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Agency

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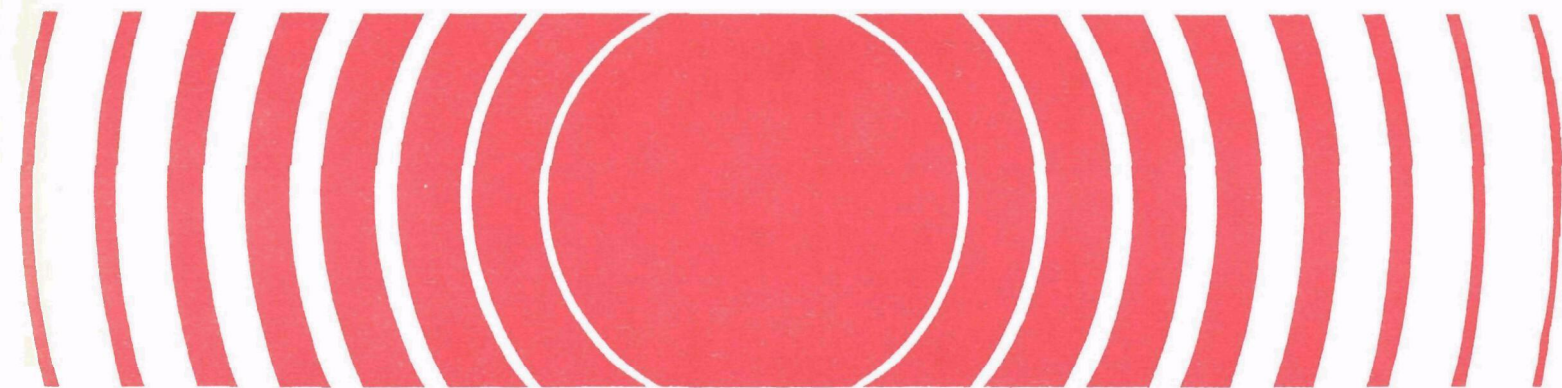
Radiation

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# Environmental Radiation Data Report 36

October - December 1983



E N V I R O N M E N T A L

R A D I A T I O N

D A T A

REPORT 36

October - December 1983

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Office of Radiation Programs

## Preface

Environmental Radiation Data (ERD) is compiled and distributed quarterly by the Office of Radiation Programs' Eastern Environmental Radiation Facility (EERF), Montgomery, Alabama. Data from the Environmental Radiation Ambient Monitoring System (ERAMS) and similar networks operated by contributing States, Canada, Mexico, and the Pan American Health Organization are reported in the ERD when available.

ERAMS was established in 1973 by the U. S. Environmental Protection Agency's Office of Radiation Programs (ORP). The ERAMS is comprised of nationwide sampling stations that provide air, surface and drinking water, and milk samples from which environmental radiation levels are derived. The major emphasis for ERAMS is toward identifying trends in the accumulation of long-lived radionuclides in the environment.

Sampling locations are selected to provide optimal population coverage while functioning to monitor fallout from nuclear devices and other forms of radioactive contamination of the environment. The radiation analyses performed on these samples include gross alpha and gross beta levels, gamma analyses for fission products, and specific analyses for uranium, plutonium, strontium, iodine, radium, krypton, and tritium. This monitoring effort also provides ancillary information on natural background levels and on releases into the environment from stationary sources such as nuclear power reactors, fuel fabrication facilities, and reprocessing plants.

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D A T A

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## DATA ~ Reporting Rationale and Procedures

The intent of EPA's Office of Radiation Programs in establishing the Environmental Radiation Ambient Monitoring System was to provide continuous, accurate and usable environmental radiation data for the public. Therefore, new data reporting procedures were developed to allow better interpretation of the data. The most significant change in this reporting procedure is that all specific radionuclide analyses will be reported as the counting results indicate, whether the number is negative, zero, or positive.

### Reporting Rationale

Frequently, concentrations of a radionuclide in environmental media are close to zero. When the actual concentration of a nuclide is zero, the net counting results should statistically show a distribution of negative and positive numbers about zero. This occurs when the background count is subtracted from a sample which has only background activity. Prior to July 1975, ERAMS data were not reported numerically when the results were less than a specified reporting level or minimum detectable level. The present reporting procedure allows all the data to be reported and evaluated statistically without an arbitrary cutoff of small or negative numbers. This approach will facilitate estimates of bias in the nuclide analyses and will allow better evaluation of distributions and trends in environmental data.

When reviewing the data in this report, caution should be exercised in the interpretation of individual negative values. Obviously, a negative activity value does not have physical significance. Such numbers, however, are significant when taken together with other observations which indicate that the true value of a distribution is near zero. When an average of several measurements produces a result less than zero, this indicates a negative bias in the measurement procedure.

#### (1) Reported Values

Specific Analyses ~ All specific radionuclide analyses will be reported as the counting results indicate, whether the number is negative, zero, or positive. Numerical values given are as of sample collection date.

Gross Analyses ~ The actual value of gross radioactivity measurements will be reported, unless the value is below the minimum detectable level (MDL) at the 2 sigma confidence level, then < minimum detectable level will be reported.

MDL is defined as the 3 sigma error of the background. A tabulation of MDL's is given in the following table.

(2) Reported Error Terms

Each reported value for specific analyses will be accompanied by a counting error term at the 2 sigma (95%) confidence interval. Potassium concentrations are determined by specific activity analyses. Error terms are therefore reported as counting errors. At the very low levels characteristic of most ERAMS measurements, counting error is the greatest contributor to overall error.

(3) Significant Figures

All reported values will be rounded to no more than three significant figures. The last significant figure will be increased by one if the figure following is five or greater, otherwise it is left unchanged.

(4) Reporting Levels

The reporting units, smallest increments for reporting, and minimum detectable levels for each isotope are shown in table 1. Smallest increments are sometimes considerably smaller than minimum detectable amounts to avoid truncation errors in averaging.

(5) Averages

Averages will be calculated along with appropriate error terms in an annual summary and analysis of ERAMS data. In calculating these averages, all values of individual data including negative numbers will be utilized. Averages will not be included in ERD quarterly reports.

TABLE 1

## ERAMS Reporting Increments and Minimum Detectable Levels

## for Radionuclide Analyses

<u>Radionuclide</u>	<u>Media</u>	<u>Reporting Units</u>	<u>Reporting Increments</u>	<u>Minimum Detectable Levels</u>
Gross alpha	Water	pCi/l	1 pCi/l	2 pCi/l
Gross beta	Air	pCi/m <sup>3</sup>	.01 pCi/m <sup>3</sup>	.01 pCi/m <sup>3</sup>
	Water	pCi/l	1 pCi/l	1 pCi/l
	Precipitation	nCi/m <sup>2</sup>	.01 nCi/m <sup>2</sup>	.01 nCi/m <sup>2</sup> (a)
Tritium	Water	nCi/l	.1 nCi/l	.2 nCi/l
	Milk	nCi/l	.1 nCi/l	.2 nCi/l
Carbon-14	Milk	pCi/l	1 pCi/l	15 pCi/l
Krypton-85	Ambient Air	pCi/m <sup>3</sup>	.1 pCi/m <sup>3</sup>	2 pCi/m <sup>3</sup>
Plutonium-238, 239	Air	aCi/m <sup>3</sup>	.1 aCi/m <sup>3</sup>	.015 pCi(b) per sample
	Milk	pCi/l	.001 pCi/l	.015 pCi per sample
	Water	pCi/l	.001 pCi/l	.015 pCi per sample
Uranium-234, 235,238	Air	aCi/m <sup>3</sup>	.1 aCi/m <sup>3</sup>	.015 pCi(b) per sample
	Milk	pCi/l	.001 pCi/l	.015 pCi per sample
	Water	pCi/l	.001 pCi/l	.015 pCi per sample
Radium-226	Water	pCi/l	.1 pCi/l	.1 pCi/l
Strontium-90	Milk	pCi/l	.1 pCi/l	1 pCi/l
	Water	pCi/l	.1 pCi/l	1 pCi/l



<u>Radionuclide</u>	<u>Media</u>	<u>Reporting Units</u>	<u>Reporting Increments</u>	<u>Minimum Detectable Levels</u>
Strontium-89	Milk	pCi/l	1 pCi/l	5 pCi/l(c)
Iodine-131	Milk	pCi/l	1 pCi/l	10 pCi/l(c)
	Water	pCi/l	1 pCi/l	10 pCi/l(c)
	Water (specific radiochemical analysis)	pCi/l	.1 pCi/l	.4 pCi/l
Iodine-129	Milk	fCi/l	.1 fCi/l	.4 fCi/l
Iodine-127	Milk	g/l	10 g/l	10 g/l
Cesium-137	Milk	pCi/l	1 pCi/l	10 pCi/l
	Water	pCi/l	1 pCi/l	10 pCi/l
Barium-140	Milk	pCi/l	1 pCi/l	10 pCi/l(c)
	Water	pCi/l	1 pCi/l	10 pCi/l(c)
Potassium	Milk	g/l	.1 g/l	.12 g/l
	Water	g/l	.1 g/l	.12 g/l
Potassium-40	Water	pCi/l	1 pCi/l	100 pCi/l

- (a) The value in terms of nCi/m<sup>2</sup> would be dependent on precipitation (mm).  
(b) This value in terms of pCi/m<sup>3</sup> would be dependent on the air volume.  
(c) Activity as of the day of counting.

ENVIRONMENTAL RADIATION  
AMBIENT MONITORING SYSTEM (ERAMS)

SECTION I. Air Program

Airborne Particulates and Precipitation

Gross beta radioactivity measurements and certain specific analyses are performed on air particulates and precipitation samples as indicator measurements in assessing the general (national) impact of all contributing sources on environmental levels of radiation.

Airborne particulates are collected continuously at field stations representing wide geographic coverage, including present and potential sources of environmental radioactivity. Sampling sites are located throughout the United States, Virgin Islands, and the Panama Canal.

Filters ( 10-cm diameter synthetic fiber ) from air samplers are changed twice weekly and field measurements are made with a G-M survey meter at 5 hours and 29 hours after collection to allow for radon and thoron daughter product decay. Field estimates are reported to appropriate EPA officials by telephone or mail depending on the activity levels found.

The filters are sent to EERF for more sensitive analyses in a low background beta counter. Gamma scans are performed on all filters showing laboratory gross beta counts greater than 1 pCi/m<sup>3</sup>. The lower gross beta values reported for laboratory measurements are largely due to the decay of radionuclides which occurred between the times of the field estimates and laboratory measurements.

Precipitation samples are collected at the field stations where air filters are collected. These samples are also sent to EERF where they are composited monthly for tritium, gross beta activity measurements and gamma scans.

These locations also correspond to airborne particulate and drinking water sampling locations selected for plutonium analyses. Plutonium-238, -239, and uranium-234, -235, and -238 analyses are performed annually on precipitation samples collected during March ~ May.

Tables 2 ~ 4 present the monthly average gross beta concentrations in airborne particulates for October ~ December 1983.

Tables 5 ~ 7 present the monthly average gross beta concentration in precipitation October ~ December 1983.

The tritium in precipitation samples for October ~ December 1983 at the selected stations are shown in Table 8.

A compilation of individual measurements is available from the EPA, EERF, Montgomery, AL 36193.

TABLE 2

AIRBORNE PARTICULATES  
GROSS BETA CONCENTRATION  
OCTOBER 1983

LOCATION	# SAM	5-HR FIELD ESTIMATE			EERF LAB MEASUREMENT		
		MAX	MIN	AVG	MAX	MIN	AVG
		(pCi/m <sup>3</sup> )			(pCi/m <sup>3</sup> )		
AL:MONTGOMERY	16	2.2	0.2	0.9	0.02	0.01	0.01
CA:BERKELEY	8	0.1	0.1	0.1	0.03	0.01	0.01
CA:LOS ANGELES	8	1.0	0.4	0.6	0.02	0.01	0.02
CT:HARTFORD	9	0.3	0.1	0.1	0.01	0.00	0.00
DE:WILMINGTON	8	0.9	0.0	0.3	0.02	0.00	0.01
FL:JACKSONVILLE	9	0.1	0.0	0.1	0.01	0.00	0.01
FL:MIAMI	8	0.0	0.0	0.0	0.01	0.00	0.00
HI:HONOLULU	9	0.3	0.0	0.1	0.01	0.00	0.01
IA:IOWA CITY	8	0.7	0.1	0.3	0.03	0.01	0.01
ID:BOISE	7	1.6	0.6	0.9	0.03	0.01	0.02
ID:IDAHO FALLS	8	0.0	0.0	0.0	0.03	0.01	0.01
IL:CHICAGO	7	0.5	0.1	0.3	0.03	0.01	0.01
IN:INDIANAPOLIS	7	0.9	0.1	0.5	0.01	0.01	0.01
ME:AUGUSTA	9	0.3	0.2	0.2	0.01	0.00	0.01
MI:LANSING	10	0.4	0.1	0.2	0.02	0.00	0.01
MO:JEFFERSON CITY	8	1.1	0.2	0.6	0.04	0.01	0.02
MS:JACKSON	5	1.3	0.4	0.8	0.03	0.01	0.02
ND:BISMARCK	8	1.0	0.1	0.5	0.03	0.01	0.02
NH:CONCORD	8	0.6	0.0	0.2	0.01	0.00	0.00
NJ:TRENTON	7	0.6	0.0	0.3	0.02	0.00	0.01
NV:LAS VEGAS	8	1.0	0.1	0.6	0.03	0.01	0.01
NY:ALBANY	8	0.2	0.1	0.2	0.03	0.01	0.01
NY:NIAGARA FALLS	8	0.2	0.0	0.1	0.01	0.00	0.01
NY:SYRACUSE	4	0.3	0.0	0.2	0.01	0.01	0.01
OH:COLUMBUS	8	0.4	0.1	0.2	0.02	0.00	0.01
OH:PAINESVILLE	8	0.3	0.0	0.1	0.02	0.00	0.01
OH:TOLEDO	8	0.4	0.1	0.2	0.09	0.01	0.02
OK:OKLAHOMA CITY	2	0.3	0.1	0.2	0.01	0.00	0.00
OR:PORTLAND	8	0.0	0.0	0.0	0.01	0.00	0.01
PA:HARRISBURG	9	0.9	0.1	0.4	0.03	0.01	0.01
PA:PITTSBURGH	9	0.1	0.1	0.1	0.02	0.00	0.01
RI:PROVIDENCE	5	0.4	0.1	0.2	0.02	0.00	0.01
SC:BARNWELL	2	0.0	0.0	0.0	0.01	0.00	0.00
SC:COLUMBIA	8	1.6	0.2	0.8	0.05	0.01	0.02
SD:PIERRE	9	0.4	0.1	0.2	0.08	0.01	0.02
TN:KNOXVILLE	7	1.6	0.2	0.9	0.05	0.01	0.02
TN:NASHVILLE	8	1.4	1.4	1.4	0.05	0.01	0.02
TX:AUSTIN	9	1.9	0.6	1.4	0.08	0.01	0.03

TABLE 2 (CONTINUED)

AIRBORNE PARTICULATES  
GROSS BETA CONCENTRATION  
OCTOBER 1983

LOCATION	# SAM	5-HR FIELD ESTIMATE			EERF LAB MEASUREMENT		
		MAX	MIN	AVG	MAX	MIN	AVG
		(pCi/m <sup>3</sup> )			(pCi/m <sup>3</sup> )		
TX:EL PASO	3	1.2	0.2	0.7	0.02	0.01	0.02
UT:SALT LAKE CITY	7	0.2	0.0	0.1	0.01	0.00	0.01
VA:LYNCHBURG	8	1.6	0.1	0.3	0.01	0.00	0.01
VA:VIRGINIA BEACH	5	0.2	0.0	0.1	0.01	0.00	0.01
WA:SEATTLE	9	0.1	0.0	0.0	0.01	0.00	0.01
WA:SPOKANE	9	0.7	0.3	0.5	0.02	0.01	0.01
WI:MADISON	8	0.5	0.1	0.3	0.03	0.00	0.01
WV:CHARLESTON	6	0.4	0.0	0.2	0.02	0.00	0.01

MINIMUM DETECTABLE LIMIT FOR FIELD ESTIMATES ~ .1 pCi/m<sup>3</sup>  
 MINIMUM DETECTABLE LIMIT FOR LAB MEASUREMENT ~ .01 pCi/m<sup>3</sup>

TABLE 3

AIRBORNE PARTICULATES  
GROSS BETA CONCENTRATION  
NOVEMBER 1983

LOCATION	# SAM	5-HR FIELD ESTIMATE			EERF LAB MEASUREMENT		
		MAX	MIN	AVG	MAX	MIN	AVG
		(pCi/m <sup>3</sup> )			(pCi/m <sup>3</sup> )		
AL:MONTGOMERY	18	2.2	0.1	0.6	0.02	0.01	0.01
CA:BERKELEY	9	0.3	0.0	0.1	0.01	0.00	0.00
CA:LOS ANGELES	9	2.2	0.2	0.8	0.03	0.01	0.02
CT:HARTFORD	8	0.6	0.1	0.2	0.01	0.00	0.01
DE:WILMINGTON	9	0.6	0.0	0.2	0.01	0.00	0.01
FL:JACKSONVILLE	6	0.2	0.0	0.1	0.01	0.00	0.01
FL:MIAMI	6	0.1	0.0	0.1	0.01	0.00	0.01
HI:HONOLULU	8	0.3	0.1	0.1	0.01	0.00	0.00
IA:IOWA CITY	7	0.4	0.0	0.2	0.01	0.01	0.01
ID:BOISE	8	0.4	0.1	0.3	0.03	0.00	0.01
ID:IDAHO FALLS	8	0.0	0.0	0.0	0.01	0.00	0.01
IL:CHICAGO	7	0.9	0.2	0.4	0.03	0.01	0.02
ME:AUGUSTA	8	0.3	0.0	0.1	0.01	0.00	0.01
MI:LANSING	5	0.3	0.1	0.2	0.02	0.00	0.01
MN:MINNEAPOLIS	2	0.2	0.1	0.2	0.01	0.01	0.01
MO:JEFFERSON CITY	8	0.8	0.1	0.3	0.06	0.01	0.02
MS:JACKSON	7	0.8	0.0	0.4	0.02	0.01	0.02
ND:BISMARCK	9	0.7	0.0	0.4	0.05	0.01	0.02
NH:CONCORD	8	0.3	0.0	0.1	0.01	0.00	0.01
NV:LAS VEGAS	5	0.9	0.2	0.5	0.02	0.01	0.01
NY:ALBANY	8	0.5	0.0	0.2	0.01	0.01	0.01
NY:NIAGARA FALLS	8	0.4	0.1	0.3	0.02	0.00	0.01
NY:SYRACUSE	5	0.1	0.0	0.0	0.01	0.01	0.01
OH:COLUMBUS	7	0.4	0.1	0.2	0.02	0.01	0.01
OH:PAINESVILLE	9	0.2	0.1	0.1	0.02	0.01	0.01
OH:TOLEDO	8	0.4	0.0	0.1	0.02	0.01	0.01
OR:PORTLAND	9	0.0	0.0	0.0	0.01	0.00	0.00
PA:HARRISBURG	8	0.8	0.1	0.3	0.02	0.01	0.02
PA:PITTSBURGH	2	0.0	0.0	0.0	0.02	0.01	0.01
RI:PROVIDENCE	6	0.5	0.0	0.2	0.01	0.01	0.01
SC:BARNWELL	2	0.2	0.0	0.1	0.01	0.01	0.01
SC:COLUMBIA	9	2.0	0.1	0.7	0.04	0.01	0.02
SD:PIERRE	8	0.6	0.0	0.2	0.03	0.01	0.01
TN:KNOXVILLE	8	2.2	0.0	0.9	0.07	0.01	0.02
TN:NASHVILLE	8	2.3	2.3	2.3	0.02	0.01	0.01
TX:AUSTIN	5	1.7	0.6	1.0	0.01	0.01	0.01
TX:EL PASO	6	0.9	0.4	0.6	0.02	0.01	0.01
VA:LYNCHBURG	8	0.7	0.0	0.3	0.01	0.00	0.01

TABLE 3 (CONTINUED)

AIRBORNE PARTICULATES  
GROSS BETA CONCENTRATION  
NOVEMBER 1983

LOCATION	# SAM	5-HR FIELD ESTIMATE			EERF LAB MEASUREMENT		
		MAX	MIN	AVG	MAX	MIN	AVG
		(pCi/m <sup>3</sup> )			(pCi/m <sup>3</sup> )		
VA: VIRGINIA BEACH	9	0.1	0.0	0.1	0.01	0.00	0.01
WA: SEATTLE	7	0.1	0.0	0.0	0.00	0.00	0.00
WA: SPOKANE	7	0.1	0.1	0.1	0.01	0.00	0.00
WI: MADISON	8	0.6	0.1	0.3	0.01	0.01	0.01
WV: CHARLESTON	6	0.4	0.0	0.2	0.03	0.01	0.01

MINIMUM DETECTABLE LIMIT FOR FIELD ESTIMATES ~ .1 pCi/m<sup>3</sup>  
 MINIMUM DETECTABLE LIMIT FOR LAB MEASUREMENT ~ .01 pCi/m<sup>3</sup>

TABLE 4  
 AIRBORNE PARTICULATES  
 GROSS BETA CONCENTRATION  
 DECEMBER 1983

LOCATION	# SAM	5-HR FIELD ESTIMATE			EERF LAB MEASUREMENT		
		MAX	MIN	AVG	MAX	MIN	AVG
		(pCi/m <sup>3</sup> )			(pCi/m <sup>3</sup> )		
AL:MONTGOMERY	10	1.2	0.1	0.4	0.03	0.01	0.02
CA:BERKELEY	9	0.1	0.0	0.0	0.01	0.00	0.00
CA:LOS ANGELES	9	0.7	0.0	0.5	0.02	0.01	0.01
CT:HARTFORD	9	0.1	0.0	0.1	0.01	0.00	0.01
DE:WILMINGTON	9	2.5	0.0	0.4	0.02	0.01	0.01
FL:JACKSONVILLE	8	0.2	0.0	0.1	0.01	0.00	0.01
FL:MIAMI	9	0.1	0.0	0.0	0.01	0.00	0.00
HI:HONOLULU	9	0.3	0.0	0.2	0.01	0.00	0.00
IA:IOWA CITY	9	0.3	0.0	0.1	0.03	0.01	0.02
ID:BOISE	9	0.3	0.0	0.1	0.06	0.00	0.03
ID:IDAHO FALLS	9	0.0	0.0	0.0	0.03	0.01	0.02
IL:CHICAGO	8	0.1	0.0	0.1	0.03	0.01	0.02
ME:AUGUSTA	9	0.1	0.0	0.1	0.02	0.00	0.01
MN:MINNEAPOLIS	9	0.1	0.0	0.1	0.03	0.01	0.02
MO:JEFFERSON CITY	9	0.2	0.0	0.1	0.03	0.02	0.02
MS:JACKSON	9	0.4	0.0	0.2	0.03	0.01	0.02
ND:BISMARCK	9	0.4	0.0	0.2	0.03	0.01	0.02
NH:CONCORD	9	0.1	0.0	0.0	0.01	0.00	0.01
NV:LAS VEGAS	13	4.3	0.1	0.6	0.02	0.01	0.01
NY:ALBANY	4	0.0	0.0	0.0	0.01	0.01	0.01
NY:NEW YORK CITY	8	0.1	0.1	0.1	0.02	0.01	0.01
NY:NIAGARA FALLS	9	0.2	0.0	0.1	0.01	0.00	0.01
NY:SYRACUSE	8	0.1	0.0	0.0	0.01	0.00	0.01
OH:COLUMBUS	8	0.2	0.1	0.1	0.02	0.01	0.02
OH:PAINESVILLE	9	0.1	0.0	0.1	0.02	0.01	0.01
OH:TOLEDO	8	0.1	0.0	0.1	0.02	0.01	0.01
OR:PORTLAND	9	0.0	0.0	0.0	0.02	0.00	0.01
PA:HARRISBURG	9	0.1	0.0	0.1	0.02	0.00	0.01
RI:PROVIDENCE	5	0.1	0.0	0.1	0.01	0.00	0.01
SC:BARNWELL	3	0.0	0.0	0.0	0.01	0.01	0.01
SC:COLUMBIA	9	1.2	0.0	0.3	0.02	0.00	0.01
SD:PIERRE	9	0.1	0.0	0.0	0.03	0.01	0.02
TN:KNOXVILLE	8	1.9	0.1	0.5	0.03	0.01	0.02
TN:NASHVILLE	4	0.0	0.0	0.0	0.02	0.01	0.01
TX:EL PASO	8	1.6	0.2	0.6	0.02	0.01	0.01
UT:SALT LAKE CITY	3	0.1	0.0	0.0	0.02	0.00	0.01
VA:LYNCHBURG	7	0.4	0.0	0.2	0.02	0.01	0.01
VA:VIRGINIA BEACH	6	0.1	0.1	0.1	0.01	0.01	0.01



TABLE 4 (CONTINUED)

AIRBORNE PARTICULATES  
GROSS BETA CONCENTRATION  
DECEMBER 1983

LOCATION	# SAM	5-HR FIELD ESTIMATE			EERF LAB MEASUREMENT		
		MAX	MIN	AVG	MAX	MIN	AVG
		(pCi/m <sup>3</sup> )			(pCi/m <sup>3</sup> )		
/ WA:SEATTLE	7	0.0	0.0	0.0	0.01	0.00	0.00
WA:SPOKANE	9	0.1	0.0	0.1	0.02	0.00	0.01
WI:MADISON	9	0.1	0.0	0.0	0.03	0.00	0.01
WV:CHARLESTON	2	0.1	0.1	0.1	0.01	0.01	0.01

MINIMUM DETECTABLE LIMIT FOR FIELD ESTIMATES ~ .1 pCi/m<sup>3</sup>  
 MINIMUM DETECTABLE LIMIT FOR LAB MEASUREMENT ~ .01 pCi/m<sup>3</sup>

TABLE 5  
GROSS BETA CONCENTRATION IN PRECIPITATION

OCTOBER 1983

LOCATION	DEPTH	ACT. + 2s		SPECIFIC GAMMA ACT.
	(mm)	(nCi/m <sup>2</sup> )		(pCi/l)
AL:MONTGOMERY	87.5	0.14	0.04	ND
CA:BERKELEY	9.5	0.01	0.00	ND
CT:HARTFORD	128.3	0.21	0.07	ND
FL:JACKSONVILLE	109.6	0.12	0.05	ND
FL:MIAMI	83.8	0.07	0.04	ND
! ID:BOISE	51.0	0.04	0.02	ND
! ID:IDAHO FALLS	29.8	0.01	0.01	ND
IL:CHICAGO	59.9	0.05	0.03	ND
MI:LANSING	66.5	0.03	0.03	ND
MN:MINNEAPOLIS	62.5	0.05	0.03	ND
MO:JEFFERSON CITY	136.3	0.14	0.06	ND
MS:JACKSON	57.0	0.03	0.02	ND
ND:BISMARCK	37.8	0.02	0.02	ND
NJ:TRENTON	65.7	0.34	0.05	ND
NV:LAS VEGAS	11.3	0.02	0.01	ND
NY:NEW YORK CITY	51.3	0.11	0.03	ND
NY:NIAGARA FALLS	160.9	0.13	0.07	ND
OH:COLUMBUS	168.1	0.14	0.07	ND
OH:PAINESVILLE	117.3	0.19	0.06	ND
OH:TOLEDO	198.8	0.19	0.09	ND
! OR:PORTLAND	38.0	0.03	0.02	ND
PA:HARRISBURG	104.8	0.09	0.05	ND
PA:PITTSBURGH	59.0	0.07	0.03	ND
RI:PROVIDENCE	20.0	0.03	0.01	ND
SC:BARNWELL	10.0	0.01	0.00	ND
SC:COLUMBIA	80.0	0.36	0.06	ND
SD:PIERRE	33.8	0.02	0.01	ND
TX:AUSTIN	23.8	0.03	0.01	ND
TX:EL PASO	28.8	0.02	0.01	ND
VA:LYNCHBURG	19.7	0.31	0.03	ND
VA:VIRGINIA BEACH	240.0	0.25	0.11	ND
WI:MADISON	108.8	0.15	0.05	ND

ND NO GAMMA ACTIVITY DETECTABLE  
s SIGMA COUNTING ERROR

TABLE 6

## GROSS BETA CONCENTRATION IN PRECIPITATION

NOVEMBER 1983

LOCATION	DEPTH (mm)	ACT. $\pm$ 2s (nCi/m <sup>2</sup> )		SPECIFIC GAMMA ACT. (pCi/l)
AL:MONTGOMERY	102.5	0.17	0.05	ND
CA:BERKELEY	150.8	0.12	0.07	ND
CO:DENVER	18.0	0.07	0.01	ND
CT:HARTFORD	55.0	0.05	0.03	ND
FL:JACKSONVILLE	100.9	0.16	0.05	ND
FL:MIAMI	85.0	0.07	0.04	ND
ID:BOISE	82.5	0.08	0.04	ND
ID:IDAHO FALLS	10.0	0.04	0.01	ND
IL:CHICAGO	80.4	0.03	0.03	ND
MI:LANSING	110.4	0.09	0.05	ND
MN:MINNEAPOLIS	67.8	0.22	0.04	ND
MO:JEFFERSON CITY	116.3	0.10	0.05	ND
MS:JACKSON	167.3	0.19	0.08	ND
ND:BISMARCK	20.1	0.03	0.01	ND
NV:LAS VEGAS	6.8	0.02	0.00	ND
NY:NEW YORK CITY	54.3	0.04	0.02	ND
NY:NIAGARA FALLS	146.3	0.14	0.07	ND
OH:COLUMBUS	147.8	0.11	0.06	ND
OH:PAINESVILLE	196.3	0.32	0.10	ND
OH:TOLEDO	287.5	0.19	0.12	ND
OR:PORTLAND	211.8	0.29	0.10	ND
PA:HARRISBURG	235.0	0.30	0.13	ND
PA:PITTSBURGH	24.5	0.04	0.01	ND
RI:PROVIDENCE	135.0	0.25	0.07	ND
SC:BARNWELL	30.0	0.02	0.01	ND
SC:COLUMBIA	126.3	0.31	0.07	ND
SD:PIERRE	22.5	0.03	0.01	ND
TN:KNOXVILLE	82.0	0.03	0.03	ND
TN:NASHVILLE	89.8	0.12	0.05	ND
TX:AUSTIN	20.0	0.02	0.01	ND
TX:EL PASO	41.3	0.03	0.02	ND
VA:LYNCHBURG	118.1	0.43	0.08	ND
VA:VIRGINIA BEACH	105.0	0.11	0.05	ND
WI:MADISON	33.8	0.05	0.02	ND
WV:CHARLESTON	69.1	0.14	0.04	ND

ND NO GAMMA ACTIVITY DETECTABLE  
s SIGMA COUNTING ERROR

TABLE 7

## GROSS BETA CONCENTRATION IN PRECIPITATION

DECEMBER 1983

LOCATION	DEPTH (mm)	ACT. + 2s (nCi/m <sup>2</sup> )		SPECIFIC GAMMA ACT. (pCi/l)
AL: MONTGOMERY	127.5	0.08	0.05	ND
CA: BERKELEY	64.6	0.07	0.03	ND
CT: HARTFORD	157.5	0.22	0.08	ND
FL: MIAMI	93.7	0.07	0.04	ND
ID: BOISE	114.8	0.11	0.05	ND
ID: IDAHO FALLS	132.8	0.24	0.09	ND
IL: CHICAGO	37.2	0.06	0.02	ND
MI: LANSING	56.2	0.36	0.05	ND
MN: MINNEAPOLIS	14.9	0.12	0.01	ND
MS: JACKSON	60.0	0.04	0.03	ND
ND: BISMARCK	23.8	0.17	0.02	ND
NV: LAS VEGAS	15.0	0.03	0.01	ND
NY: ALBANY	30.0	0.04	0.02	ND
NY: NEW YORK CITY	50.0	0.08	0.03	ND
NY: NIAGARA FALLS	88.4	0.09	0.04	ND
OH: COLUMBUS	70.8	0.05	0.03	ND
OH: PAINESVILLE	78.8	0.33	0.06	ND
OH: TOLEDO	117.5	0.26	0.07	ND
OR: PORTLAND	86.8	0.09	0.04	ND
PA: HARRISBURG	125.0	0.10	0.06	ND
RI: PROVIDENCE	310.0	0.50	0.17	ND
SC: BARNWELL	132.5	0.11	0.06	ND
SC: COLUMBIA	205.0	0.13	0.08	ND
SD: PIERRE	15.0	0.04	0.01	ND
TN: KNOXVILLE	65.0	0.01	0.03	ND
TN: NASHVILLE	128.8	0.09	0.06	ND
TX: AUSTIN	10.0	0.01	0.00	ND
VA: LYNCHBURG	118.1	0.39	0.08	ND
VA: VIRGINIA BEACH	162.5	0.33	0.10	ND
WI: MADISON	88.5	0.35	0.06	ND
WV: CHARLESTON	60.0	0.06	0.03	ND

ND NO GAMMA ACTIVITY DETECTABLE  
s SIGMA COUNTING ERROR

TABLE 8

PRECIPITATION  
TRITIUM CONCENTRATION

OCTOBER ~ DECEMBER 1983

LOCATION	OCTOBER	NOVEMBER	DECEMBER
	nCi/1 $\pm$ 2s	nCi/1 $\pm$ 2s	nCi/1 $\pm$ 2s
AL:MONTGOMERY	0.3 0.2	0.1 0.2	0.1 0.2
CA:BERKELEY	0.3 0.2	0.1 0.2	0.3 0.2
CO:DENVER	NS	0.1 0.2	NS
CT:HARTFORD	0.2 0.2	0.5 0.2	0.2 0.2
FL:JACKSONVILLE	0.1 0.2	0.2 0.2	NS
FL:MIAMI	0.2 0.2	0.3 0.2	0.1 0.2
ID:BOISE	0.2 0.2	0.1 0.2	0.2 0.2
ID:IDAHO FALLS	0.2 0.2	0.2 0.2	0.2 0.2
IL:CHICAGO	0.4 0.2	0.2 0.2	0.1 0.2
MI:LANSING	0.3 0.2	0.2 0.2	0.1 0.2
MN:MINNEAPOLIS	0.2 0.2	0.1 0.2	0.4 0.2
MO:JEFFERSON CITY	0.3 0.2	0.2 0.2	NS
MS:JACKSON	0.3 0.2	0.1 0.2	0.4 0.2
ND:BISMARCK	0.3 0.2	0.1 0.2	0.1 0.2
NJ:TRENTON	0.1 0.2	NS	NS
NV:LAS VEGAS	0.2 0.2	0.2 0.2	0.1 0.2
NY:ALBANY	NS	NS	0.2 0.2
NY:NEW YORK CITY	0.2 0.2	0.3 0.2	0.1 0.2
NY:NIAGARA FALLS	0.3 0.2	0.5 0.2	0.2 0.2
OH:COLUMBUS	0.2 0.2	0.2 0.2	0.2 0.2
OH:PAINESVILLE	0.3 0.2	0.2 0.2	0.2 0.2
OH:TOLEDO	0.2 0.2	0.2 0.2	0.3 0.2
OR:PORTLAND	0.3 0.2	0.2 0.2	0.1 0.2
PA:HARRISBURG	0.1 0.2	0.5 0.2	0.2 0.2
PA:PITTSBURGH	0.2 0.2	0.4 0.2	NS
RI:PROVIDENCE	0.2 0.2	0.5 0.2	0.2 0.2
SC:BARNWELL	0.7 0.2	1.1 0.2	2.2 0.2
SC:COLUMBIA	0.5 0.2	0.5 0.2	0.2 0.2
SD:PIERRE	0.2 0.2	1.0 0.2	0.2 0.2
TN:KNOXVILLE	NS	0.1 0.2	0.1 0.2
TN:NASHVILLE	NS	0.5 0.2	NS
TX:AUSTIN	0.4 0.2	0.1 0.2	0.1 0.2
TX:EL PASO	0.3 0.2	0.1 0.2	NS
VA:LYNCHBURG	0.3 0.2	0.2 0.2	0.2 0.2
VA:VIRGINIA BEACH	0.2 0.2	0.2 0.2	0.3 0.2
WI:MADISON	0.3 0.2	0.2 0.2	0.2 0.2
WV:CHARLESTON	NS	0.2 0.2	0.3 0.2

NS NO SAMPLE  
s SIGMA COUNTING ERROR

### Plutonium and Uranium in Airborne Particulates and Precipitation

Environmental radiation levels of plutonium and uranium are determined by the analyses of quarterly composite samples (air filters) collected from the 67 continuously operating airborne particulate samplers.

Analyses of the composited filters consist of ashing, separating by liquid ion exchange, and coprecipitation of the plutonium or uranium.

Concentration of the specific isotopes of plutonium-238, -239, and uranium-234, -235, and -238 are determined by alpha spectroscopy. The volume of air analyzed normally ranges from 25,000 to 40,000 m<sup>3</sup> for each quarterly composite.

Table 8.1 contains the results of plutonium and uranium analyses performed on selected precipitation composite samples.

Plutonium and uranium in airborne particulates data for July - September 1983 will be published when they become available.

TABLE 8.1  
 PLUTONIUM AND URANIUM ANALYSES  
 OF  
 SELECTED PRECIPITATION COMPOSITE SAMPLES

1983

LOCATION	$^{238}\text{Pu}$		$^{239}\text{Pu}$		$^{234}\text{U}$		$^{235}\text{U}$		$^{238}\text{U}$	
	pCi/l	$\pm 2s$	pCi/l	$\pm 2s$	pCi/l	$\pm 2s$	pCi/l	$\pm 2s$	pCi/l	$\pm 2s$
AL:MONTGOMERY	0.004	0.008	0.000	0.000	0.057	0.016	0.003	0.004	0.025	0.010
CA:BERKELEY	0.006	0.012	0.001	0.006	0.058	0.019	0.006	0.007	0.046	0.016
CO:DENVER	~.001	0.007	0.002	0.003	0.010	0.010	0.003	0.004	0.006	0.005
CT:HARTFORD	0.013	0.007	0.001	0.002	0.044	0.018	~0.001	0.006	0.015	0.010
FL:JACKSONVILLE	0.011	0.010	0.003	0.006	0.029	0.014	0.005	0.005	0.031	0.016
ID:BOISE	0.004	0.009	~0.001	0.004	0.017	0.011	0.002	0.003	0.005	0.007
ID:IDAHO FALLS	0.008	0.012	0.002	0.004	0.020	0.009	0.002	0.003	0.008	0.006
IL:CHICAGO	~.002	0.007	0.002	0.003	0.009	0.009	0.000	0.000	0.002	0.008
IN:INDIANAPOLIS	0.007	0.009	0.001	0.002	0.027	0.011	0.000	0.000	0.027	0.012
MI:LANSING	0.006	0.006	~0.001	0.004	0.028	0.012	~0.001	0.002	0.021	0.010
MN:MINNEAPOLIS	0.004	0.006	0.000	0.000	0.041	0.014	0.002	0.003	0.044	0.015
MS:JACKSON	0.008	0.008	0.000	0.003	0.026	0.012	0.000	0.003	0.013	0.010
ND:BISMARCK	0.003	0.010	0.000	0.000	0.051	0.019	0.004	0.005	0.018	0.011
NJ:TRENTON	0.025	0.012	~0.003	0.003	0.020	0.010	0.001	0.005	0.025	0.011
NV:LAS VEGAS	0.016	0.023	0.005	0.008	0.324	0.076	0.004	0.007	0.134	0.044
NY:NEW YORK CITY	0.011	0.012	0.000	0.004	0.064	0.020	~0.005	0.007	0.027	0.014
NY:NIAGARA FALLS	0.006	0.005	0.001	0.002	0.084	0.023	0.001	0.003	0.031	0.013
OH:COLUMBUS	0.013	0.010	0.002	0.003	0.076	0.021	0.006	0.005	0.023	0.011
OH:PAINESVILLE	0.001	0.005	0.002	0.005	0.048	0.017	0.001	0.002	0.048	0.017
OH:TOLEDO	0.005	0.005	0.001	0.003	0.030	0.012	0.003	0.004	0.020	0.010
OR:PORTLAND	~.002	0.009	0.002	0.003	0.035	0.014	0.000	0.000	0.022	0.011
PA:HARRISBURG	0.020	0.011	0.000	0.001	0.057	0.017	0.000	0.003	0.029	0.012
PA:PITTSBURGH	0.007	0.010	0.000	0.005	0.035	0.015	0.002	0.003	0.023	0.011
SC:BARNWELL	0.004	0.009	0.002	0.003	0.049	0.019	0.003	0.005	0.015	0.010
SC:COLUMBIA	0.002	0.006	0.000	0.000	0.010	0.008	0.000	0.003	0.029	0.012
TX:AUSTIN	~.001	0.007	0.001	0.004	0.034	0.016	0.007	0.007	0.020	0.011
VA:LYNCHBURG	0.003	0.007	0.001	0.006	0.467	0.069	0.029	0.014	0.067	0.020
WV:CHARLESTON	0.002	0.006	0.003	0.004	0.013	0.010	0.002	0.005	0.028	0.014

THE MINIMUM DETECTABLE LIMIT IS .015 pCi/SAMPLE, FOR EACH INDIVIDUAL ISOTOPE.

s SIGMA COUNTING ERROR

## Krypton-85

Krypton-85 is a long-lived noble gas with a half life of 10.8 years. It is released into the atmosphere by nuclear reactor operations, fuel fabrication, fuel reprocessing, and nuclear detonations. Krypton-85 also occurs naturally in minor quantities primarily from the neutron capture of stable krypton-84 as well as spontaneous fission and neutron-induced fission of uranium. Monitoring of krypton-85 in the atmosphere has been conducted to identify and establish baseline levels and long-term trends.

Krypton-85 analysis began in January 1973 with sample collections and analyses being performed for 12 sampling locations. These locations were selected to provide atmospheric coverage of the United States with considerations being given to the proximity to fuel reprocessing plants, nuclear reactors, and wide geographic coverage.

Dry compressed air samples, collected at each location, are purchased from commercial air suppliers annually and shipped to the EERF where the krypton-85 is cryogenically separated and counted in a liquid scintillation system.

The Kr-85 results will be published when they are available.



ERAMS

SECTION II. Water Program

The ERAMS water program provides ambient radiation data to assess the effects of nuclear fallout, the natural radiation environment, and other nuclear sources on the nation's rivers, streams and drinking water supplies.

Surface Water

Grab samples are taken quarterly at 58 stations located downstream from operating or future nuclear facilities.

Surface water monitoring consists of tritium analyses quarterly and gamma scans annually. Tritium is the primary radioactive pollutant from nuclear power plants.

Tritium concentrations are determined by liquid scintillation counting of distilled samples. Gamma scans are performed annually to determine if there is a buildup of other contaminants.

Tritium concentrations for surface water samples for October - December 1983 are given in Table 9.

TABLE 9

SURFACE WATER  
TRITIUM CONCENTRATION

OCTOBER - DECEMBER 1983

LOCATION	SOURCE	DATE COLLECTED	nCi/l	<u>±</u> 2s
AL:DECATUR	TENNESSEE RIVER	10/ 6/83	0.1	0.2
AL:DOTHAN	CHATTAHOOCHEE R.	10/20/83	0.5	0.2
AL:SCOTTSBORO	TENNESSEE RIVER	10/ 4/83	0.3	0.2
CA:CLAY STATION	FOLSOM S. CANAL	10/ 8/83	1.4	0.2.
CA:DIABLO CANYON	PACIFIC OCEAN	10/14/83	0.2	0.2
CA:EUREKA	HUMBOLDT BAY	10/ 6/83	0.2	0.2
CA:SAN ONOFRE	PACIFIC OCEAN	12/13/83	0.2	0.2
CO:GREELEY	SOUTH PLATTE RIVER	10/11/83	0.4	0.2
CT:EAST HADDAM	CONNECTICUT RIVER	12/ 8/83	0.2	0.2
CT:WATERFORD	LONG ISLAND SOUND	12/14/83	0.2	0.2
FL:CRYSTAL RIVER	GULF OF MEXICO	10/ 2/83	0.3	0.2
FL:FT. PIERCE	ATLANTIC OCEAN	10/ 4/83	0.1	0.2
FL:HOMESTEAD	BISCAYNE BAY	10/19/83	0.2	0.2
IA:CEDAR RAPIDS	CEDAR RIVER	10/ 4/83	0.3	0.2.
ID:BUHL	SNAKE RIVER	10/13/83	0.2	0.2
IL:BYRON	ROCK RIVER	11/ 1/83	0.1	0.2
IL:MOLINE	MISSISSIPPI RIVER	11/15/83	0.2	0.2
IL:MORRIS	ILLINOIS RIVER	10/30/83	0.2	0.2
IL:OREGON	ROCK RIVER	10/31/83	0.3	0.2
IL:ZION	LAKE MICHIGAN	11/22/83	0.2	0.2
LA:NEW ORLEANS	MISSISSIPPI RIVER	10/ 3/83	0.3	0.2
MA:PLYMOUTH	CAPE CODE BAY	10/ 3/83	0.4	0.2
MA:ROWE	DEERFIELD RIVER	10/20/83	0.7	0.2
MD:CONOWINGO	SUSQUEHANNA RIVER	10/ 4/83	0.3	0.2
MD:LUSBY	CHESAPEAKE BAY	10/11/83	0.2	0.2
ME:WISCASSET	MONTSEWAY BAY	10/ 3/83	0.3	0.2
MI:BRIDGMAN	LAKE MICHIGAN	10/11/83	0.5	0.2
MI:CHARLEVOIX	LAKE MICHIGAN	10/ 8/83	0.2	0.2
MI:MONROE	LAKE ERIE	10/ 9/83	0.2	0.2
MI:SOUTH HAVEN	LAKE MICHIGAN	10/11/83	0.4	0.2
MN:MONTICELLO	MISSISSIPPI RIVER	10/ 5/83	0.3	0.2
MN:RED WING	MISSISSIPPI RIVER	10/11/83	0.4	0.2
MS:PORT GIBSON	MISSISSIPPI RIVER	10/20/83	0.3	0.2
NC:CHARLOTTE	CATAWBA RIVER	10/ 3/83	0.3	0.2
NC:SOUTHPORT	ATLANTIC OCEAN	10/ 4/83	0.3	0.2
NE:RULO	MISSOURI RIVER	10/11/83	0.3	0.2
NJ:BAYSIDE	DELAWARE RIVER	10/12/83	0.2	0.2
NJ:OYSTER CREEK	OYSTER CREEK	10/ 6/83	0.2	0.2
NV:BOULDER CITY	COLORADO RIVER	9/29/83	0.5	0.2

TABLE 9 (CONTINUED)

SURFACE WATER  
TRITIUM CONCENTRATION

OCTOBER - DECEMBER 1983

LOCATION	SOURCE	DATE COLLECTED	nCi/1	$\pm$ 2s
NY:OSSINING	HUDSON RIVER	10/ 5/83	0.3	0.2
NY:OSWEGO	LAKE ONTARIO	10/15/83	0.3	0.2
NY:POUGHKEEPSIE	HUDSON RIVER	10/ 5/83	0.2	0.2
OH:TOLEDO	LAKE ERIE	9/28/83	0.5	0.2
OR:BRADWOOD	COLUMBIA RIVER	10/30/83	0.3	0.2
PA:DANVILLE	SUSQUEHANNA RIVER	10/12/83	0.3	0.2
SC:ALLENDALE	SAVANNAH RIVER	10/20/83	3.3	0.3
SC:BROAD RIVER	BROAD RIVER	10/26/83	0.3	0.2
SC:HARTSVILLE	LAKE ROBINSON	10/ 4/83	0.3	0.2
TN:DAISY	TENNESSEE RIVER	11/ 8/83	0.2	0.2
TN:KINGSTON	CLINCH RIVER	10/ 7/83	3.3	0.3
TX:EL PASO	RIO GRANDE	10/ 7/83	0.2	0.2
TX:MATAGORDA	COLORADO RIVER	10/ 5/83	0.2	0.2
VA:DOSWELL	NORTH ANNA RIVER	10/ 3/83	3.4	0.3
WA:NORTHPORT	COLUMBIA RIVER	11/16/83	0.2	0.2
WA:RICHLAND	COLUMBIA RIVER	10/ 7/83	0.2	0.2
WI:TWO CREEKS	LAKE MICHIGAN	10/ 5/83	0.3	0.2
WI:VICTORY	MISSISSIPPI RIVER	10/24/83	0.3	0.2
WV:WHEELING	OHIO RIVER	10/25/83	0.3	0.2

s SIGMA COUNTING ERROR

## Drinking Water

The drinking water program provides ambient radiation monitoring relevant to the effects of the nuclear power industry, natural environmental levels, and other pertinent sources. These data serve to assess trends and anomalies in concentrations, and to compare with standards set forth in the EPA "National Interim Primary Drinking Water Regulations." These regulations provide for approval of supplies when the combined radium-226 and radium-228 levels do not exceed 5 pCi/l, when the gross alpha (excluding radon and uranium) levels do not exceed 15 pCi/l, when tritium levels do not exceed 20,000 pCi/l, when the strontium-90 levels do not exceed 8 pCi/l, and when the gross beta levels do not exceed 50 pCi/l.

Grab samples are taken at 78 sites which are either major population centers or selected nuclear facility environs.

The analyses include (a) tritium on a quarterly basis (b) gross alpha, gross beta, strontium-90 and gamma on annual composites. Radium-226 analyses are performed if the gross alpha exceeds 2 pCi/l; and radium-228 analyses are performed if the radium-226 activity falls between 3 and 5 pCi/l) (c) specific iodine-131 is performed on one quarterly sample per year for each station (d) an annual composite for plutonium-238, -239, uranium-234, -235, -238, for stations which demonstrate gross alpha levels greater than 2 pCi/l.

Tritium analyses are performed by scintillation counting of the distilled samples, gross beta, and gross alpha by evaporating an aliquot on stainless steel planchets for counting, and radium-226 by the standard emanation technique. Strontium-90 is determined by beta counting a strontium carbonate precipitate isolated by ion exchange.

The results of tritium in drinking water analyses for October - December 1983 are shown in Table 10.

Iodine-131 concentration in drinking water for 1983 is shown in Table 11.

All samples were taken as either a single grab sample or composite samples taken over 12 to 14 days.

TABLE 10

DRINKING WATER  
TRITIUM CONCENTRATION

OCTOBER - DECEMBER 1983

LOCATION	DATE COLLECTED	nCi/l	+ 2s
AK:FAIRBANKS	10/20/83	0.2	0.2
AL:DOTHAN	10/20/83	0.2	0.2
AL:MONTGOMERY	10/ 5/83	0.3	0.2
AL:MUSCLE SHOALS	10/ 5/83	0.2	0.2
AL:SCOTTSBORO	10/ 4/83	0.2	0.2
CA:BERKELEY	10/ 6/83	0.1	0.2
CA:LOS ANGELES	10/ 3/83	0.2	0.2
CO:DENVER	10/17/83	0.4	0.2
CO:PLATTEVILLE	10/14/83	0.5	0.2
CT:HARTFORD	10/ 7/83	0.1	0.2
DE:DOVER	10/ 3/83	0.3	0.2
FL:MIAMI	10/ 3/83	0.2	0.2
FL:TAMPA	10/11/83	0.2	0.2
GA:SAVANNAH	10/ 3/83	4.2	0.3
HI:HONOLULU	10/24/83	0.1	0.2
IA:CEDAR RAPIDS	10/ 6/83	0.3	0.2
ID:BOISE	10/14/83	0.3	0.2
ID:IDAHO FALLS	10/17/83	0.3	0.2
IL:MORRIS	10/ 7/83	0.2	0.2
IL:W. CHICAGO	10/ 3/83	0.3	0.2
KS:TOPEKA	10/ 3/83	0.3	0.2
LA:NEW ORLEANS	10/ 4/83	0.4	0.2
MA:LAWRENCE	10/ 4/83	0.3	0.2
MA:ROWE	10/26/83	0.1	0.2
MD:BALTIMORE	10/ 6/83	0.2	0.2
MD:CONOWINGO	10/ 4/83	0.3	0.2
ME:AUGUSTA	10/ 5/83	0.2	0.2
MI:DETROIT	10/11/83	0.5	0.2
MI:GRAND RAPIDS	10/13/83	0.3	0.2
MN:MINNEAPOLIS	10/ 7/83	0.3	0.2
MN:RED WING	10/12/83	0.1	0.2
MS:JACKSON	10/ 3/83	0.2	0.2
MS:PORT GIBSON	10/ 4/83	0.3	0.2
MT:HELENA	10/ 7/83	0.3	0.2
NC:CHARLOTTE	10/ 3/83	0.3	0.2
NC:WILMINGTON	10/ 6/83	0.2	0.2
ND:BI SMARCK	10/ 3/83	0.3	0.2
NE:LINCOLN	10/24/83	0.3	0.2
NH:CONCORD	10/ 6/83	0.3	0.2
NJ:TRENTON	10/ 5/83	0.3	0.2
NJ:WARETOWN	10/ 6/83	0.2	0.2
NM:SANTA FE	10/ 3/83	0.2	0.2
NV:LAS VEGAS	10/ 6/83	0.2	0.2
NY:ALBANY	10/ 5/83	0.3	0.2

TABLE 10 (CONTINUED)

DRINKING WATER  
TRITIUM CONCENTRATION

OCTOBER - DECEMBER 1983

LOCATION	DATE COLLECTED	nCi/l	+ 2s
NY:NEW YORK CITY	10/ 6/83	0.2	0.2
NY:NIAGARA FALLS	10/ 6/83	0.3	0.2
NY:SYRACUSE	10/ 6/83	0.6	0.2
OH:CINCINNATI	10/ 5/83	0.3	0.2
OH:COLUMBUS	10/ 5/83	0.3	0.2
OH:EAST LIVERPOOL	10/12/83	0.2	0.2
OH:PAINESVILLE	10/ 4/83	0.2	0.2
OH:TOLEDO	9/29/83	0.3	0.2
OK:OKLAHOMA CITY	10/ 3/83	0.4	0.2
OR:PORTLAND	10/ 6/83	0.1	0.2
PA:COLUMBIA	10/13/83	0.4	0.2
PA:HARRISBURG	10/12/83	0.2	0.2
PA:PITTSBURGH	10/12/83	0.3	0.2
PC:ANCON	10/24/83	0.1	0.2
RI:PROVIDENCE	10/ 5/83	0.3	0.2
SC:BARNWELL	10/20/83	0.3	0.2
SC:COLUMBIA	10/ 3/83	0.5	0.2
SC:HARTSVILLE	10/ 4/83	1.2	0.2
SC:JENKINSVILLE	10/13/83	0.2	0.2
SC:SENECA	10/11/83	0.3	0.2
TN:CHATTANOOGA	10/20/83	0.2	0.2
TN:KNOXVILLE	9/28/83	0.3	0.2
TX:AUSTIN	10/ 5/83	0.2	0.2
VA:DOSWELL	11/16/83	0.2	0.2
VA:LYNCHBURG	10/ 5/83	0.5	0.2
VA:VIRGINIA BEACH	10/ 4/83	0.3	0.2
VI:ST. THOMAS	10/19/83	0.2	0.2
WA:RICHLAND	10/ 7/83	0.4	0.2
WA:SEATTLE	10/ 6/83	0.3	0.2
WI:GENOA CITY	10/25/83	0.2	0.2
WI:MADISON	10/ 3/83	0.2	0.2

s SIGMA COUNTING ERROR

TABLE 11

IODINE-131 IN DRINKING WATER  
1983

LOCATION	DATE COLLECTED	pCi/l	<u>±</u> 2s
AK:FAIRBANKS	1/14/83	-0.1	0.1
AL:MONTGOMERY	10/ 5/83	0.1	0.1
AL:MUSCLE SHOALS	7/ 6/83	-0.2	0.1
AL:SCOTTSBORO	7/ 8/83	-0.2	0.1
CA:BERKELEY	10/ 6/83	0.1	0.1
CA:LOS ANGELES	10/ 3/83	0.0	0.1
CO:DENVER	10/17/83	-0.1	0.1
CO:PLATTEVILLE	10/14/83	0.1	0.2
CT:HARTFORD	1/13/83	-0.1	0.1
DC:WASHINGTON	1/10/83	0.1	0.1
DE:DOVER	10/ 3/83	0.1	0.1
FL:MIAMI	7/ 5/83	0.1	0.1
FL:TAMPA	1/26/83	0.1	0.1
GA:SAVANNAH	4/20/83	-0.1	0.2
HI:HONOLULU	7/18/83	0.3	0.2
IA:CEDAR RAPIDS	10/ 6/83	0.0	0.1
ID:BOISE	8/11/83	-0.6	0.2
ID:IDAHO FALLS	5/ 2/83	0.1	0.1
IL:MORRIS	4/ 4/83	0.0	0.1
IL:W. CHICAGO	7/ 5/83	-0.3	0.1
KS:TOPEKA	4/ 1/83	0.2	0.1
LA:NEW ORLEANS	2/ 3/83	0.2	0.1
MA:LAWRENCE	7/18/83	0.2	0.2
MA:ROWE	10/26/83	0.0	0.2
MD:BALTIMORE	1/ 7/83	0.1	0.1
MD:CONOWINGO	1/25/83	0.2	0.1
ME:AUGUSTA	4/ 7/83	-0.2	0.1
MI:DETROIT	4/ 5/83	0.1	0.1
MI:GRAND RAPIDS	1/19/83	0.1	0.1
MN:MINNEAPOLIS	1/ 7/83	-0.1	0.1
MN:RED WING	9/ 9/83	0.1	0.1
MS:JACKSON	7/ 5/83	0.1	0.1
MS:PORT GIBSON	7/ 8/83	0.0	0.1
MT:HELENA	7/ 7/83	0.1	0.1
NC:CHARLOTTE	1/12/83	0.0	0.1
NC:WILMINGTON	4/ 7/83	0.3	0.1
ND:BISMARCK	1/10/83	-0.2	0.1
NE:LINCOLN	4/ 1/83	-0.2	0.1
NH:CONCORD	7/ 5/83	-0.2	0.1
NJ:TRENTON	10/ 5/83	0.1	0.1
NJ:WARETOWN	7/21/83	-0.1	0.1
NM:SANTA FE	1/10/83	-0.1	0.1
NV:LAS VEGAS	1/10/83	0.0	0.1
NY:ALBANY	4/ 1/83	0.0	0.1
NY:NEW YORK CITY	1/19/83	0.0	0.1

TABLE 11 (CONTINUED)

IODINE-131 IN DRINKING WATER  
1983

LOCATION	DATE COLLECTED	pCi/l	+ 2s
NY:NIAGARA FALLS	4/ 6/83	-0.3	0.1
NY:SYRACUSE	1/11/83	0.0	0.1
OH:CINCINNATI	7/ 5/83	0.2	0.1
OH:COLUMBUS	1/ 7/83	0.1	0.1
OH:EAST LIVERPOOL	2/17/83	0.2	0.1
OH:PAINESVILLE	7/ 7/83	-0.1	0.1
OH:TOLEDO	9/29/83	0.1	0.1
OK:OKLAHOMA CITY	4/ 1/83	0.2	0.1
OR:PORTLAND	7/ 6/83	0.0	0.1
PA:COLUMBIA	4/21/83	0.0	0.1
PA:HARRISBURG	4/15/83	-0.5	0.3
PA:PITTSBURGH	4/13/83	0.1	0.1
PC:ANCON	4/ 6/83	0.0	0.1
RI:PROVIDENCE	1/11/83	0.1	0.1
SC:BARNWELL	1/13/83	0.0	0.1
SC:COLUMBIA	1/ 5/83	0.1	0.1
SC:HARTSVILLE	1/31/83	0.2	0.1
SC:JENKINSVILLE	1/ 7/83	0.1	0.1
SC:SENECA	1/19/83	-0.2	0.1
TN:CHATTANOOGA	8/15/83	0.1	0.1
TN:KNOXVILLE	4/ 1/83	0.0	0.1
TX:AUSTIN	7/ 7/83	-0.1	0.1
VA:DOSWELL	1/26/83	0.4	0.2
VA:LYNCHBURG	4/ 1/83	-0.1	0.1
VA:VIRGINIA BEACH	1/14/83	-0.1	0.1
VI:ST. THOMAS	10/19/83	0.3	0.3
WA:RICHLAND	1/13/83	0.0	0.1
WA:SEATTLE	1/11/83	0.1	0.1
WI:GENOA CITY	4/ 5/83	-0.2	0.3
WI:MADISON	1/14/83	-0.1	0.1

s SIGMA COUNTING ERROR



## Radon-222 in Drinking Water

For all practical purposes, the Radon-222 in Drinking Water Program has been completed. Only a few samples occasionally are received for analysis. The Radon-222 and other natural radioactivity results will be the subject of several reports, including Methods and Results of EPA's Study of Radon in Drinking Water by T. R. Horton, Nationwide Occurrence of Radon and Other Natural Radioactivity in Public Water Supplies by T. R. Horton and The occurrence of Radioactivity in Public Water Supplies in the United States by C. T. Hess, J. Michel, T. R. Horton, H. M. Prichard, and W. A. Coniglio. Copies of these reports will be available from the --

U. S. Environmental Protection Agency  
Office of Radiation Programs  
Eastern Environmental Radiation Facility  
Montgomery, AL 36193

The Radon-222 in Drinking Water section will be terminated as of this issue but it will be reinstated if sufficient results are accumulated in the future.

### SECTION III. External Gamma Ambient Monitoring Program

The external gamma monitoring program, which began in October 1978, provides a continuous measurement of ambient gamma exposure rates, including cosmic, at selected sites throughout the continental United States. Data from this program will be used to evaluate fluctuations in natural background due to variations in environmental conditions and to provide a means of monitoring any significant increases in ambient gamma levels due to weapons fallout, reactor operations, etc. Initially, the program will consist of approximately 22 sites representing a wide geographic coverage throughout the country. Hopefully, at some later date additional sites will be added to the program. Although exposure measurements at these few sites are not totally representative of nationwide exposures, they will be indicative of national trends.

The monitoring program utilizes  $\text{CaF}_2:\text{Mn}$  thermoluminescent dosimeters (TLD's). These dosimeters are commercially available glass-bulb type dosimeters with energy compensating shields. A group of four TLD's is located at each station or site. Dosimeters are annealed by the station operator prior to positioning in the field. The dosimeters are returned to EERF for readout on an approximate one-month cycle. Several dosimeters are annealed by the station operator as controls and returned with the exposed field dosimeters to correct for any exposures accumulated during shipment.

Results from the period October- December 1983 are shown in Table 12.

TABLE 12

ENVIRONMENTAL GAMMA AMBIENT MONITORING PROGRAM				
LOCATION	DATE RANGE	INTEGRATED	EXPOSURE	
		EXPOSURE	RATE	
		MR	MICRO R/HR $\pm$ 2 s *	
AL:MONTGOMERY	100383-110383	4.7	6.3	7.7
AL:MONTGOMERY	110383-120183	4.7	6.9	8.6
AL:MONTGOMERY	120183- 10384	5.2	6.6	5.7
CA:BERKELEY	93083-110183	4.5	5.9	11.4
CA:BERKELEY	110183-120183	4.3	5.9	7.5
CA:BERKELEY	120183- 11384	5.6	5.4	8.7
CO:DENVER	100383-110183	9.3	13.3	6.6
CO:DENVER	110183-120683	11.2	13.3	16.4
CO:DENVER	120683- 11284	12.5	14.1	6.1
FL:ORLANDO	100483-111583	6.2	6.2	7.3
FL:ORLANDO	111583-120583	2.7	5.7	7.5
FL:ORLANDO	120583- 11684	5.7	5.6	15.8
ID:BOISE	101183-110883	7.7	11.5	19.7
ID:BOISE	110883-120883	8.4	11.7	8.5
ID:BOISE	120883- 11284	9.3	11.0	5.8
IL:CHICAGO	100783-111883	7.5	7.4	9.9
ND:BISMARCK	100483-110483	7.1	9.5	5.2
ND:BI SMARCK	110483-113083	5.8	9.4	4.7
ND:BI SMARCK	113083- 11184	9.9	9.8	7.1
NM:SANTA FE	100783-110283	8.6	13.8	5.0
NM:SANTA FE	110283-120783	11.6	13.8	11.6
NV:LAS VEGAS	93083-103183	4.5	6.1	11.2
NV:LAS VEGAS	103183-113083	4.7	6.6	15.0
NV:LAS VEGAS	113083- 10984	6.5	6.8	8.5
NY:NEW YORK	101183-111483	6.2	7.6	8.2
NY:NEW YORK	111483-121583	6.3	8.5	9.1
OH:COLUMBUS	93083-103183	4.8	6.4	10.1
OH:COLUMBUS	103183-120183	5.4	7.3	11.0
OH:COLUMBUS	120183- 10984	6.7	7.1	8.8
OK:OKLAHOMA CITY	101483-111583	5.9	7.7	6.3
OK:OKLAHOMA CITY	111583-122083	6.0	7.2	10.9
OR:PORTLAND	90283-102683	9.9	7.6	8.7
OR:PORTLAND	102683-112983	6.3	7.7	6.6
OR:PORTLAND	112983- 11284	8.0	7.6	8.7
PA:HARRISBURG	93083-103183	4.0	5.4	11.1
PA:HARRISBURG	103183-112883	4.6	6.8	14.7
PA:HARRISBURG	112883- 11384	6.8	6.1	6.5
PA:PITTSBURGH	100383-110383	8.9	12.0	6.3
RI:PROVIDENCE	110783-120883	8.0	10.8	6.8
RI:PROVIDENCE	120883- 10684	6.8	9.7	7.5
SC:BARNWELL	100683-110383	5.0	7.5	6.5
SC:BARNWELL	110383-120183	5.8	8.7	7.5
SC:BARNWELL	120183- 11284	9.4	9.3	10.3
SC:COLUMBIA	110183-120283	6.0	8.0	8.7
SC:COLUMBIA	120283- 10684	6.5	7.7	4.4
SC:COLUMBUS	93083-110183	5.8	7.6	5.0
TN:KNOXVILLE	93083-110183	7.1	9.2	4.7

TABLE 12 (CONTINUED)

ENVIRONMENTAL GAMMA AMBIENT MONITORING PROGRAM				
LOCATION	DATE RANGE	INTEGRATED	EXPOSURE	
		EXPOSURE	RATE	
		MR	MICRO R/HR + 2 s *	
TN:KNOXVILLE	93083-110183	7.1	9.2	4.7
TN:KNOXVILLE	110183-120183	6.9	9.6	8.9
TN:KNOXVILLE	120183- 10584	7.2	8.6	4.2
VA:RICHMOND	100383-110183	5.4	7.8	8.7
VA:RICHMOND	110183-120183	5.5	7.6	8.4
VA:RICHMOND	120183- 11184	7.0	7.1	7.3
VT:MONTPELIER	100383-111083	6.4	7.0	11.3
VT:MONTPELIER	111083-121283	5.6	7.4	6.8

\* s = SIGMA ERROR (IN PERCENT)

## SECTION IV. Milk Program

### Pasteurized Milk

This is a cooperative program of the EPA, ORP and the Dairy and Lipid Products Branch, Milk Sanitation Section, Food and Drug Administration. Milk is a reliable indicator of the general populations intake of radionuclides since it is consumed by a large segment of the population and contains several of the biologically important contaminants resulting from environmental releases from nuclear activities. A primary function of this program is to obtain reliable monitoring data relative to current radionuclide concentrations and determine any long-term trends.

Monthly samples are collected at 65 sampling sites with one or more located in each state, Puerto Rico, and the Panama Canal. These are composite samples representing more than 80 percent of the milk consumed in a given population center.

These samples are analyzed for iodine-131, barium-140, cesium-137, and potassium. All 65 samples are analyzed annually in July for strontium-89, and strontium-90. Also, for the first month of the three quarters beginning January, April and October, 10 regional composite samples of milk made up from the states within each of EPA's 10 regions are analyzed for strontium-89 and strontium-90.

Iodine-131, barium-140, cesium-137 and potassium are determined by gamma spectral analysis. Strontium-89 and strontium-90 are determined by beta counting a total strontium precipitate which has been chemically separated by ion-exchange.

The values from the pasteurized milk samples for October-December 1983 are shown in Tables 13 - 15.

Strontium values from regional composite samples collected October - December 1983 are shown in Table 16.

### Tritium in Milk

It was previously proposed to analyze all 65 milk samples for tritium in the aqueous and organic phases, on an annual basis (on the April sample). The EERF is currently evaluating alternative analytical techniques anticipating that these analyses will begin during the coming year.

TABLE 13

## CONCENTRATIONS OF RADIONUCLIDES IN PASTEURIZED MILK

OCTOBER 1983

LOCATION	DATE COLLECTED	K g/l+2s	<sup>137</sup> Cs pCi/l+2s	<sup>140</sup> Ba pCi/l+2s	<sup>131</sup> I pCi/l+2s
AL:MONTGOMERY	10/ 6/83	1.50 0.12	1 7	0 9	0 7
AR:LITTLE ROCK	10/10/83	1.55 0.12	3 7	1 8	-3 7
AZ:PHOENIX	10/ 6/83	1.66 0.13	6 7	-3 9	-4 7
CA:LOS ANGELES	10/13/83	1.60 0.08	0 5	-3 6	2 5
CA:SACRAMENTO	10/ 6/83	1.56 0.12	3 7	-5 9	1 7
CA:SAN FRANCISCO	10/ 7/83	1.47 0.12	-3 7	3 9	-2 7
CO:DENVER	10/ 1/83	1.60 0.13	-5 7	3 9	-1 7
CT:HARTFORD	10/ 3/83	1.64 0.09	2 5	-2 6	-4 5
DC:WASHINGTON	10/ 7/83	1.57 0.12	-1 7	-1 8	4 7
FL:TAMPA	10/10/83	1.53 0.08	12 5	-4 6	-3 5
GA:ATLANTA	10/ 4/83	1.64 0.13	-3 7	1 9	0 7
HI:HONOLULU	10/ 4/83	1.67 0.13	0 7	-7 8	-1 7
IA:DES MOINES	10/ 5/83	1.59 0.13	-4 7	0 9	-1 7
ID:IDAHO FALLS	10/17/83	1.54 0.16	7 10	0 14	-5 10
IL:CHICAGO	10/ 3/83	1.55 0.12	-1 7	0 9	-7 7
IN:INDIANAPOLIS	10/ 3/83	1.54 0.12	5 7	-3 9	-4 7
KS:WICHITA	10/10/83	1.61 0.09	1 5	-1 6	-4 5
KY:LOUISVILLE	10/ 3/83	1.54 0.12	1 7	-2 9	-4 7
LA:NEW ORLEANS	10/ 4/83	1.50 0.08	4 5	0 6	-2 5
MA:BOSTON	10/ 4/83	1.59 0.13	6 7	1 9	-3 7
MD:BALTIMORE	10/ 7/83	1.58 0.13	0 7	4 9	-2 7
ME:PORTLAND	10/ 6/83	1.60 0.13	8 7	-3 9	-5 7
MI:DETROIT	10/12/83	1.48 0.12	-2 7	0 9	-1 7
MI:GRAND RAPIDS	10/ 3/83	1.54 0.08	-2 5	0 6	-2 5
MN:MINNEAPOLIS	10/ 3/83	1.56 0.12	1 7	-3 9	1 7
MN:ST PAUL	10/ 5/83	1.46 0.12	-2 7	-4 9	3 7
MO:KANSAS CITY	10/ 7/83	1.65 0.13	-1 7	0 9	0 7
MO:ST LOUIS	10/ 5/83	1.51 0.12	0 7	3 9	-1 7
MS:JACKSON	10/ 4/83	1.56 0.08	6 5	0 6	-2 5
MT:HELENA	10/11/83	1.48 0.12	-2 7	-3 8	5 7
NC:CHARLOTTE	10/ 3/83	1.84 0.24	12 15	13 21	-6 14
ND:MINOT	10/17/83	1.67 0.23	2 14	-7 20	-3 14
NE:OMAHA	10/ 6/83	1.52 0.12	0 7	0 9	-1 7
NH:MANCHESTER	10/ 3/83	1.59 0.23	15 15	12 21	10 14
NJ:TRENTON	10/ 6/83	1.61 0.13	0 7	-3 9	-2 7
NM:ALBUQUERQUE	10/ 3/83	1.58 0.12	1 7	-4 9	-4 7
NV:LAS VEGAS	10/ 7/83	1.63 0.12	0 7	-2 8	-2 7
NY:BUFFALO	10/ 3/83	1.58 0.13	-1 7	0 9	1 7
NY:NEW YORK CITY	10/ 3/83	1.40 0.12	3 7	0 9	-3 7
NY:SYRACUSE	10/ 3/83	1.64 0.13	4 7	-5 9	0 7
OH:CINCINNATI	10/ 3/83	1.55 0.12	2 7	-2 9	1 7
OH:CLEVELAND	10/10/83	1.54 0.12	-1 7	6 9	-1 7
OK:OKLAHOMA CITY	10/11/83	1.49 0.12	0 7	-2 9	3 7
OR:PORTLAND	10/ 4/83	1.42 0.12	2 7	-1 9	0 7

TABLE 13 (CONTINUED)

## CONCENTRATIONS OF RADIONUCLIDES IN PASTEURIZED MILK

OCTOBER 1983

LOCATION	DATE COLLECTED	K		$^{137}\text{Cs}$		$^{140}\text{Ba}$		$^{131}\text{I}$	
		g/1+2s		pCi/1+2s		pCi/1+2s		pCi/1+2s	
PA:PHILADELPHIA	10/ 3/83	1.55	0.08	-2	5	-2	6	-4	5
PA:PITTSBURGH	10/ 5/83	1.57	0.12	-2	7	-4	9	1	7
PR:SAN JUAN	10/13/83	1.53	0.08	2	5	1	6	0	5
SC:CHARLESTON	10/18/83	1.51	0.23	0	14	4	20	12	14
SD:RAPID CITY	10/ 4/83	1.57	0.09	0	5	2	6	-2	5
TN:CHATTANOOGA	10/ 3/83	1.60	0.13	1	7	-2	9	-1	7
TN:KNOXVILLE	10/ 3/83	1.46	0.23	0	14	-10	20	-1	14
TN:MEMPHIS	10/25/83	1.60	0.08	-1	5	-6	6	-2	5
TX:AUSTIN	10/17/83	1.53	0.12	-4	7	0	8	3	7
UT:SALT LAKE CITY	10/ 1/83	1.52	0.12	0	7	-1	9	-3	7
VA:NORFOLK	10/13/83	1.51	0.12	-1	7	-6	8	0	7
VT:BURLINGTON	10/14/83	1.66	0.12	1	7	-5	8	0	7
WA:SEATTLE	10/ 3/83	1.66	0.13	1	7	-6	9	2	7
WI:MILWAUKEE	10/ 1/83	1.60	0.12	3	7	-3	8	-1	7
WY:LARAMIE	10/ 5/83	1.46	0.12	3	7	2	9	-3	7

s SIGMA COUNTING ERROR

TABLE 14

## CONCENTRATIONS OF RADIONUCLIDES IN PASTEURIZED MILK

NOVEMBER 1983

LOCATION	DATE COLLECTED	K g/1+2s	$^{137}\text{Cs}$ pCi/1+2s	$^{140}\text{Ba}$ pCi/1+2s	$^{131}\text{I}$ pCi/1+2s
AK:PALMER	11/ 1/83	1.77 0.13	1 7	-5 8	-1 7
AL:MONTGOMERY	11/10/83	1.58 0.12	4 7	-3 8	5 7
AR:LITTLE ROCK	11/ 7/83	1.47 0.12	0 7	2 8	-3 7
AZ:PHOENIX	11/ 8/83	1.61 0.08	0 5	5 6	0 5
CA:LOS ANGELES	11/ 9/83	1.64 0.12	4 7	4 8	-5 7
CA:SACRAMENTO	11/ 1/83	1.66 0.13	0 7	-1 8	-3 7
CA:SAN FRANCISCO	11/ 9/83	1.60 0.12	1 7	2 8	-2 7
CO:DENVER	11/ 1/83	1.58 0.12	-1 7	0 8	-6 7
CT:HARTFORD	11/ 4/83	1.63 0.12	-2 7	3 8	1 7
FL:TAMPA	11/ 7/83	1.60 0.08	9 5	-4 6	-1 5
GA:ATLANTA	11/ 3/83	1.53 0.12	1 7	-2 8	1 7
HI:HONOLULU	11/ 1/83	1.62 0.12	3 7	5 8	-2 7
IA:DES MOINES	11/ 1/83	1.60 0.08	1 5	-2 6	-4 5
ID:IDAHO FALLS	11/ 3/83	1.85 0.24	1 14	12 20	-10 14
IL:CHICAGO	11/ 7/83	1.64 0.12	2 7	-4 8	2 7
IN:INDIANAPOLIS	11/ 7/83	1.53 0.08	2 5	7 6	0 5
KS:WICHITA	11/ 2/83	1.58 0.12	0 7	-2 8	2 7
KY:LOUISVILLE	11/ 7/83	1.62 0.08	0 5	1 6	-2 5
LA:NEW ORLEANS	11/ 3/83	1.62 0.12	0 7	0 8	2 7
MA:BOSTON	11/ 7/83	1.58 0.12	5 7	-1 8	-2 7
MD:BALTIMORE	11/ 4/83	1.71 0.13	0 7	1 8	0 7
ME:PORTLAND	11/ 1/83	1.67 0.23	2 14	-7 20	5 14
MI:DETROIT	11/10/83	1.49 0.12	1 7	2 8	-6 7
MI:GRAND RAPIDS	11/ 7/83	1.61 0.23	7 14	-6 20	-4 14
MN:MINNEAPOLIS	11/ 8/83	1.67 0.13	1 7	2 8	1 7
MN:ST PAUL	11/ 1/83	1.63 0.23	3 14	-8 19	2 14
MO:KANSAS CITY	11/ 9/83	1.66 0.12	0 7	-7 8	0 7
MO:ST LOUIS	11/ 2/83	1.72 0.13	0 7	-2 8	-1 7
MS:JACKSON	11/ 7/83	1.63 0.12	4 7	0 8	-4 7
MT:HELENA	11/ 7/83	1.71 0.13	0 7	5 8	0 7
NC:CHARLOTTE	11/ 7/83	1.48 0.23	4 14	4 20	4 14
NE:OMAHA	11/14/83	1.42 0.12	5 7	0 8	3 7
NH:MANCHESTER	11/ 7/83	1.57 0.12	4 7	-4 8	-1 7
NJ:TRENTON	11/ 3/83	1.55 0.12	4 7	-1 8	1 7
NM:ALBUQUERQUE	11/ 7/83	1.51 0.12	4 7	-3 8	1 7
NV:LAS VEGAS	11/17/83	1.58 0.12	-3 7	2 8	-2 7
NY:BUFFALO	11/15/83	1.55 0.12	3 7	2 8	-5 7
NY:NEW YORK CITY	11/ 7/83	1.63 0.12	-1 7	2 8	-1 7
NY:SYRACUSE	11/ 7/83	1.68 0.09	0 5	1 6	-2 5
OH:CINCINNATI	11/ 1/83	1.56 0.12	4 7	-5 8	3 7
OH:CLEVELAND	11/ 7/83	1.51 0.12	-1 7	3 8	-3 7
OK:OKLAHOMA CITY	11/ 1/83	1.62 0.12	-3 7	3 8	-4 7
OR:PORTLAND	11/ 7/83	1.57 0.12	-1 7	5 8	-2 7
PA:PHILADELPHIA	11/14/83	1.58 0.12	4 7	-2 8	-2 7



TABLE 14 (CONTINUED)

## CONCENTRATIONS OF RADIONUCLIDES IN PASTEURIZED MILK

NOVEMBER 1983

LOCATION	DATE COLLECTED	K		$^{137}\text{Cs}$		$^{140}\text{Ba}$		$^{131}\text{I}$	
		g/1+2s		pCi/1+2s		pCi/1+2s		pCi/1+2s	
PA:PITTSBURGH	11/ 7/83	1.63	0.09	-4	5	-2	6	-2	5
PC:CRISTOBAL	11/15/83	1.62	0.12	8	7	-4	8	1	7
PR:SAN JUAN	11/10/83	1.60	0.23	8	14	9	20	-10	14
SD:RAPID CITY	11/15/83	1.58	0.12	0	7	-8	8	3	7
TN:CHATTANOOGA	11/ 7/83	1.74	0.23	4	14	1	20	-6	14
TN:KNOXVILLE	11/ 7/83	1.70	0.23	7	14	6	20	5	14
TN:MEMPHIS	11/29/83	1.63	0.12	3	7	-2	8	0	7
UT:SALT LAKE CITY	11/ 7/83	1.53	0.12	-2	7	4	8	1	7
VA:NORFOLK	11/10/83	1.58	0.12	2	7	5	8	-1	7
VT:BURLINGTON	11/ 7/83	1.58	0.16	10	10	9	14	-6	10
WA:SEATTLE	11/ 7/83	1.55	0.12	0	7	1	8	1	7
WA:SPOKANE	11/ 7/83	1.64	0.12	1	7	2	8	-4	7
WI:MILWAUKEE	11/ 1/83	1.69	0.13	-1	7	-1	8	-4	7
WV:CHARLESTON	11/16/83	1.61	0.12	1	7	-3	8	0	7
WY:LARAMIE	11/ 7/83	1.61	0.08	0	5	0	6	0	5

s SIGMA COUNTING ERROR

TABLE 15

## CONCENTRATIONS OF RADIONUCLIDES IN PASTEURIZED MILK

DECEMBER 1983

LOCATION	DATE COLLECTED	K		$^{137}\text{Cs}$		$^{140}\text{Ba}$		$^{131}\text{I}$	
		g/1+2s		pCi/1+2s		pCi/1+2s		pCi/1+2s	
AK:PALMER	12/ 1/83	1.56	0.12	0	7	3	8	4	7
AL:MONTGOMERY	12/ 8/83	1.66	0.13	0	7	5	8	-2	7
AR:LITTLE ROCK	12/ 5/83	1.49	0.08	5	5	4	6	1	5
AZ:PHOENIX	12/ 7/83	1.64	0.12	-3	7	-1	8	-3	7
CA:LOS ANGELES	12/15/83	1.64	0.12	3	7	1	8	2	7
CA:SACRAMENTO	12/ 2/83	1.62	0.08	-1	5	-4	6	0	5
CA:SAN FRANCISCO	12/ 6/83	1.63	0.12	0	7	2	8	-3	7
CO:DENVER	12/ 1/83	1.59	0.12	5	7	-3	8	5	7
CT:HARTFORD	12/ 2/83	1.55	0.12	0	7	2	8	0	7
FL:TAMPA	12/ 7/83	1.63	0.12	16	7	-5	8	5	7
GA:ATLANTA	12/ 2/83	1.53	0.12	3	7	-6	8	2	7
GA:ATLANTA	12/27/83	1.53	0.12	2	7	-1	8	-1	7
HI:HONOLULU	12/ 6/83	1.56	0.12	0	7	0	8	-4	7
IA:DES MOINES	12/ 6/83	1.67	0.13	-1	7	-3	8	-4	7
ID:IDAHO FALLS	12/ 8/83	1.69	0.13	2	7	2	8	1	7
IL:CHICAGO	12/ 5/83	1.61	0.12	-3	7	-4	8	5	7
IN:INDIANAPOLIS	12/ 5/83	1.58	0.12	1	7	2	8	-1	7
KS:WICHITA	12/ 5/83	1.59	0.12	2	7	-2	8	-2	7
KY:LOUISVILLE	12/ 6/83	1.55	0.12	3	7	3	8	-3	7
LA:NEW ORLEANS	12/ 1/83	1.57	0.12	7	7	-1	8	1	7
MA:BOSTON	12/ 6/83	1.50	0.12	4	7	5	8	2	7
MD:BALTIMORE	12/ 2/83	1.69	0.13	0	7	0	8	0	7
ME:PORTLAND	12/ 6/83	1.58	0.12	4	7	0	8	-4	7
MI:DETROIT	12/ 8/83	1.65	0.09	1	5	4	6	0	5
MI:GRAND RAPIDS	12/ 5/83	1.53	0.12	7	7	-1	8	-1	7
MN:MINNEAPOLIS	12/ 5/83	1.57	0.12	-2	7	7	8	5	7
MN:ST PAUL	12/ 7/83	1.72	0.23	6	14	6	20	1.	14
MO:KANSAS CITY	12/ 8/83	1.67	0.13	2	7	1	8	1	7
MO:ST LOUIS	12/ 7/83	1.59	0.08	4	5	1	6	-1.	5
MS:JACKSON	12/ 6/83	1.66	0.13	1	7	8	8	-2	7
MT:HELENA	12/ 6/83	1.59	0.12	2	7	-7	8	3	7
NC:CHARLOTTE	12/ 5/83	1.49	0.16	6	10	10	14	-7	10
NE:OMAHA	12/12/83	1.66	0.12	3	7	0	8	0	7
NH:MANCHESTER	12/ 6/83	1.61	0.09	2	5	-2	6	2	5
NJ:TRENTON	12/ 1/83	1.56	0.12	2	7	-3	8	5	7
NM:ALBUQUERQUE	12/ 6/83	1.53	0.12	-1	7	-1	8	-1	7
NV:LAS VEGAS	12/ 5/83	1.58	0.12	3	7	2	8	-2	7
NY:BUFFALO	12/12/83	1.62	0.08	2	5	1	6	0	5
NY:NEW YORK CITY	12/ 5/83	1.57	0.12	1	7	-1	8	3	7
NY:SYRACUSE	12/ 5/83	1.61	0.12	3	7	2	8	0	7
OH:CINCINNATI	12/ 5/83	1.44	0.12	-1	7	-5	8	1	7
OH:CLEVELAND	12/ 7/83	1.70	0.13	-7	7	3	8	-2	7
OK:OKLAHOMA CITY	12/ 5/83	1.60	0.12	3	7	5	8	-2	7
OR:PORTLAND	12/ 6/83	1.44	0.08	0	5	0	6	0	5

TABLE 15 (CONTINUED)

## CONCENTRATIONS OF RADIONUCLIDES IN PASTEURIZED MILK

DECEMBER 1983

LOCATION	DATE COLLECTED	K		$^{137}\text{Cs}$		$^{140}\text{Ba}$		$^{131}\text{I}$	
		g/1+2s		pCi/1+2s		pCi/1+2s		pCi/1+2s	
PA:PHILADELPHIA	12/ 5/83	1.52	0.12	-1	7	1	8	-5	7
PA:PITTSBURGH	12/ 7/83	1.56	0.12	2	7	0	8	4	7
PC:CRISTOBAL	12/15/83	1.56	0.12	19	7	-3	8	-6	7
PR:SAN JUAN	12/15/83	1.61	0.23	10	15	16	20	4	14
SD:RAPID CITY	12/ 5/83	1.65	0.12	3	7	-4	8	-3	7
TN:CHATTANOOGA	12/ 5/83	1.45	0.12	3	7	-3	8	2	7
TN:KNOXVILLE	12/ 6/83	1.74	0.23	-2	14	-10	19	4	14
TX:AUSTIN	12/ 1/83	1.52	0.12	-4	7	-5	8	3	7
UT:SALT LAKE CITY	12/ 5/83	1.61	0.12	6	7	-4	8	0	7
VA:NORFOLK	12/ 8/83	1.63	0.08	2	5	2	6	0	5
VT:BURLINGTON	12/ 2/83	1.61	0.12	2	7	2	8	-2	7
WA:SEATTLE	12/ 1/83	1.53	0.12	-4	7	-3	8	4	7
WA:SPOKANE	12/ 6/83	1.67	0.13	6	7	-1	8	-4	7
WI:MILWAUKEE	12/ 1/83	1.71	0.13	3	7	1	8	-2	7
WV:CHARLESTON	12/19/83	1.72	0.23	9	14	-4	20	3	14
WV:CHARLESTON	12/12/83	1.50	0.12	3	7	5	8	-1	7
WY:LARAMIE	12/ 6/83	1.55	0.12	7	7	-2	8	3	7

s SIGMA COUNTING ERROR

TABLE 16  
 STRONTIUM-90 AND STRONTIUM-89 IN PASTEURIZED MILK  
 EPA REGIONAL COMPOSITES  
 OCTOBER - DECEMBER 1983

EPA REGION	$^{90}\text{Sr}$		$^{89}\text{Sr}$	
	pCi/l $\pm$ 2s		pCi/l $\pm$ 2s*	
I	3.0	0.5	1	1
II	2.2	0.5	1	1
III	1.9	0.7	2	1
IV	2.8	1.0	1	2
V	2.3	0.6	1	1
VI	2.0	0.6	2	1
VII	2.6	0.7	0	1
VIII	2.1	0.4	1	1
IX	0.4	0.2	1	0
X	1.4	0.4	1	1

s SIGMA COUNTING ERROR  
 s\* ANALYTICAL ERROR TERM WHICH CLOSELY APPROXIMATES  
 THE COUNTING ERROR

### Carbon-14 in Milk

Nine stations, chosen for wide geographical distribution, contribute milk samples for annual analysis for carbon-14. These samples have monitored the carbon-14 levels in the food chain resulting from nuclear testing.

Analysis consists of combusting the samples and measuring released carbon dioxide through liquid scintillation.

Data will be published as it becomes available.

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO  
RESEARCH AND DEVELOPMENT DEPARTMENT  
100 EAST ERIE STREET  
CHICAGO, ILLINOIS 60611

RADIOLOGICAL MONITORING OF THE CHICAGO AREA WATERWAYS  
January - December 1980

The three river systems of the greater Chicago area -- Chicago, Calumet, and Des Plaines -- are under the jurisdiction of the Metropolitan Sanitary District of Greater Chicago (District). They comprise 170 miles (273.6 Km) of waterways. The District maintains a monitoring program of the water quality of these systems with regards to the standards established by the Illinois Pollution Control Board (IPCB) as well as for the purpose of detecting any changes with respect to the water quality of the past and future years. The analyses for total alpha and beta radioactivity have been a part of this overall monitoring program of the river systems since mid-1975. The program is an ongoing activity of the District and this report presents the results for 1980.

Samples for radioactivity were collected in HCl-containing plastic bottles once a month at a predetermined number of locations: 17 on the Chicago River, 12 on the Calumet River, and 18 on the Des Plaines River.

A 500 ml aliquot of a water sample was evaporated to approximately 20 ml, transferred into an evaporating dish, evaporated to dryness, and flamed until no vapors were given off. The remaining solids were scraped loose, ground with a pestle, and then transferred into a counting planchet. A couple of drops

of carbon tetrachloride were added to help evenly spread the solids. Subsequently, the samples were counted 100 minutes for total alpha and 100 minutes for total beta activity by the use of a Beckman Widebeta II proportional counter which was previously calibrated with radium-226 and cesium-137, respectively, for total alpha and total beta determinations.

The results of the determinations for the year 1980 are tabulated in Tables 1-3 in terms of the number of samples analyzed, the yearly low, high, and average ( $\bar{x}$ ) total alpha and total beta concentration for each sampling location; the reported error is given by

$$e = 1.96 S_{\bar{x}}$$

where  $S_{\bar{x}}$  is the standard error of the average net activity.

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 1

CHICAGO RIVER SYSTEM  
TOTAL ALPHA AND BETA CONCENTRATION IN WATER  
January-December 1980

STATION	#SAMPLES ANALYZED	TOTAL ALPHA pCi/l				#SAMPLES ANALYZED	TOTAL BETA pCi/l			
		LOW	HIGH	AVERAGE	*ERROR		LOW	HIGH	AVERAGE	*ERROR
County Line Road, West Fork, North Branch, Chicago River	12	0.00	0.75	0.36	0.15	12	7.58	22.06	14.63	0.51
County Line Road, Middle Fork, North Branch, Chicago River	9	0.20	1.55	0.64	0.17	8	6.38	18.98	10.34	0.52
County Line Road, Skokie River	11	0.37	1.44	0.66	0.20	11	6.73	23.26	14.72	0.53
Dempster St., North Branch, Chicago River	9	0.00	0.79	0.36	0.13	9	0.23	13.63	6.94	0.41
Central Ave., North Shore Channel	9	0.00	1.05	0.27	0.12	8	2.14	13.33	5.63	0.42
Touhy Avenue, North Shore Channel	11	0.00	0.54	0.23	0.12	11	4.71	13.82	9.29	0.44
Wilson Ave., North Branch, Chicago River	12	0.08	0.64	0.35	0.12	12	6.28	15.20	10.80	0.44
Diversey Ave. North Branch, Chicago River	12	0.12	1.06	0.52	0.13	12	8.81	14.37	11.39	0.45
Grand Ave., North Branch, Chicago River	12	0.00	0.69	0.26	0.12	11	6.03	14.27	10.48	0.46
Outer Drive Bridge, Chicago River	11	0.00	0.21	0.06	0.08	11	0.60	7.60	3.90	0.33
Madison St., South Branch, Chicago River	12	0.00	0.89	0.20	0.10	11	4.59	11.37	7.97	0.41
Damen Avenue, South Branch, Chicago River	12	0.03	0.90	0.32	0.11	12	5.74	12.47	8.71	0.41
Cicero Ave., Chicago Sanitary & Ship Canal	12	0.00	0.89	0.33	0.11	12	5.19	12.94	8.58	0.40
Harlem Ave., Chicago Sanitary & Ship Canal	12	0.00	0.49	0.11	0.10	12	6.59	13.38	9.79	0.42



TABLE 1 (Continued)  
 CHICAGO RIVER SYSTEM  
 TOTAL ALPHA AND BETA CONCENTRATION IN WATER  
 January-December 1980

STATION	#SAMPLES ANALYZED	TOTAL ALPHA pCi/l				#SAMPLES ANALYZED	TOTAL BETA pCi/l			
		LOW	HIGH	AVERAGE	*ERROR		LOW	HIGH	AVERAGE	*ERROR
Route 83, Chicago Sanitary & Ship Canal	12	0.00	0.66	0.23	0.11	12	7.47	13.90	10.32	0.43
Stephens St., Chicago Sanitary & Ship Canal	11	0.00	0.44	0.24	0.12	11	8.14	15.55	11.58	0.48
16th St., Chicago Sanitary & Ship Canal	9	0.13	0.74	0.33	0.14	11	6.30	17.30	11.25	0.47

\*ERROR (e) = 1.96  $S_{\bar{x}}$  where  $S_{\bar{x}}$  is the standard error of the average net activity.

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 2

CALUMET RIVER SYSTEM  
TOTAL ALPHA AND BETA CONCENTRATION IN WATER  
January - December 1980

STATION	#SAMPLES ANALYZED	LOW	TOTAL ALPHA HIGH	pCi/l AVERAGE	*ERROR	#SAMPLES ANALYZED	LOW	TOTAL BETA HIGH	pCi/l AVERAGE	*ERROR
Ewing Ave., Calumet River	11	0.02	0.24	0.14	0.08	12	2.44	5.59	4.54	0.32
Wolf Lake, Burnham Ave., (Overflow Ditch)	9	0.03	0.32	0.16	0.10	11	4.95	8.12	7.14	0.37
Indiana Harbor Belt RR Bridge, Grand Calumet River	11	0.05	1.13	0.40	0.20	12	10.83	19.54	15.01	0.53
Wentworth Ave., Little Calumet River	10	0.07	1.39	0.56	0.20	10	10.39	23.63	16.22	0.57
Joe Orr Road, Thorn Creek	12	0.00	3.06	0.80	0.33	12	11.37	34.73	24.20	0.68
130th St., Calumet River	12	0.00	0.46	0.21	0.10	12	3.50	17.82	9.91	0.40
Indiana Ave. @ 135th St., Little Calumet River	11	0.04	0.87	0.38	0.14	10	6.48	18.46	11.92	0.50
Halsted St., Little Calumet River	11	0.16	1.05	0.49	0.16	11	6.92	23.79	15.57	0.54
Ashland Ave. near 135th St., Little Calumet River	10	0.27	1.86	0.70	0.24	10	10.51	27.32	16.44	0.60
Ashland Ave., Cal-Sag Channel	11	0.11	1.50	0.61	0.17	12	4.32	27.02	14.71	0.50
Cicero Ave., Cal-Sag Channel	12	0.03	1.23	0.50	0.15	12	4.20	22.23	14.43	0.50
Route 83 Bridge, Cal-Sag Channel	12	0.16	1.53	0.50	0.15	12	7.58	22.53	14.11	0.50

\*ERROR (e) = 1.96  $S_{\bar{x}}$  where  $S_{\bar{x}}$  is the standard error of the average net activity.

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 3

DES PLAINES RIVER SYSTEM  
TOTAL ALPHA AND BETA CONCENTRATION IN WATER  
January - December 1980

STATION	#SAMPLES ANALYZED	LOW	TOTAL ALPHA HIGH	pCi/l AVERAGE	*ERROR	#SAMPLES ANALYZED	LOW	TOTAL BETA HIGH	pCi/l AVERAGE	*ERROR
Longmeadow Lane, upstream of Hanover Park Treatment Plant, Du Page River	12	0.31	5.25	1.74	0.32	12	9.60	67.79	24.84	0.71
Lake St., downstream of Hanover Park Treatment Plant, Du Page River	12	0.34	2.16	1.23	0.22	11	12.31	32.06	21.03	0.63
Elmhurst Road, upstream of O'Hare Treatment Plant, Higgins Creek	11	0.17	1.36	0.72	0.18	11	8.30	18.44	12.93	0.50
Wille Road, downstream of O'Hare Treatment Plant, Higgins Creek	11	0.60	1.62	0.91	0.22	10	6.90	25.95	18.48	0.63
Higgins Road, upstream of Egan Treatment Plant, Salt Creek	9	0.45	1.24	0.93	0.20	9	10.30	19.43	13.19	0.55
Arlington Heights Road, downstream of Egan Treatment Plant, Salt Creek	12	0.35	1.93	1.04	0.22	12	9.95	28.89	18.26	0.58
Devon Ave., Salt Creek	12	0.26	1.94	1.13	0.23	12	10.75	29.14	19.70	0.60
County Line Road, Des Plaines River	11	0.18	1.53	0.68	0.18	10	10.72	18.77	14.74	0.56
County Line Road, Buffalo Creek	11	0.00	5.59	1.27	0.21	10	9.71	71.34	19.82	0.63
Oakton St., Des Plaines River	10	0.00	1.39	0.62	0.17	11	10.93	20.15	15.46	0.55
Belmont Ave., Des Plaines River	11	0.06	2.38	0.91	0.21	11	11.80	30.73	17.33	0.57
Roosevelt Road, Des Plaines River	11	0.21	1.58	0.71	0.19	10	11.55	19.59	14.84	0.56

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 3 (Continued)

DES PLAINES RIVER SYSTEM  
TOTAL ALPHA AND BETA CONCENTRATION IN WATER  
January - December 1980

STATION	#SAMPLES ANALYZED	TOTAL ALPHA pCi/l				#SAMPLES ANALYZED	TOTAL BETA pCi/l			
		LOW	HIGH	AVERAGE	*ERROR		LOW	HIGH	AVERAGE	*ERROR
Wolf Road, Salt Creek	12	0.00	2.29	1.14	0.26	12	12.46	34.19	22.02	0.63
First Ave., Salt Creek	11	0.31	1.84	1.01	0.24	11	14.24	25.69	19.79	0.62
Jgden Ave., Des Plaines River	11	0.27	1.72	0.94	0.21	11	11.99	19.05	15.30	0.55
Willow Springs Road, Des Plaines River	11	0.11	1.28	0.68	0.20	11	11.01	21.14	14.96	0.55
Stephens St., Des Plaines River	11	0.00	1.81	0.89	0.23	11	11.52	24.57	16.47	0.57
Chicago-Elgin Rd., Poplar Creek	9	0.24	0.86	0.49	0.17	9	8.63	14.91	11.35	0.53

\*ERROR (e) =  $1.96 S_{\bar{x}}$  where  $S_{\bar{x}}$  is the standard error of the average net activity.

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO  
RESEARCH AND DEVELOPMENT DEPARTMENT  
100 EAST ERIE STREET  
CHICAGO, ILLINOIS 60611

RADIOLOGICAL MONITORING OF THE CHICAGO AREA WATERWAYS  
1981 AND 1982

The three river systems of the greater Chicago area -- Chicago, Calumet, and Des Plaines -- are under the jurisdiction of the Metropolitan Sanitary District of Greater Chicago (District). They comprise 170 miles (273.6 Km) of waterways. The District maintains a monitoring program of the water quality of these systems with regards to the standards established by the Illinois Pollution Control Board (IPCB) as well as for the purpose of detecting any changes with respect to the water quality of the past and future years. The analyses for total alpha and beta radioactivity have been a part of this overall monitoring program of the river systems since mid-1975. The program is an ongoing activity of the District and this report presents the results for 1981 and 1982.

Samples for radioactivity were collected in (HCl-containing plastic bottles) once a month at a predetermined number of locations: 17 on the Chicago River, 12 on the Calumet River, and 18 on the Des Plaines River.

A 500 ml aliquot of a water sample was evaporated to approximately 20 ml, transferred into an evaporating dish, evaporated to dryness, and flamed until no vapors were given

off. The remaining solids were scraped loose, ground with a pestle, and then transferred into a counting planchet. A couple of drops of carbon tetrachloride were added to help evenly spread the solids. Subsequently, the samples were counted 100 minutes for total alpha and 100 minutes for total beta activity by the use of a Beckman Widebeta II proportional counter which was previously calibrated with radium-226 and cesium-137, respectively, for total alpha and total beta determinations.

The results of the determinations for the years 1981 and 1982 are tabulated in Tables 1-3 and 4-6, respectively. The results are presented in terms of the number of samples analyzed, the yearly low, high, and average ( $\bar{x}$ ) total alpha and total beta concentration for each sampling location; the reported error is given by

$$e = 1.96 S_{\bar{x}}$$

where  $S_{\bar{x}}$  is the standard error of the average net activity.

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 1

CHICAGO RIVER SYSTEM  
TOTAL ALPHA AND BETA CONCENTRATION IN WATER  
January - December 1981

STATION	TOTAL ALPHA pCi/l					TOTAL BETA pCi/l				
	#SAMPLES ANALYZED	LOW	HIGH	AVERAGE	*ERROR	#SAMPLES ANALYZED	LOW	HIGH	AVERAGE	*ERROR
County Line Road, West Fork, North Branch, Chicasso River	12	0.00	1.14	0.37	0.25	12	10.24	23.47	16.23	0.49
County Line Road, Middle Fork, North Branch, Chicasso River	10	0.00	1.24	0.39	0.22	10	7.81	15.46	10.73	0.46
County Line Road, Skokie River	12	0.00	0.90	0.33	0.20	12	7.76	12.74	10.75	0.41
Dempster St., North Branch, Chicasso River	10	0.00	0.47	0.16	0.13	10	4.46	12.06	6.15	0.38
Central Ave., North Shore Channel	10	0.00	0.62	0.17	0.16	10	3.62	11.43	5.81	0.45
Touhy Avenue, North Shore Channel	11	0.00	0.41	0.16	0.15	12	4.66	11.05	9.13	0.39
Wilson Ave., North Branch, Chicasso River	12	0.00	0.81	0.32	0.17	12	9.36	12.49	10.64	0.41
Diversey Ave., North Branch, Chicasso River	11	0.00	0.69	0.24	0.19	12	7.10	13.27	10.73	0.41
Grand Ave., North Branch, Chicasso River	11	0.00	0.44	0.18	0.17	10	6.61	11.91	9.95	0.43
Outer Drive Bridge, Chicasso River	10	0.00	0.37	0.15	0.14	10	4.04	6.60	4.84	0.36
Madison St., South Branch, Chicasso River	10	0.00	1.09	0.32	0.15	10	6.38	9.84	7.73	0.41
Damen Avenue, South Branch, Chicasso River	12	0.00	0.52	0.24	0.14	12	5.53	11.24	8.27	0.38
Cicero Ave., Chicasso Sanitary & Ship Canal	12	0.00	0.51	0.26	0.15	11	4.89	11.70	8.36	0.40
Harlem Ave., Chicasso Sanitary & Ship Canal	10	0.00	0.44	0.21	0.17	12	7.32	12.94	9.81	0.40

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 1 (Continued)

CHICAGO RIVER SYSTEM  
TOTAL ALPHA AND BETA CONCENTRATION IN WATER  
January - December 1981

STATION	#SAMPLES ANALYZED	TOTAL ALPHA pCi/l				#SAMPLES ANALYZED	TOTAL BETA pCi/l			
		LOW	HIGH	AVERAGE	*ERROR		LOW	HIGH	AVERAGE	*ERROR
Route 83, Chicago Sanitary & Ship Canal	12	0.00	1.63	0.28	0.15	12	4.88	13.77	9.91	0.40
Stephens St., Chicago Sanitary & Ship Canal	12	0.00	0.72	0.27	0.17	12	7.50	13.48	10.63	0.41
16th St., Chicago Sanitary & Ship Canal	12	0.00	0.82	0.28	0.16	12	6.89	13.04	10.19	0.41

\*ERROR (e) = 1.96  $S_{\bar{x}}$  where  $S_{\bar{x}}$  is the standard error of the average net activity.



THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 2

CALUMET RIVER SYSTEM  
TOTAL ALPHA AND BETA CONCENTRATION IN WATER  
January - December 1981

STATION	#SAMPLES ANALYZED	LOW	TOTAL ALPHA pCi/l HIGH	AVERAGE	*ERROR	#SAMPLES ANALYZED	LOW	TOTAL BETA pCi/l HIGH	AVERAGE	*ERROR
Ewins Ave., Calumet River	11	0.00	0.54	0.11	0.12	11	3.57	5.80	4.77	0.37
Wolf Lake, Burnham Ave., (Overflow Ditch)	12	0.00	0.79	0.27	0.12	12	4.37	12.16	7.71	0.38
Indiana Harbor Belt RR Bridge, Grand Calumet River	12	0.00	2.63	0.61	0.28	11	11.24	22.78	14.69	0.51
Wentworth Ave., Little Calumet River	11	0.20	2.32	0.92	0.22	11	9.95	26.39	14.31	0.49
Joe Orr Road, Thorn Creek	12	0.00	3.22	0.94	0.46	12	14.81	25.97	20.01	0.58
130th St., Calumet River	11	0.00	0.68	0.28	0.14	11	5.31	12.86	9.20	0.42
Indiana Ave. @ 135th St., Little Calumet River	11	0.00	0.37	0.22	0.15	11	6.89	12.50	9.97	0.42
Halsted St., Little Calumet River	12	0.00	1.74	0.54	0.21	12	7.15	16.37	13.07	0.45
Ashland Ave. near 135th St., Little Calumet River	11	0.06	1.85	0.71	0.26	11	10.33	26.54	15.59	0.51
Ashland Ave., Cal-Sas Channel	11	0.04	1.62	0.47	0.21	12	6.29	23.92	14.38	0.47
Cicero Ave., Cal-Sas Channel	12	0.00	2.31	0.48	0.22	12	6.95	22.54	13.46	0.45
Route 83 Bridge, Cal-Sas Channel	12	0.09	3.11	0.66	0.23	12	8.59	27.97	14.53	0.47

\*ERROR (e) = 1.96  $S_{\bar{x}}$  where  $S_{\bar{x}}$  is the standard error of the average net activity.

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 3

DES PLAINES RIVER SYSTEM  
TOTAL ALPHA AND BETA CONCENTRATION IN WATER  
January - December 1981

STATION	#SAMPLES ANALYZED	LOW	TOTAL ALPHA HIGH	pCi/1 AVERAGE	*ERROR	#SAMPLES ANALYZED	LOW	TOTAL BETA HIGH	pCi/1 AVERAGE	*ERROR
Longmeadow Lane, upstream of Hanover Park Treatment Plant, Du Page River	10	0.20	1.96	0.90	0.25	10	10.25	24.56	15.07	0.53
Lake St., downstream of Hanover Park Treatment Plant, Du Page River	12	0.00	4.40	1.40	0.32	12	13.88	32.58	19.95	0.55
Elmhurst Road, upstream of O'Hare Treatment Plant, Missins Creek	10	0.08	1.20	0.51	0.22	10	7.51	18.45	11.33	0.47
Wille Road, downstream of O'Hare Treatment Plant, Missins Creek	12	0.00	1.57	0.81	0.30	12	9.06	29.14	18.98	0.54
Missins Road, upstream of Esan Treatment Plant, Salt Creek	10	0.00	1.02	0.50	0.21	9	8.11	16.68	11.03	0.49
Arlington Heights Road, downstream of Esan Treatment Plant, Salt Creek	12	0.00	2.39	0.64	0.27	12	10.36	24.86	16.40	0.50
Devon Ave., Salt Creek	12	0.00	3.17	1.14	0.30	12	0.00	28.67	16.72	0.51
County Line Road, Des Plaines River	10	0.10	1.16	0.49	0.22	10	0.00	18.38	11.01	0.46
County Line Road, Buffalo Creek	10	0.31	1.78	0.88	0.24	9	7.35	20.36	13.40	0.58
Oakton St., Des Plaines River	9	0.05	1.32	0.80	0.25	10	8.84	19.30	13.47	0.50
Belmont Ave., Des Plaines River	12	0.04	1.52	0.59	0.23	12	9.30	24.49	14.15	0.47
Roosevelt Road, Des Plaines River	10	0.21	1.28	0.75	0.23	10	0.00	19.93	11.88	0.48

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 3 (Continued)

DES PLAINES RIVER SYSTEM  
TOTAL ALPHA AND BETA CONCENTRATION IN WATER  
January - December 1981

STATION	#SAMPLES ANALYZED	TOTAL ALPHA pCi/l				#SAMPLES ANALYZED	TOTAL BETA pCi/l			
		LOW	HIGH	AVERAGE	*ERROR		LOW	HIGH	AVERAGE	*ERROR
Wolf Road, Salt Creek	11	0.20	2.69	1.16	0.31	11	0.00	28.02	15.85	0.52
First Ave., Salt Creek	10	0.32	2.52	1.34	0.29	10	10.20	24.80	17.46	0.56
Osdan Ave., Des Plaines River	9	0.31	1.76	0.73	0.24	10	11.70	27.92	16.13	0.54
Willow Springs Road, Des Plaines River	10	0.00	1.02	0.49	0.23	10	9.99	16.76	14.18	0.51
Stephens St., Des Plaines River	10	0.11	2.13	0.88	0.24	10	8.60	19.97	14.38	0.51
Chicago-Elsin Rd., Poplar Creek	10	0.07	0.80	0.47	0.20	10	8.29	16.53	10.72	0.47

\*ERROR (e) = 1.96  $S_x$  where  $S_x$  is the standard error of the average net activity.

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 4

CHICAGO RIVER SYSTEM  
TOTAL ALPHA AND BETA CONCENTRATION IN WATER  
January-December 1982

STATION	#SAMPLES ANALYZED	TOTAL ALPHA pCi/l				#SAMPLES ANALYZED	TOTAL BETA pCi/l			
		LOW	HIGH	AVERAGE	*ERROR		LOW	HIGH	AVERAGE	*ERROR
County Line Road, West Fork, North Branch, Chicago River	12	0.05	0.95	0.31	0.13	12	8.46	25.66	15.44	0.46
County Line Road, Middle Fork, North Branch, Chicago River	9	0.04	0.85	0.34	0.10	9	6.22	13.74	8.56	0.41
County Line Road, Skokie River	12	0.00	0.90	0.35	0.10	12	3.64	13.26	9.78	0.38
Dempster St., North Branch, Chicago River	9	0.00	0.58	0.18	0.08	8	3.57	11.66	7.37	0.42
Central Ave., North Shore Channel	9	0.00	0.47	0.12	0.06	9	2.99	7.38	4.44	0.34
Touhy Avenue, North Shore Channel	12	0.00	0.92	0.24	0.09	11	5.24	11.62	8.82	0.39
Wilson Ave., North Branch, Chicago River	12	0.00	0.58	0.22	0.09	12	5.98	12.62	9.42	0.38
Diversey Ave., North Branch, Chicago River	12	0.00	0.73	0.32	0.09	12	8.19	12.14	10.03	0.38
Grand Ave., North Branch, Chicago River	12	0.00	2.15	0.42	0.10	12	6.09	23.61	9.70	0.38
Outer Drive Bridge, Chicago River	12	0.00	0.63	0.16	0.06	12	2.90	16.60	5.86	0.32
Madison St., South Branch, Chicago River	12	0.03	0.22	0.13	0.07	12	4.78	15.69	8.19	0.35
Damen Avenue, South Branch, Chicago River	12	0.00	1.85	0.34	0.08	12	3.95	10.10	6.76	0.34
Cicero Ave., Chicago Sanitary & Ship Canal	12	0.00	1.12	0.31	0.09	12	4.92	14.17	7.86	0.36
Harlem Ave., Chicago Sanitary & Ship Canal	12	0.00	0.31	0.12	0.07	12	5.84	11.04	8.00	0.35

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 4 (Continued)

CHICAGO RIVER SYSTEM  
TOTAL ALPHA AND BETA CONCENTRATION IN WATER  
January-December 1982

STATION	#SAMPLES ANALYZED	TOTAL ALPHA pCi/l				#SAMPLES ANALYZED	TOTAL BETA pCi/l			
		LOW	HIGH	AVERAGE	*ERROR		LOW	HIGH	AVERAGE	*ERROR
Route 83, Chicasso Sanitary & Ship Canal	12	0.00	0.35	0.12	0.07	12	5.87	12.55	8.26	0.36
Stephens St., Chicasso Sanitary & Ship Canal	12	0.00	0.72	0.33	0.09	12	6.36	12.53	9.46	0.37
16th St., Chicasso Sanitary & Ship Canal	11	0.00	0.80	0.31	0.09	12	7.12	13.05	10.27	0.38

\*ERROR (e) = 1.96  $S_{\bar{x}}$  where  $S_{\bar{x}}$  is the standard error of the average net activity.

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 5

CALUMET RIVER SYSTEM  
TOTAL ALPHA AND BETA CONCENTRATION IN WATER  
January-December 1982

STATION	#SAMPLES ANALYZED	TOTAL ALPHA pCi/l				#SAMPLES ANALYZED	TOTAL BETA pCi/l			
		LOW	HIGH	AVERAGE	*ERROR		LOW	HIGH	AVERAGE	*ERROR
Ewing Ave., Calumet River	10	0.00	3.10	0.60	0.10	10	2.46	7.34	4.74	0.35
Wolf Lake, Burnham Ave., (Overflow Ditch)	11	0.00	2.95	0.47	0.08	11	4.44	8.09	5.75	0.33
Indiana Harbor Belt RR Bridge, Grand Calumet River	9	0.06	1.30	0.39	0.14	9	11.43	19.01	13.65	0.50
Wentworth Ave., Little Calumet River	10	0.00	2.84	0.89	0.16	10	9.12	29.18	13.76	0.47
Joe Orr Road, Thorn Creek	12	0.00	2.15	0.80	0.28	12	12.45	26.18	19.32	0.55
130th St., Calumet River	10	0.00	1.43	0.41	0.09	9	4.62	12.11	7.76	0.41
Indiana Ave. @ 135th St., Little Calumet River	10	0.06	2.18	0.61	0.11	8	5.46	14.97	9.09	0.45
Halsted St., Little Calumet River	12	0.00	2.76	0.83	0.12	12	0.00	16.04	11.70	0.40
Ashland Ave. near 135th St., Little Calumet River	9	0.00	1.40	0.58	0.17	10	10.76	21.70	13.96	0.49
Ashland Ave., Cal-Sas Channel	12	0.00	1.27	0.49	0.11	12	7.42	15.00	11.36	0.40
Cicero Ave., Cal-Sas Channel	12	0.00	1.20	0.44	0.10	12	7.24	16.35	11.75	0.40
Route 83 Bridge, Cal-Sas Channel	9	0.00	2.62	0.70	0.13	10	6.54	22.06	12.28	0.45

\*ERROR (e) = 1.96  $S_{\bar{x}}$  where  $S_{\bar{x}}$  is the standard error of the average net activity.

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 6

DES PLAINES RIVER SYSTEM  
TOTAL ALPHA AND BETA CONCENTRATION IN WATER  
January-December 1982

STATION	#SAMPLES ANALYZED	LOW	TOTAL ALPHA HIGH	PCi/1 AVERAGE	*ERROR	#SAMPLES ANALYZED	LOW	TOTAL BETA HIGH	PCi/1 AVERAGE	*ERROR
Lonsmeadow Lane, upstream of Hanover Park Treatment Plant, Du Page River	9	0.00	1.27	0.73	0.16	9	7.59	23.03	13.86	0.51
Lake St., downstream of Hanover Park Treatment Plant, Du Page River	12	0.05	2.02	0.91	0.17	12	9.32	30.21	18.15	0.50
Elmhurst Road, upstream of O'Hare Treatment Plant, Hissins Creek	9	0.00	1.26	0.38	0.12	9	5.41	14.30	8.70	0.43
Wille Road, downstream of O'Hare Treatment Plant, Hissins Creek	12	0.00	1.01	0.50	0.15	12	5.25	27.09	17.21	0.49
Hissins Road, upstream of Esan Treatment Plant, Salt Creek	9	0.17	0.84	0.55	0.13	9	6.49	17.26	10.04	0.44
Arlinston Heights Road, downstream of Esan Treatment Plant, Salt Creek	12	0.13	1.99	0.71	0.15	12	8.40	22.42	14.73	0.46
Devon Ave., Salt Creek	12	0.36	1.51	0.81	0.16	12	6.35	28.50	16.78	0.48
County Line Road, Des Plaines River	10	0.00	1.02	0.38	0.11	10	7.13	13.92	10.86	0.43
County Line Road, Buffalo Creek	9	0.52	0.94	0.72	0.14	9	7.24	14.53	11.74	0.47
Oakton St., Des Plaines River	10	0.08	0.68	0.42	0.12	10	9.46	13.96	11.82	0.44
Belmont Ave., Des Plaines River	10	0.23	1.31	0.48	0.13	10	8.13	21.82	13.35	0.47
Roosevelt Road, Des Plaines River	10	0.00	0.52	0.26	0.11	10	7.02	18.29	11.85	0.44

THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

TABLE 6 (Continued)

DES PLAINES RIVER SYSTEM  
TOTAL ALPHA AND BETA CONCENTRATION IN WATER  
January-December 1982

STATION	#SAMPLES ANALYZED	TOTAL ALPHA pCi/l				TOTAL BETA pCi/l				
		LOW	HIGH	AVERAGE	*ERROR	LOW	HIGH	AVERAGE	*ERROR	
Wolf Road, Salt Creek	10	0.06	1.60	0.71	0.19	10	10.09	31.63	17.74	0.54
First Ave., Salt Creek	10	0.00	0.88	0.53	0.16	10	10.50	22.98	15.60	0.51
Ogden Ave., Des Plaines River	10	0.08	1.07	0.44	0.13	10	8.77	19.44	12.54	0.46
Willow Springs Road, Des Plaines River	9	0.14	1.19	0.59	0.15	9	8.92	19.34	13.33	0.49
Stephens St., Des Plaines River	10	0.33	2.19	0.89	0.17	10	9.30	23.25	14.12	0.48
Chicasso-Elsin Rd., Poplar Creek	9	0.00	0.85	0.34	0.11	9	5.57	21.30	9.20	0.43

\*ERROR (e) = 1.96  $S_{\bar{x}}$  where  $S_{\bar{x}}$  is the standard error of the average net activity.



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