1	11.0±1.2	0.7±0.1
Kingsmill (NNE)	-31	14.1±1.9	0.9±0.1	12.0±1.2	0.7±0.1
Budweiser	-32	16.5±1.3	1.0±0.1	15.1±1.9	0.9±0.1
Water Plant	-33	13.3±1.9	0.8±0.1	13.1±1.3	0.8±0.1
Dow Chemical	-34	16.3±2.4	1.0±0.1	14.8±1.5	0.9±0.1
Lee Hall	-35	18.9±1.2	1.2±0.1	16.5±1.7	1.0±0.1
Goose Island	-36	16.1±1.0	1.0±0.1	15.6±1.9	1.0±0.1
Fort Eustis	-37	15.9±0.6	1.0±0.1	17.8±1.8	1.1±0.1
Newport News	-38	14.6±1.0	0.9±0.1	19.5±2.0	1.2±0.1
(C) Control (J.R. Bridge)	-39	15.4±2.2	0.9±0.1	15.0±1.5	0.9±0.1
(C) Control (Benn's Church)	-40	12.3±1.5	0.8±0.1	12.2±1.2	0.7±0.1
Smithfield	-41	15.1±1.0	0.9±0.1	14.9±1.5	0.9±0.1
Rushmere	-42	12.9±1.5	0.8±0.1	12.9±2.0	0.8±0.1
Route 628	-43	17.7±2.1	1.1±0.1	13.6±3.4	0.8±0.2

VEPCO - Surry

GAMMA RADIATION
TOTAL mR/QTR. USING THERMOLUMINISCENT DOSIMETERS

VEPCO-ENVIRONMENTAL TLD'S 1981

		3rd Quarter		4th Quarter	
Date Annealed:		06/19/81		09/17/81	
Date Read:		10/07/81		02/11/82	
Location		ΣmR	mR/wk	ΣmR	mR/wk
(C) Control (Site)	-00	8.7±2.0	0.6±0.1	17.9±3.4	0.9±0.2
Surry Station	-01	154.4±5.4	9.8±0.3	169.1±94.9	9.8±4.5
WNW	-02	29.2±2.8	2.9±0.2	43.7±21.5	2.1±1.0
Discharge Canal	-03	12.6±2.6	0.8±0.2	missing	missing
NNW	-04	23.0±1.2	1.5±0.1	34.4±8.7	1.6±0.4
North	-05	19.3±0.9	1.2±0.1	33.9±10.1	1.6±0.5
NNE	-06	24.1±1.2	1.5±0.1	17.4±2.6	0.8±0.1
NE	-07	20.0±0.2	1.3±0.1	35.3±3.5	1.7±0.2
ENE	-08	21.9±3.1	1.4±0.2	34.5±6.3	1.6±0.3
East exclusion area	-09	24.2±0.1	1.5±0.1	36.1±7.9	1.7±0.4
WEST	-10	20.0±0.7	1.3±0.2	36.4±5.5	1.7±0.3
WSW	-11	20.9±2.0	1.3±0.1	35.0±5.8	1.7±0.3
SW	-12	20.5±0.9	1.3±0.1	37.1±8.6	1.8±0.4
SSW	-13	19.3±3.0	1.2±0.2	33.0±9.6	1.6±0.5
South	-14	19.2±2.5	1.2±0.2	39.6±5.7	1.9±0.3
SSE	-15	19.9±1.7	1.3±0.1	41.5±19.1	2.0±0.9
SE	-16	21.0±1.6	1.3±0.1	32.0±5.9	1.5±0.3
East	-17	24.4±2.9	1.6±0.2	34.1±14.0	1.6±0.7
Intake Canal	-18	15.4±1.3	1.0±0.1	27.0±4.6	1.3±0.2
Hog Island Reserve	-19	15.7±1.5	1.0±0.1	30.1±3.5	1.4±0.2
Bacons Castle	-20	16.3±1.1	1.0±0.1	27.0±5.1	1.3±0.2
Route 633	-21	18.9±0.5	1.2±0.1	34.7±3.3	1.7±0.2
Alliance	-22	16.6±2.0	1.1±0.1	36.8±18.9	1.8±0.9
Surry	-23	18.1±0.5	1.2±0.1	30.7±12.0	1.5±0.6
Routes 637 & 635	-24	18.2±2.0	1.2±0.1	31.0±4.9	1.5±0.2
Scotland Wharf	-25	18.6±1.5	1.2±0.1	31.8±6.9	1.5±0.3
Jamestown	-26	16.4±2.0	1.0±0.1	32.6±7.4	1.6±0.4
Colonial Parkway (NW)	-27	17.7±1.8	1.1±0.1	27.7±17.1	1.3±0.8
Route 617 & 618	-28	18.4±2.1	1.2±0.1	29.3±5.8	1.4±0.3
Kingsmill (North)	-29	18.0±1.6	1.1±0.1	29.6±5.0	1.4±0.2
Williamsburg	-30	15.7±0.7	1.0±0.1	33.0±5.8	1.6±0.3
Kingsmill (NNE)	-31	27.2±3.7	1.7±0.2	24.0±7.5	1.1±0.4
Budweiser	-32	21.1±1.1	1.3±0.1	38.2±10.5	1.8±0.5
Water Plant	-33	18.8±2.6	1.2±0.2	29.4±3.2	1.4±0.2
Dow Chemical	-34	22.2±2.7	1.4±0.2	32.4±15.3	1.5±0.7
Lee Hall	-35	23.0±1.5	1.5±0.1	40.0±12.3	1.9±0.6
Goose Island	-36	23.7±2.2	1.5±0.1	missing	missing
Fort Eustis	-37	21.4±1.6	1.4±0.1	34.6±2.0	1.6±0.1
Newport News	-38	30.4±3.0	1.9±0.2	38.7±6.5	1.8±0.3
(C) Control (J.R. Bridge)	-39	19.8±3.6	1.3±0.2	33.0±2.9	1.6±0.1
(C) Control (Benn's Church)	-40	15.7±0.7	1.0±0.1	25.1±15.3	1.2±0.7
Smithfield	-41	19.0±3.8	1.2±0.2	32.3±2.9	1.5±0.1
Rushmere	-42	17.8±3.1	1.1±0.2	29.5±4.0	1.4±0.2
Route 628	-43	19.8±2.9	1.3±0.2	28.3±12.5	1.3±0.6

VEPCO - Surry

GAMMA RADIATION
TOTAL mR/QTR. USING THERMOLUMINESCENT DOSIMETERS

VEPCO-AREA TLD'S 1981

	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
Date Annealed:	12/23/80		03/20/81		06/19/81		09/17/81	
Date Read:	04/16/81		07/13/81 * 08/05/81		10/06/81		02/11/82	
Location	ΣmR	mR/wk	ΣmR	mR/wk	ΣmR	mR/wk	ΣmR	mR/wk
Control -00	5.2±1.4	0.3±0.1	6.2±1.0	0.4±0.1	8.0±1.4	0.5±0.1	18.9±3.7	0.9±0.2
Training Center -01	11.7±0.6	0.7±0.1	11.4±1.3	0.7±0.1	12.3±2.4	1.1±0.2	28.7±1.6	1.4±0.1
Admin Bldg Entrance-02	missing	missing	19.5±2.0	1.2±0.1	25.0±1.1	1.6±0.1	43.8±9.1	2.1±0.4
Admin Bldg Recep -03	25.9±3.6	1.6±0.2	29.2±7.0	1.8±0.4	39.9±1.2	2.6±0.1	53.4±8.6	2.5±0.4
Admin Bldg Kitchen -04	18.1±3.6	1.1±0.2	20.4±2.3	1.2±0.1	26.4±1.5	1.7±0.1	37.6±2.7	1.8±0.1
Admin Bldg (Men) -05	21.9±3.4	1.3±0.2	26.8±2.7	1.6±0.2	32.1±0.3	2.1±0.1	47.8±7.1	2.3±0.3
Admin Bldg Conf -06	19.3±2.9	1.2±0.2	29.1±3.4 *	1.5±0.2	29.2±0.0	1.9±0.0	35.1±3.7	1.7±0.2
Cafeteria -07	19.2±2.7	1.2±0.2	23.4±2.4	1.4±0.1	31.0±2.1	2.0±0.1	43.9±3.8	2.1±0.2
Maintenance Shop -08	19.0±2.9	1.2±0.2	22.0±3.4	1.3±0.2	26.1±0.8	1.7±0.1	42.1±5.1	2.0±0.2
Storeroom East End -09	20.1±0.4	1.2±0.1	23.2±2.4	1.4±0.2	20.5±0.8	1.8±0.1	45.8±4.6	2.2±0.2
Storeroom West End -10	13.8±1.7	0.8±1.3	17.4±1.7	1.1±0.1	23.6±1.4	1.5±0.1	44.2±21.0	2.1±1.0
Control Room East -11	12.3±0.5	0.8±0.1	12.5±1.3	0.8±0.1	17.0±1.3	1.1±0.1	35.8±9.1	1.7±0.4
Control Room West -12	7.6±1.0	0.5±0.1	9.5±1.0	0.6±0.1	10.1±1.6	0.6±0.1	27.0±6.0	1.3±0.3
Intrument Shop -13	287.8±20.7	17.7±1.3	302±30	18.4±1.8	350.6±6.2	22.5±0.4	462.1±54.6	22.0±2.6
Clean Change Room -14	30.1±2.5	1.8±0.1	39.2±3.9	2.4±0.2	48.0±3.3	3.1±0.2	87.8±11.1	4.2±0.5
Security Bldg. -15	24.5±3.1	1.5±0.2	27.9±2.8	1.7±0.2	42.4±0.6	2.7±0.1	71.3±4.2	3.4±0.2
East Fence -16	62.0±5.6	3.0±0.3	66.4±8.6	4.1±0.5	45.0±1.1	2.9±0.1	112.9±13.8	5.4±0.6

VEPCO - Surry

GROSS BETA DEPOSITION AND TRITIUM CONCENTRATIONS
IN PRECIPITATION SAMPLES
(Monthly Collections)

Collection Period	Surry Station (I) Gross β pCi/l	Gross β nCi/m²	Tritium pCi/l	Newport News (C) Gross β pCi/l	Gross β nCi/m²	Tritium pCi/l
January	23.9±2.4	2.1±0.2	<500	7.7±2.5	0.6±0.2	<500
February	23.0±2.0	0.3±0.1	<500	13.0±2.0	0.2±0.1	<500
March	39.0±4.0	0.6±0.1	500±400	20.0±2.0	0.3±0.1	400±400
April	36.0±3.0	1.7±0.2	680±310	15.0±2.0	1.2±0.1	820±310
May	38.4±6.1	0.6±0.1	<500	16.0±4.5	0.2±0.1	<500
June	5.0±2.0	0.1±0.1	550±370	7.0±2.0	0.1±0.1	380±180
July	29.0±3.0	1.2±0.1	600±400	4.0±1.0	0.13±0.01	<500
August	7.0±2.0	0.4±0.1	530±390	5.0±2.0	0.5±0.2	640±390
September	10.0±2.0	0.3±0.1	<500	<5.0	<0.2	<500
October	5.0±2.0	0.1±0.1	<500	5.0±2.0	0.1±0.1	<500
November	9.0±2.0	0.3±0.1	1500±400	3.0±1.0	0.1±0.1	500±300
December	4.0±1.0	0.3±0.1	<500	3.0±1.0	0.3±0.1	<500

GROSS BETA DEPOSITION AND TRITIUM CONCENTRATIONS
IN PRECIPITATION SAMPLES
(Quarterly Composites of Monthly Collections)

Collection Period	Surry Station (I) Gross β pCi/l	Gross β nCi/m²	Tritium pCi/l	Newport News (C) Gross β pCi/l	Gross β nCi/m²	Tritium pCi/l
1st Quarter	25.9±2.6	0.387±0.039	260±100	29.3±3.3	0.370±0.042	250±100
2nd Quarter	16.0±2.0	0.230±0.020	550±370	10.0±2.0	0.120±0.010	600±370
3rd Quarter	15.0±2.0	2.0±0.3	400±150	<5.0	<0.6	240±150
4th Quarter	5.0±1.0	0.650±0.210	370±90	2.0±1.0	0.250±0.160	350±110

RADIOACTIVITY IN MILK SAMPLES
(Monthly Collections)

(I) Bacon's Castle (EPPS) - State Split Samples

Collection Date	pCi/l as of collection date					g/l Stable Ca
	I-131	Sr-89	Sr-90	Cs-137	Ba-La-140	
01/12/81	<1	<5	<2	<15	<15	1.5
02/08/81	<1	<5	4±2	<15	<15	1.0
03/02/81	<1	<5	3±1	<15	<15	1.2
04/06/81	<1	<5	4±1	<15	<15	1.6
05/04/81	<1	<5	7±2	<15	<15	0.9
06/01/81	<1	<5	<2	<15	<15	1.1
07/07/81	<1	<5	9±3	<15	<15	1.0
08/04/81	<1	<5	1±1	<15	<15	1.0
08/31/81	<1	<5	5±2	<15	<15	0.8
10/05/81	<1	<5	<2	<15	<15	1.1
11/10/81	<1	<5	<2	<15	<15	1.0
11/30/81	<2.8(a)	<5	<2	<15	<15	0.9

(I) Bacon's Castle (Judkins)

	pCi/l as of collection date					g/l Stable Ca
	I-131	Sr-89	Sr-90	Cs-137	Ba-La-140	
01/15/81	<1	<5	3±1	<15	<15	1.0
02/10/81	<1	<5	2±1	<15	<15	1.0
03/17/81	<1	<5	2±1	<15	<15	0.6
04/14/81	<1	<5	7±1	<15	<15	0.6
05/13/81	<1	<5	5±3	<15	<15	1.1
06/09/81	<1	<5	6±1	<15	<15	1.1
07/14/81	<1	<5	5±1	<15	<15	1.0
08/13/81	<1	<5	5±1	<15	<15	0.9
09/08/81	<1	<5	5±2	<15	<15	1.2
10/13/81	<1	<5	<2	<15	<15	0.9
11/10/81	<1	<5	2±1	<15	<15	0.8
12/11/81	<1	<5	<2	<15	<15	1.2

(a) Lower sensitivity due to length of time (23 days) between collection and receipt of sample at EIC.

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RADIOACTIVITY IN MILK SAMPLES
(Monthly Collections)

(C) Smithfield (Gwaltney)

Collection Date	pCi/l as of collection date					g/l
	I-131	Sr-89	Sr-90	Cs-137	Ba-La-140	Stable Ca
01/21/81	<1	<5	3±2	<15	<15	1.3
02/17/81	<1	<5	3±1	<15	<15	1.6
03/24/81	<1	<5	5±2	<15	<15	1.4
04/21/81	<1	<5	5±1	<15	<15	1.0
05/26/81	<1	<5	8±2	<15	<15	0.7
06/16/81	(a)	<5	1±1	<15	<15	0.8
07/21/81	<1	<5	5±1	<15	<15	1.1
08/18/81	<1	<5	3±1	<15	<15	0.9
09/15/81	<1	<5	2±1	<15	<15	0.8
10/20/81	<1	<5	<2	<15	<15	0.7
11/17/81	1.7(b)	<5	2±1	<15	<15	0.9
12/15/81	<1	<5	1±1	<15	<15	0.6

(I) Colonial Parkway (Smith)

	pCi/l as of collection date					g/l
	I-131	Sr-89	Sr-90	Cs-137	Ba-La-140	Stable Ca
01/15/81	<1	<5	5±1	<15	<15	1.4
02/10/81	<1	<5	5±2	<15	<15	0.8
03/24/81	<1	<5	3±2	<15	<15	0.9
04/21/81	<1	<5	3±1	<15	<15	1.0
05/13/81	<1	<5	4±2	<15	<15	1.2
06/09/81	<1	<5	4±1	<15	<15	1.1
07/14/81	<1	<5	4±1	<15	<15	0.9
08/11/81	<1	<5	5±1	<15	<15	1.0
09/08/81	<1	<5	5±1	<15	<15	0.9
10/13/81	<1	<5	6±1	<15	<15	1.0
11/10/81	<1	<5	3±1	<15	<15	0.9
12/22/81	<1	<5	4±1	<15	<15	1.1

(a) Sample lost in processing.
(b) Lower sensitivity due to low chemical yield.

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RADIOACTIVITY IN MILK SAMPLES
(Monthly Collections)

(I) Lee Hall (Ross) - State Split Samples

Collection Date	pCi/l as of collection date					g/l
	I-131	Sr-89	Sr-90	Cs-137	Ba-La-140	Stable Ca
01/12/81	<1	<5	<2	<15	<15	1.2
02/08/81	<1	<5	4±2	<15	<15	0.8
03/02/81	<1	<5	2±1	<15	<15	1.5
04/06/81	<1	<5	1±1	<15	<15	1.3
05/04/81	<1	<5	3±1	<15	<15	0.8
06/01/81	<1	<5	4±1	<15	<15	1.0
07/07/81	<1	<5	<2	<15	<15	0.9
08/04/81	<1	<5	2±1	<15	<15	1.0
08/31/81	<1	<5	5±1	<15	<15	0.9
10/05/81	<1	<5	5±1	<15	<15	1.0
11/09/81	<1	<5	<2	<15	<15	0.3
11/30/81	<3.1(a)	<5	<2	<15	<15	0.9

(a) Lower sensitivity due to length of time (23 days) between collection and receipt of sample at EIC.

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GAMMA EMITTERS IN JAMES RIVER WATER SAMPLES
(Bimonthly Collections)

Month Collected	pCi/l								
	Ba-La-140	Cs-134	Cs-137	Zr-Nb-95	Co-58	Mn-54	Zn-65	Co-60	Fe-59
CHICKAHOMINY (C)									
January	<15	<15	<15	<10	<15	<15	<30	<15	<30
March	<15	<15	<15	<10	<15	<15	<30	<15	<30
May	<15	<15	<15	<10	<15	<15	<30	<15	<30
July	<15	<15	<15	<10	<15	<15	<30	<15	<30
September (a)	<15	<15	<15	<10	<15	<15	<30	<15	<30
November	<15	<15	<15	<10	<15	<15	<30	<15	<30
HOG ISLAND POINT (I)									
January	<15	<15	<15	<10	<15	<15	<30	<15	<30
March	<15	<15	<15	<10	<15	<15	<30	<15	<30
May	<15	<15	<15	<10	<15	<15	<30	<15	<30
July	<15	<15	<15	<10	<15	<15	<30	<15	<30
September	<15	<15	<15	<10	<15	<15	<30	<15	<30
November	<15	<15	<15	<10	<15	<15	<30	<15	<30
NEWPORT NEWS (I)									
January	<15	<15	<15	<10	<15	<15	<30	<15	<30
March	<15	<15	<15	<10	<15	<15	<30	<15	<30
May	<15	<15	<15	<10	<15	<15	<30	<15	<30
July	<15	<15	<15	<10	<15	<15	<30	<15	<30
September	<15	<15	<15	<10	<15	<15	<30	<15	<30
November	<15	<15	<15	<10	<15	<15	<30	<15	<30

(a) Ba-La-140 <15.

GAMMA EMITTERS IN JAMES RIVER WATER SAMPLES
(Bimonthly Collections)

Month Collected	pCi/l								
	Ba-La-140	Cs-134	Cs-137	Zr-Nb-95	Co-58	Mn-54	Zn-65	Co-60	Fe-59
STATION INTAKE (I)									
January	<15	<15	<15	<10	<15	<15	<30	<15	<30
March	<15	<15	<15	<10	<15	<15	<30	<15	<30
May	<15	<15	<15	<10	<15	<15	<30	<15	<30
July	<15	<15	<15	<10	<15	<15	<30	<15	<30
September (a)	<15	<15	<15	<10	<15	<15	<30	<15	<30
November	<15	<15	<15	<10	<15	<15	<30	<15	<30
STATION DISCHARGE (I)									
January	<15	<15	<15	<10	<15	<15	<30	<15	<30
March	<15	<15	<15	<10	<15	<15	<30	<15	<30
May	<15	<15	<15	<10	<15	<15	<30	<15	<30
July	<15	<15	<15	<10	<15	<15	<30	<15	<30
September	<15	<15	<15	<10	<15	<15	<30	<15	<30
November	<15	<15	<15	<10	<15	<15	<30	<15	<30

(a) Ce-141 = 18±16.

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RADIOACTIVITY in JAMES RIVER WATER
-STATE SPLIT SAMPLES-

pCi/l

Collection Date	Sr-89	Sr-90	Tritium	Zr-Nb-95	Mn-54 Co-58-60 Cs-134-137 Ba-La-140	Zn-65 Fe-59
			Station Discharge			
01/06/81	<5	<2	990±430	<10	<15	<30
02/03/81	<5	<2	<500	<10	<15	<30
03/02/81	<5	<2	<500	<10	<15	<30
04/06/81	<5	2±1	<500	<10	<15	<30
05/04/81	<5	<2	<500	<10	<15	<30
06/02/81	<5	<2	500±300	<10	<15	<30
07/07/81	<5	<2	<500	<10	<15	<30
07/81	<5	<2	<500	<10	<15	<30
08/81	<5	<2	850±390	<10	<15	<30
09/81	<5	<2	<500	<10	<15	<30
10/81	<5	<2	<500	<10	<15	<30
12/14/81	<5	<2	1000±400	<10	<15	<30
12/81	<5	<2	900±300	<10	<15	<30
			Scotland Wharf			
01/06/81	<5	<2	510±480	<10	<15	<30
02/03/81	<5	<2	<500	<10	<15	<30
03/02/81	<5	<2	<500	<10	<15	<30
04/06/81	<5	<2	<500	<10	<15	<30
05/04/81	<5	1±1	<500	<10	<15	<30
06/02/81	<5	<2	500±300	<10	<15	<30
07/07/81	<5	<2	<500	<10	<15	<30
07/81	<5	<2	<500	<10	<15	<30
08/81	<5	<2	530±390	<10	<15	<30
09/81	<5	<2	<500	<10	<15	<30
10/81	<5	<2	<500	<10	<15	<30
12/14/81	<5	<2	600±400	<10	<15	<30
12/81	<5	<2	1700±400	<10	<15	<30

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TRITIUM IN JAMES RIVER WATER SAMPLES
(Semiannual Composites of Bimonthly Samples)

Sample Location	pCi/l	
	1st half 1981	2nd half 1981
CH	<330	<330
NN	260±90	480±140

VEPCO - Surry

GAMMA EMITTERS IN CLAM SAMPLES
(Bi-Monthly Collections)

Sample Site	Month Collected	pCi/kg Wet Weight						
		Mn-54	Fe-59	Co-58	Co-60	Zn-65	Cs-134	Cs-137
CHICKAHOMINY (C)	January	<130	<260	<130	<130	<260	<130	<130
	March	<130	<260	<130	<130	<260	<130	<130
	May	<130	<260	<130	<130	<260	<130	<130
	July	<130	<260	<130	<130	<260	<130	<130
	September	<130	<260	<130	<130	<260	<130	<130
	November	<130	<260	<130	<130	<260	<130	<130
LAWNES CREEK (I)	January	<130	<260	<130	<130	<260	<130	<130
	March	<130	<260	<130	<130	<260	<130	<130
	May	<130	<260	<130	<130	<260	<130	<130
	July	<130	<260	<130	<130	<260	<130	<130
	September	<130	<260	<130	<130	<260	<130	<130
	November	<130	<260	<130	<130	<260	<130	<130
JAMESTOWN (I)	January	<130	<260	<130	<130	<260	<130	<130
	March	<130	<260	<130	<130	<260	<130	<130
	May	<130	<260	<130	<130	<260	<130	<130
	July	<130	<260	<130	<130	<260	<130	<130
	September	<130	<260	<130	<130	<260	<130	<130
	November	<130	<260	<130	<130	<260	<130	<130
HOG ISLAND POINT (I)	January	<130	<260	<130	<130	<260	<130	<130
	March	<130	<260	<130	210±40	<260	<130	<130
	May	<130	<260	<130	<130	<260	<130	<130
	July	<130	<260	<130	<130	<260	<130	<130
	September	<130	<260	<130	<130	<260	<130	<130
	November	<130	<260	<130	<130	<260	<130	<130
STATION DISCHARGE (I)	January	<130	<260	<130	<130	<260	<130	<130
	March	(See State Split results next page)						
	May	(See State Split results next page)						
	July	(See State Split results next page)						
	September	(See State Split results next page)						
	November	(See State Split results next page)						

VEPCO - Surry

GAMMA EMITTERS IN CLAM SAMPLES

State Split Samples from
Station Discharge

Month Collected	pCi/kg Wet						
	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Cs-134	Cs-137
March	<130	<260	<130	<130	<260	<130	<130
May	<130	<260	<130	<130	<260	<130	<130
July	<130	<260	<130	<130	<260	<130	<130
September	<130	<260	<130	<130	<260	<130	<130
November	<130	<260	<130	<130	<260	<130	<130

Strontium-89 and Strontium-90 in Clams
(State Split Samples from
Station Discharge)

Collection Date	pCi/kg Wet Weight	
	Sr-89	Sr-90
March	<20	50±10
May	<20	30±10
July	<20	<10
September	<20	<10
November	<20	<30(a)

(a) Insufficient sample for more sensitive analysis.

VEPCO - Surry

GAMMA EMITTERS IN OYSTER SAMPLES
(Bi-Monthly Collections)

Location	Month Collected	pCi/kg Wet Weight						
		Mn-54	Fe-59	Co-58	Co-60	Zn-65	Cs-134	Cs-137
Deep Water Shoal (I)	January	<130	<260	<130	<130	<260	<130	<130
	March	<130	<260	<130	<130	<260	<130	<130
	May	<130	<260	<130	<130	<260	<130	<130
	July	<130	<260	<130	<130	<260	<130	<130
	September	<130	<260	<130	<130	<260	<130	<130
	November	<130	<260	<130	<130	<260	<130	<130
Point of Shoal (I)	January	<130	<260	<130	<130	<260	<130	<130
	March	<130	<260	<130	<130	<260	<130	<130
	May	<130	<260	<130	<130	<260	<130	<130
	July	<130	<260	<130	<130	<260	<130	<130
	September	<130	<260	<130	<130	<260	<130	<130
	November	<130	<260	<130	<130	<260	<130	<130
Newport News (I)	February	<130	<260	<130	<130	<260	<130	<130
	March	<130	<260	<130	<130	<260	<130	<130
	May	<130	<260	<130	<130	<260	<130	<130
	July	<130	<260	<130	<130	<260	<130	<130
	September	<130	<260	<130	<130	<260	<130	<130
	November	<130	<260	<130	<130	<260	<130	<130

GAMMA EMITTERS IN FISH SAMPLES COLLECTED IN THE VICINITY OF SURRY STATION (I)
(Semi-Annual Collection)

Collection Date	Sample Type	pCi/kg Wet Weight						
		Mn-54	Fe-59	Co-58	Co-60	Zn-65	Cs-134	Cs-137
02/20/81	Catfish	<130	<260	<130	<130	<260	<130	<130
	White perch	<130	<260	<130	<130	<260	<130	<130
08/81	Catfish	<130	<260	<130	<130	<260	<130	<130
	perch	<130	<260	<130	<130	<260	<130	<130

GAMMA EMITTERS IN CRAB SAMPLES COLLECTED IN THE VICINITY OF SURRY STATION (I)
(July, August, September Collection)

Month Collected	pCi/kg Wet Weight						
	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Cs-134	Cs-137
July	<130	<260	<130	<130	<260	<130	<130
August	<130	<260	<130	<130	<260	<130	<130
September	<130	<260	<130	<130	<260	<130	<130

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GAMMA EMITTERS in SILT SAMPLES
(Semiannual Collections)

Collection Period: 03/25-31/81

Collection Site	pCi/kg dry Cs-134	Cs-137	Co-60
(C) Chickahominy	<150	850±160	<150
(I) Station Discharge	<150	810±150	960±220
(I) Hog Island Point	270±70	200±100	100±100
(I) Station Intake	220±50	540±70	710±80
(I) Point of Shoals	<150	890±160	<150
(I) Newport News	<150	<150	<150

Collection Period: 05/05/81

Discharge Canal (state split)	<150	<150	<150

Collection Period: 09/18-22/81

Collection Site	pCi/kg dry Cs-134	Cs-137	Co-60	Zr-95	Nb-95	Co-58	Mn-54
(C) Chickahominy	<150	760±80	<150	<150	<150	<150	<150
(I) Station Discharge	690±80	1750±180	3190±320	550±150	190±50	290±60	140±50
(I) Hog Island Point	280±40	700±80	650±80	<150	<150	<150	<150
(I) Station Intake	210±40	770±80	430±70	390±120	270±50	<150	<150
(I) Point of Shoals	<150	910±90	<150	<150	<150	<150	<150
(I) Newport News	<150	390±50	140±30	<150	<150	<150	<150

Collection Period: 11/12-19/81

Collection Site	pCi/kg dry Cs-134	Cs-137	Co-58	co-60
Upstream Discharge Canal	490±90	1620±160	230±90	<150
Discharge Canal	640±90	1900±190	130±50	<150
Intake Canal (11/12)	240±20	830±80	<150	410±40
Intake Canal (11/19)	250±30	1010±100	<150	340±30

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GAMMA EMITTERS IN SOIL SAMPLES
(Annual Collection)

Samples Collected: 08/04/81

Location	pCi/kg Cs-134	Cs-137
SS	<150	<150
BC	<150	1600±200
ALL	<150	130±20
CP	<150	750±80
DOW	<150	360±40
FE	<150	<150

GAMMA EMITTERS IN FOWL
(Semi-Annual Collections)

Collection Area	Month Collected	Sample Type	pCi/kg Cs-134	Cs-137
HIP	March	Coot	<80	<80
HIP	September	Goose	<80	<80

RADIOACTIVITY IN FOOD CROPS
(Annual Collection)

State Split Samples

Date Collected	Farm	Type	pCi/kg, Wet Weight Cs-134	Cs-137	Sr-89	Sr-90
05/26/81	Poole	kale	<80	<80	<20	310±20
06/29/81	Carters Grove	cabbage	<80	<80	<20	50±10
10/04/81	Slades	Peanuts	<80	<80	<30(a)	60±20
10/04/81	Slades	Corn	<80	<80	<20	<10
10/04/81	Slades	Soybeans	<80	<80	<20	100±20
10/04/81	Brocks	Peanuts	<80	<80	<20	100±10
10/04/81	Brocks	Corn	<80	<80	<20	<10
11/17/81	Brocks	Soybean	<80	<80	<20	130±20

(a) Lower sensitivity due to low chemical yield.

RADIOACTIVITY IN WELL WATER SAMPLES
(Semi-Annual Collections)

	1st Half Coll. 04/14/81 pCi/l			2nd Half Coll. 10/06/81 pCi/l		
	Gross α	Gross β	Tritium*	Gross α	Gross β	Tritium*
(I)Surry Station	<1	6±2	<330	<1	6±2	<330
(I)Hog Island Res.	<1	4±2	<330	<1	4±2	<330
(I)Bacon's Castle	4±1	8±2	<330	2±1	8±2	<330
(C)Jamestown	<1	4±2	260±110	<1	9±2	<330

* Tritium Analyzed by enrichment method.

RADIOACTIVITY IN SURFACE WATER SAMPLES
(Semi-Annual Collections)

	1st Half Coll. 04/14/81 pCi/l			2nd Half Coll. 10/06/81 pCi/l		
	Gross α	Gross β	Tritium*	Gross α	Gross β	Tritium*
(I)Chippokes Creek	<1	4±2	430±300	2±1	7±2	<500
(I)Williamsburg Reserve	1±1	<2	550±310	13±2	21±2	<500
(I)Newport News Reserve	1±1	3±2	480±300	2±1	13±2	<500
(C)Smithfield	<1	7±2	350±300	4±1	8±2	<500

* Tritium Analyzed by direct L. S. Counting.

SECTION 6

QUALITY ASSURANCE DATA

ENVIRONMENTAL QUALITY CONTROL ANALYSES SUMMARY

1981

The tables below summarize results of samples run for process quality control purposes during the subject month. These listings are in addition to such measurements as detector backgrounds, check source values, radiometric-gravimetric comparisons, system calibrations, etc. Detailed listings of each measurement are maintained at the laboratory and are available for inspection if required.

BLANK SAMPLES

Nuclide Analyzed	Number of Determinations	Number of analyses exceeding the LLD for that analysis
Gross beta	46	1*
Gross alpha	47	0
Strontium-89	95	0
Strontium-90	95	0
Tritium	61	1*
Gamma emitter	64	0
Iodine-131	191	0
Calcium-45	3	0

SPLIT SAMPLES

Nuclide Analyzed	Number of Det'ns	No. agreeing within 2σ	No. agreeing within 3σ	No. differing by > 3σ
Gross beta	142	138	4	0
Gross alpha	39	38	1	0
Gamma emitters	126	122	4	0
Iodine-131	146	146	0	0
Strontium-89	38	38	0	0
Strontium-90	44	42	2	0
Tritium	89	89	0	0
Calcium-45	8	8	0	0
Uranium	71	71	0	0

SPIKED SAMPLES

Nuclide Analyzed	No. of Det'ns	Within 2σ of known	Within 3σ of known	differing from known by > 3σ
Gross beta	55	53	1	1*
Gamma emitters	44	43	1	0
Iodine-131	11	11	0	0
Strontium-89	18	18	0	0
Strontium-90	94	93	1	0
Tritium	45	44	1	0

*Corrective actions were taken to eliminate the problem.

EPA INTERCOMPARISON RESULTS

1981

Month/Year	Sample Type	Analysis	Agency Value	Control Limits (3σ,n=3)	MWF Measured ±2σ error*	Units
December 1980	Water	Iodine-131	22	6	17±2	pCi/liter
December 1980	Water	Tritium	2240	604	2600±300	pCi/liter
December 1980	Air Filter	Gross Alpha	21	9.1	21±2	pCi/filter
December 1980	Air Filter	Gross Beta	19	8.7	28±3	pCi/filter
December 1980	Air Filter	Strontium-90	0	0	LT 1	pCi/filter
December 1980	Air Filter	Cesium-137	19	8.7	19±2	pCi/filter
January 1981	Water	Gross Alpha	9	8.7	10±1	pCi/liter
January 1981	Water	Gross Beta	44	8.7	43±4	pCi/liter
January 1981	Water	Strontium-89	16	8.7	LT 5	pCi/liter
January 1981	Water	Strontium-90	34	2.9	35±4	pCi/liter
January 1981	Milk	Strontium-89	0	0	LT 2	pCi/liter
January 1981	Milk	Strontium-90	20.2	2.6	14±1	pCi/liter
January 1981	Milk	Iodine-131	25.8	10.4	29±3	pCi/liter
January 1981	Milk	Cesium-137	43.5	8.7	47±5	pCi/liter
January 1981	Milk	Barium-140	0	0	LT 25	pCi/liter
January 1981	Milk	Potassium	1551	134	1350±140	pCi/liter
February 1981	Water	Tritium	1760	590	1680±170	pCi/liter
February 1981	Water	Chromium-51	0	0	LT 100	pCi/liter
February 1981	Water	Cobalt-60	25	8.7	29±5	pCi/liter
February 1981	Water	Zinc-65	85	8.7	92±9	pCi/liter
February 1981	Water	Ruthenium-106	0	0	LT 100	pCi/liter
February 1981	Water	Cesium-134	36	8.7	29±5	pCi/liter
February 1981	Water	Cesium-137	4	8.7	9±3	pCi/liter
March 1981	Water	Gross Beta	25	8.7	27±3	pCi/liter
March 1981	Water	Gross Alpha	25	10.4	20±2	pCi/liter
March 1981	Air Filter	Gross Alpha	30	13	30±3	pCi/filter
March 1981	Air Filter	Gross Beta	50	8.7	66±7	pCi/filter
March 1981	Air Filter	Strontium-90	18	2.6	17±4	pCi/filter
March 1981	Air Filter	Cesium-137	14	8.7	15±2	pCi/filter
April 1981	Water	Tritium	2710	615	3000±300	pCi/liter
April 1981	Water	Cesium-134	10	8.7	7±2	pCi/liter
April 1981	Water	Cesium-137	15	8.7	13±1	pCi/liter
April 1981	Water	Strontium-89	38	8.7	35±7	pCi/liter
April 1981	Water	Strontium-90	28	2.6	24±3	pCi/liter
April 1981	Water	Radium-226	15.0	4.0	13.2±1.3	pCi/liter
April 1981	Water	Radium-228	12.0	3.1	10±2	pCi/liter
April 1981	Water	Uranium	12	10	6±2	pCi/liter
May 1981	Water	Strontium-89	36	8.7	29±3	pCi/liter
May 1981	Water	Strontium-90	22	2.6	26±3	pCi/liter
May 1981	Water	Strontium-89	25	8.7	30±8	pCi/liter
May 1981	Water	Strontium-90	11	3.6	14±2	pCi/liter
May 1981	Water	Iodine-131	26	10	40±20	pCi/liter
May 1981	Water	Cesium-137	22	8.7	20±5	pCi/liter

*When analyses of a particular type result in concentrations below the detection limits, the term "LT" is used to indicate "Less Than" values for that measurement based on 3σ (99.5%) confidence level.

EPA INTERCOMPARISON RESULTS

1981

Month/Year	Sample Type	Analysis	Agency Value	Control Limits (3σ,n=)	MWF Measured ±2σ error	Units
May 1981	Water	Barium-140	0	0	LT 20	pCi/lite
May 1981	Water	Potassium	1559	135	1400±140	mg/lite
June 1981	Water	Chromium-51	0	0	LT 20	pCi/lite
June 1981	Water	Cobalt-60	17	8.7	16±2	pCi/lite
June 1981	Water	Zinc-65	0	0	LT 20	pCi/lite
June 1981	Water	Ruthenium-106	15	8.7	13±4	pCi/lite
June 1981	Water	Cesium-134	21	8.7	13±2	pCi/lite
June 1981	Water	Cesium-137	31	8.7	25±3	pCi/lite
June 1981	Water	Tritium	1950	596	2300±200	pCi/lite
June 1981	Water	Radium-226	6.7	1.7	5.9±0.4	pCi/lite
June 1981	Water	Radium-228	8.0	2.1	10.6±1.6	pCi/lite
June 1981	Air filter	Gross alpha	28	12	31±6	pCi/filt
June 1981	Air filter	Gross beta	54	8.7	74±8	pCi/filt
June 1981	Air filter	Strontium-90	19	2.6	21±5	pCi/filt
June 1981	Air filter	Cesium-137	16	8.7	15±2	pCi/filt
July 1981	Food	Strontium-89	44	8.7	38±4	pCi/kilo
July 1981	Food	Strontium-90	31	2.8	28±3	pCi/kilo
July 1981	Food	Iodine-131	82	14	75±8	pCi/kilo
July 1981	Food	Cesium-137	45	8.7	40±4	pCi/kilo
July 1981	Food	Barium-140	0	0	<25	pCi/kilo
July 1981	Food	Potassium	2640	229	2267±227	mg/kilog
July 1981	Milk	Strontium-89	25	8.7	13±3	pCi/lite
July 1981	Milk	Strontium-90	17	2.6	16±3	pCi/lite
July 1981	Milk	Iodine-131	0	0	<5	pCi/lite
July 1981	Milk	Cesium-137	31	8.7	35±12	pCi/lite
July 1981	Milk	Barium-140	0	0	<16	pCi/lite
July 1981	Milk	Potassium	1600	139	1463±305	mg/liter
August 1981	Water	Iodine-131	73	13	53±11	pCi/lite
August 1981	Water	Tritium	2630	613	2973±878	pCi/lite
August 1981	Water	Uranium	23	10	14±2	pCi/lite
September 1981	Water	Strontium-89	23	8.7	18±5	pCi/lite
September 1981	Water	Strontium-90	11	2.6	14±2	pCi/lite
September 1981	Urine	Tritium	2050	599	2166±624	pCi/lite
September 1981	Water	Radium-226	8.3	2.2	8.4±0.8	pCi/lite
September 1981	Water	Radium-228	11.7	3.0	4.6±3.7	pCi/lite
September 1981	Water	Gross alpha	33	4	32±14	pCi/lite
September 1981	Water	Gross beta	28	8.7	30±6	pCi/lite
September 1981	Air filter	Gross alpha	25	11	25±6	pCi/filt
September 1981	Air filter	Gross beta	52	8.7	71±7	pCi/filt
September 1981	Air filter	Strontium-90	16	2.6	18±2	pCi/filt
September 1981	Air filter	Cesium-137	19	8.7	20±2	pCi/filt

EPA INTERCOMPARISON RESULTS

1981

Month/Year		Sample Type	Analysis	Agency Value	Control Limits (3σ,n=)	MWF Measured ±2σ error	Units
tober	1981	Water	Gross alpha	80	35	91±26	pCi/liter
tober	1981	Water	Gross beta	96	8.7	112±11	pCi/liter
tober	1981	Water	Cobalt-60	0	0	LT 5	pCi/liter
tober	1981	Water	Strontium-89	21	8.7	13±6	pCi/liter
tober	1981	Water	Strontium-90	14.4	2.6	14.6±2.0	pCi/liter
tober	1981	Water	Cesium-134	12	2.6	14±2	pCi/liter
tober	1981	Water	Cesium-137	15	8.7	20±14	pCi/liter
tober	1981	Water	Radium-226	12.7	3.3	11.8±3.5	pCi/liter
tober	1981	Water	Radium-228	9.2	2.4	8.3±5.1	pCi/liter
tober	1981	Water	Gross Uranium	15	10	9±2	pCi/liter
tober	1981	Milk	Strontium-89	23	8.7	24±8	pCi/liter
tober	1981	Milk	Strontium-90	18	2.6	14±5	pCi/liter
tober	1981	Milk	Iodine-131	52	10	58±11	pCi/liter
tober	1981	Milk	Cesium-137	25	8.7	29±9	pCi/liter
tober	1981	Milk	Barium-140	0	0	LT 16	pCi/liter
tobe	1981	Milk	Potassium	1530	133	1700±240	mg/liter
vember	1981	Food	Strontium-89	38	8.7	41±6	pCi/kilogram
vember	1981	Food	Strontium-90	23	2.6	21±5	pCi/kilogram
vember	1981	Food	Cobalt-60	30	8.7	35±8	pCi/kilogram
vember	1981	Food	Cesium-137	33	8.7	32±8	pCi/kilogram
vember	1981	Food	Barium-140	0	0	LT 31	pCi/kilogram
vember	1981	Food	Potassium	2730	236	2700±270	mg/kilogram
cember	1981	Water	Tritium	2700	615	2950±127	pCi/liter

EPA INTERCOMPARISON RESULTS

(Lab Performance Evaluation Study-EMSL-LV)

Sample Type	Analysis	Agency Value	Control Limits (3σ,n=1)	MWF Measured ±2σ error	Units
Water	Gross alpha	39	10	39±4	pCi/liter
Water	Gross beta	60	5	70±7	pCi/liter
Water	Cobalt-60	12	5	LT20	pCi/liter
Water	Cesium-134	12	5	11±2	pCi/liter
Water	Cesium-137	20	5	20±2	pCi/liter
Water	Ruthenium-106	0	-	LT100	pCi/liter
Water	Zinc-65	0	-	LT20	pCi/liter
Water	Strontium-89	6	5	5±1	pCi/liter
Water	Strontium-90	0	-	LT 1	pCi/liter
Water	Radium-226	12.8	1.8	12.6±1.3	pCi/liter
Water	Uranium	5	6	4±2	pCi/liter

USDOE QUALITY ASSESSMENT PROGRAM

1981

Sample Type	Nuclide	Known	Measured ±2σ error	Units
Air (81-04)	Be-7	0.244 E+04	0.247±0.015 E+04	pCi/filter
Air (81-04)	Mn-54	0.117 E+03	0.093±0.006 E+03	pCi/filter
Air (81-04)	Sr-89	0.450 E+02	0.515±0.087 E+02	pCi/filter
Air (81-04)	Sr-90	0.630 E+01	<0.100 E+02	pCi/filter
Air (81-04)	Zr-95	0.122 E+03	0.828±0.048 E+02	pCi/filter
Air (81-04)	Sb-125	0.139 E+04	0.133±0.006 E+04	pCi/filter
Air (81-04)	Cs-134	0.190 E+04	0.133±0.007 E+04	pCi/filter
Air (81-04)	U	0.223 E+01	0.750±0.053 E+01	pCi/filter
Soil (81-04)	K-40	0.213 E+02	0.290±0.017 E+02	pCi/g
Soil (81-04)	Cs-137	0.200 E+00	0.250±0.070 E+00	pCi/g
Soil (81-04)	Ra-226	0.770 E+00	0.668±0.057 E+00	pCi/g
Tissue (81-04)	K-40	0.158 E+01	0.433±0.058 E+01	pCi/g
Tissue (81-04)	Sr-90	0.240 E+01	0.188±0.016 E+01	pCi/g
Tissue (81-04)	Ra-226	0.450 E+00	0.433±0.058 E+00	pCi/g
Tissue (81-04)	U	0.290 E-01	0.850±0.333 E-01	pCi/g
Vegetation (81-04)	K-40	0.224 E+03	0.277±0.018 E+03	pCi/g
Vegetation (81-04)	Sr-90	0.560 E+01	0.258±0.016 E+01	pCi/g
Vegetation (81-04)	Cs-137	0.230 E+00	0.200±0.058 E+00	pCi/g
Vegetation (81-04)	U	0.310 E+00	0.133±0.058 E+00	pCi/g
Water (81-04)	H-3	0.246 E+02	0.197±0.012 E+02	pCi/ml
Water (81-04)	Co-57	0.118 E+01	0.243±0.018 E+01	pCi/ml
Water (81-04)	Co-60	0.129 E+01	0.133±0.006 E+01	pCi/ml
Water (81-04)	Sr-90	0.440 E-01	0.405±0.063 E-01	pCi/ml
Water (81-04)	Cs-137	0.137 E+01	0.150±0.012 E+01	pCi/ml
Water (81-04)	Ce-141	0.527 E+01	0.193±0.012 E+01	pCi/ml
Water (81-04)	U	0.145 E-01	0.200±0.026 E-01	µg/ml
Water (81-04)	U	0.102 E-01	0.750±0.140 E-02	pCi/ml

1981

TLD Intercomparison Badges
Irradiated by Battelle Northwest Labs

	Total mR less transportation control							
	1st Qtr		2nd Qtr		3rd Qtr		4th Qtr	
Badge	Known	Measured	Known	Measured	Known	Measured	Known	Measured
A	18.0	18.5±4.1	18.0	17.8±5.0	20.0	25.5±4.8	90.0	86.2±15.5
B	26.0	29.1±2.9	24.0	24.5±5.5	28.0	31.4±2.5	51.0	53.6±5.3
C	35.0	29.1±6.1	38.0	34.1±9.0	16.0	17.9±2.7	100.0	93.4±10.1
D	47.0	46.8±5.4	44.0	43.2±6.0	32.0	36.5±3.5	42.0	41.9±19.7
E	57.0	42.1±6.0	59.0	61.4±6.5	40.0	41.2±4.0	18.0	20.1±3.4
F	69.0	77.6±12.5	69.0	71.2±19.0	53.0	55.4±15.2	29.0	32.0±3.0
G	76.0	65.6±6.6	73.0	74.1±21.6	69.0	75.1±13.2	34.0	32.0±3.0
H	88.0	88.6±12.6	79.0	80.8±17.3	82.0	80.4±10.7	82.0	79.0±8.0
J	100.0	102±10	79.0	79.9±18.2	93.0	86.1±15.5	34.0	38.7±9.3
K	100.0	99±10	99.0	100.2±25.4	100.0	100.4±15.3	74.0	69.2±8.8