United States
Environmental Protection
Agency
Office of Radiation Programs

Eastern Environmental
Radiation Facility
1890 Federal Drive
Montgomery, AL 36109

EPA 520/5-88-058
December 1988

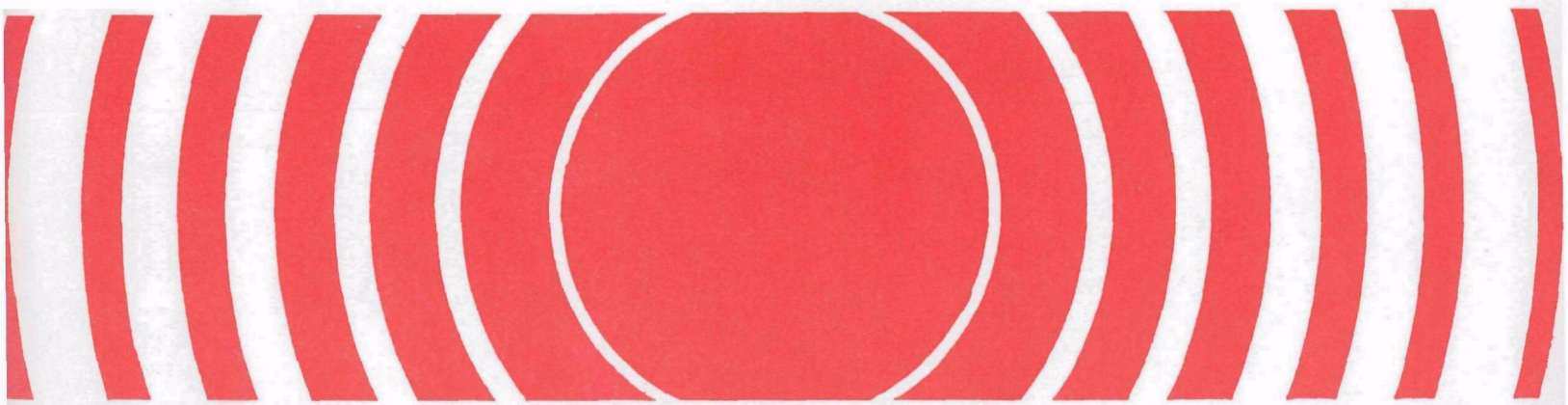
Radiation

EPA

Environmental Radiation Data

Report 54

April - June 1988



ENVIRONMENTAL RADIATION DATA

REPORT 54

April - June 1988

United States Environmental Protection Agency

Office of Radiation Programs

Environmental Radiation Data (ERD) is compiled and distributed quarterly by the Office of Radiation Programs' Eastern Environmental Radiation Facility (EERF) in Montgomery, Alabama, and contains data from the Environmental Radiation Ambient Monitoring System (ERAMS). Data from 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 upon 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 routine and accidental releases into the environment from stationary sources.

The radiochemical procedures used by the EERF to analyze the ERAMS samples are contained in *Eastern Environmental Radiation Facility Radiochemistry Procedures Manual* (EPA 520/5–84–006). Station operation and sample collection are in accordance with procedures contained in the *ERAMS Manual* (EPA 520/5–84–007, 008, 009).

Environmental Radiation Data

Contents

Environmental Radiation Data

List of Tables

DATA - Reporting Rationale and Procedures

In 1973, the U.S. Environmental Protection Agency's Office of Radiation Programs established the Environmental Radiation Ambient Monitoring System (ERAMS) to provide continuous, accurate, and usable environmental radiation data to the public. For completeness, ERAMS data for all specific radionuclide analyses are reported as the calculated results indicate, whether the numbers are negative, zero, or positive.

Reporting Rationale

Frequently, there is little or no radioactivity in environmental media. Thus, the results of laboratory analyses should statistically show a distribution of negative and positive numbers about zero. A negative value occurs when a previously determined background value is subtracted from a sample value that is less than that of the background. 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 has no physical significance. Such numbers, however, are significant when taken together with other observations that indicate that the true value of a distribution is near zero. When an average of many measurements produces a result significantly less than zero, this indicates a bias in the measurement procedure.

(1) *Reported Values*

Specific Analyses. All specific radionuclide analyses will be reported as the counting results indicate, whether the value is negative, zero, or positive. All reported values are corrected for radioactive decay to the 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 2σ confidence level, then $<$ minimum detectable level will be reported.

MDL is defined as the 3σ error of the background. A tabulation of typical 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 2σ (95%) confidence interval. 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*

No more than three significant figures will be reported. If a datum contains more than three figures, it will be rounded off to three figures.

(4) *Reporting Levels*

The reporting units, smallest increments for reporting, and typical minimum detectable levels for each isotope are shown in Table 1. Reporting 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

Radionuclide	Media	Reporting Units	Reporting Increments	Minimum Detectable Levels
Gross Alpha	Water	pCi/l	1 pCi/l	2 pCi/l
† Gross Beta	Air	pCi/m^3	0.01 pCi/m^3	0.01 pCi/m^3
	Water	pCi/l	1 pCi/l	1 pCi/l
	Precipitation	nCi/m^2	0.01 nCi/m^2	0.01 nCi/m^2
	(specific radiochemical analyses)			
Tritium	Water	nCi/l	0.1 nCi/l	0.2 nCi/l
	Milk	nCi/l	0.1 nCi/l	0.2 nCi/l
Carbon-14	Milk	pCi/l	1 pCi/l	15 pCi/l
Krypton-85	Ambient Air	pCi/m^3	0.1 pCi/m^3	2 pCi/m^3
†† Plutonium-238,239,240	Air	aCi/m^3	0.1 aCi/m^3	0.015 pCi
	Milk	pCi/l	0.001 pCi/l	0.015 pCi
	Water	pCi/l	0.001 pCi/l	0.015 pCi
‡ Uranium-234,235,238	Air	aCi/m^3	0.1 aCi/m^3	0.015 pCi
	Milk	pCi/l	0.001 pCi/l	0.015 pCi
	Water	pCi/l	0.001 pCi/l	0.015 pCi
Radium-226	Water	pCi/l	0.1 pCi/l	0.1 pCi/l
Strontium-90	Milk	pCi/l	0.1 pCi/l	1 pCi/l
	Water	pCi/l	0.1 pCi/l	1 pCi/l
‡‡ Strontium-89	Milk	pCi/l	1 pCi/l	5 pCi/l
‡‡ Iodine-131	Milk	pCi/l	1 pCi/l	10 pCi/l
	Water	pCi/l	1 pCi/l	10 pCi/l
	Water	pCi/l	0.1 pCi/l	0.4 pCi/l
Iodine-129	Milk	fCi/l	0.1 fCi/l	0.4 fCi/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
	Water	pCi/l	1 pCi/l	10 pCi/l
Potassium	Milk	g/l	0.1 g/l	0.12 g/l
	Water	g/l	0.1 g/l	0.12 g/l
Potassium-40	Water	pCi/l	1 pCi/l	100 pCi/l

† The value of MDL for precipitation in terms of nCi/m^3 would be dependent on precipitation (mm).

†† This value of MDL for air in terms of pCi/m^3 would be dependent on the air volume. Measurement by alpha spectroscopy that includes contributions of plutonium-239 and plutonium-240. MDL for all media given per sample.

‡ This value of MDL for air in terms of pCi/m^3 would be dependent on the air volume. MDL for all media given per sample.

‡‡ Activity as of the day of counting.

ENVIRONMENTAL RADIATION AMBIENT MONITORING SYSTEM (ERAMS)

Section 1. 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.

Filters (10-cm diameter synthetic fiber) from air samplers are changed twice weekly and field measurements are made with a G-M survey meter [1] 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 gross beta counts greater than 1 pCi/m^3. The laboratory obtained values are usually lower than the field estimates due to the decay of naturally occurring radionuclides between the times of the two measurements.

Precipitation samples are collected at those field stations collecting air filters. These samples are also sent to EERF where they are composited monthly for gamma scans, tritium, and gross beta activity measurements. A composite of the March, April, and May precipitation samples is analyzed for plutonium-238, -239, -240, and uranium-234, -235, and -238.

A compilation of individual measurements is available from the Eastern Environmental Radiation Facility, 1890 Congressman W.L. Dickinson Drive, Montgomery, AL 36109.

Tables 2-4 contain the data in airborne particulate samples for April June 1988. Tables 5-7 contain the data in precipitation sample for April June 1988. Table 8 contains the data for tritium in precipitation samples for April June 1988 at the selected sites.

---

[1] The counts at five hours for the Montgomery, Alabama, station are performed on a low background beta counter.

Table 2

Airborne Particulates
Gross Beta Concentrations

April 1988

Location	Number of Samples	5-Hour Field Estimate (pCi/m^3)			EERF Lab Measurment (pCi/m^3)		
		Max	Min	Avg	Max	Min	Avg
AL:MONTGOMERY	9	0.9	0.1	0.3	0.03	0.01	0.02
AR:LITTLE ROCK	9	0.4	0.1	0.3	0.01	0.01	0.01
AZ:PHOENIX	6	0.9	0.2	0.6	0.02	0.01	0.01
CA:BERKELEY	9	0.0	0.0	0.0	0.01	0.00	0.00
CA:LOS ANGELES	8	0.3	0.0	0.2	0.03	0.00	0.01
CO:DENVER	8	1.1	0.3	0.6	0.01	0.01	0.01
CT:HARTFORD	8	0.1	0.0	0.1	0.01	0.00	0.01
DE:WILMINGTON	8	0.2	0.0	0.1	0.01	0.00	0.01
FL:JACKSONVILLE	9	0.1	0.0	0.1	0.01	0.01	0.01
FL:MIAMI	9	0.1	0.0	0.0	0.01	0.01	0.01
GA:ATLANTA	3	0.4	0.3	0.4	0.01	0.01	0.01
HI:HONOLULU	6	0.2	0.1	0.2	0.01	0.00	0.00
IA:IOWA CITY	8	0.8	0.1	0.3	0.02	0.01	0.01
ID:BOISE	8	0.5	0.3	0.4	0.04	0.00	0.01
ID:IDAHO FALLS	9	0.0	0.0	0.0	0.02	0.00	0.01
IL:CHICAGO	7	0.3	0.0	0.2	0.02	0.01	0.01
IN:INDIANAPOLIS	8	0.6	0.1	0.3	0.02	0.00	0.01
KS:TOPEKA	8	2.4	0.3	1.1	0.02	0.01	0.01
KY:FRANKFORT	4	0.5	0.2	0.3	0.01	0.01	0.01
LA:NEW ORLEANS	4	0.1	0.0	0.1	0.02	0.00	0.01
MA:LAWRENCE	9	0.1	0.0	0.0	0.01	0.00	0.01
ME:AUGUSTA	8	0.1	0.0	0.1	0.01	0.00	0.01
MI:LANSING	8	0.2	0.1	0.1	0.01	0.00	0.01
MN:MINNEAPOLIS	9	0.4	0.1	0.2	0.02	0.01	0.01
MO:JEFFERSON CITY	9	1.6	0.1	0.6	0.01	0.01	0.01
MS:JACKSON	6	0.4	0.1	0.2	0.01	0.00	0.01
NC:CHARLOTTE	8	0.3	0.0	0.1	0.01	0.01	0.01
NC:WILMINGTON	8	0.0	0.0	0.0	0.01	0.00	0.01
ND:BISMARCK	7	1.5	0.3	0.9	0.02	0.01	0.01
NE:LINCOLN	7	1.9	0.0	1.2	0.12	0.01	0.03
NH:CONCORD	9	0.2	0.0	0.1	0.01	0.00	0.01
NJ:TRENTON	8	0.3	0.1	0.2	0.01	0.00	0.01
NM:SANTA FE	9	0.4	0.1	0.3	0.01	0.00	0.01
NV:LAS VEGAS	8	0.3	0.1	0.2	0.02	0.00	0.01
NY:ALBANY	5	0.1	0.0	0.0	0.01	0.01	0.01
NY:NEW YORK CITY	9	0.3	0.0	0.1	0.02	0.00	0.01
NY:NIAGARA FALLS	8	0.2	0.0	0.1	0.01	0.01	0.01

Table 2 (continued)

Airborne Particulates
Gross Beta Concentrations

April 1988

Location	Number of Samples	5-Hour Field Estimate (pCi/m^3)			EERF Lab Measurment (pCi/m^3)		
		Max	Min	Avg	Max	Min	Avg
NY:SYRACUSE	4	0.1	0.0	0.0	0.01	0.01	0.01
NY:YAPHANK	7	0.2	0.0	0.1	0.01	0.00	0.01
OH:COLUMBUS	9	0.6	0.1	0.2	0.01	0.01	0.01
OH:PAINESVILLE	9	0.3	0.0	0.2	0.01	0.01	0.01
OH:TOLEDO	8	0.7	0.0	0.2	0.01	0.01	0.01
OK:OKLAHOMA CITY	8	0.6	0.1	0.4	0.01	0.01	0.01
OR:PORTLAND	9	0.1	0.0	0.0	0.01	0.00	0.01
PA:GOLDSBORO	8	0.4	0.0	0.2	0.01	0.01	0.01
PA:HARRISBURG	8	0.3	0.0	0.2	0.01	0.00	0.01
PA:PHILADELPHIA	3	0.1	0.1	0.1	0.02	0.00	0.01
PA:PITTSBURGH	8	0.1	0.1	0.1	0.01	0.01	0.01
PA:THREE MILE ISLAND	8	0.4	0.1	0.2	0.01	0.00	0.01
RI:PROVIDENCE	9	0.1	0.0	0.0	0.01	0.00	0.01
SC:BARNWELL	2	0.1	0.0	0.1	0.01	0.01	0.01
SC:COLUMBIA	8	0.3	0.1	0.2	0.02	0.00	0.01
SD:PIERRE	9	0.6	0.2	0.4	0.02	0.00	0.01
TN:KNOXVILLE	8	0.4	0.1	0.2	0.01	0.01	0.01
TN:NASHVILLE	7	0.4	0.1	0.2	0.01	0.01	0.01
TX:AUSTIN	7	0.3	0.1	0.2	0.02	0.00	0.01
TX:EL PASO	7	0.6	0.2	0.4	0.03	0.01	0.02
VA:LYNCHBURG	8	0.3	0.2	0.3	0.01	0.00	0.01
WA:OLYMPIA	9	0.2	0.0	0.1	0.01	0.00	0.01
WA:SPOKANE	8	0.4	0.1	0.2	0.02	0.00	0.01
WI:MADISON	8	0.6	0.1	0.4	0.03	0.01	0.01
WV:CHARLESTON	7	0.3	0.0	0.1	0.01	0.01	0.01

Minimum Detectable Limit for field estimates - 0.1 pCi/m^3.
Minimum Detectable Limit for laboratory measurement - 0.01 pCi/m^3.

Table 3

Airborne Particulates
Gross Beta Concentrations

May 1988

Location	Number of Samples	5-Hour Field Estimate (pCi/m^3)			EERF Lab Measurment (pCi/m^3)		
		Max	Min	Avg	Max	Min	Avg
AL:MONTGOMERY	5	0.7	0.1	0.4	0.04	0.01	0.02
AR:LITTLE ROCK	9	0.9	0.3	0.6	0.02	0.01	0.01
AZ:PHOENIX	7	1.6	0.2	0.9	0.05	0.01	0.02
CA:BERKELEY	9	0.0	0.0	0.0	0.01	0.00	0.00
CA:LOS ANGELES	9	0.3	0.0	0.1	0.03	0.00	0.01
CO:DENVER	9	0.7	0.2	0.5	0.02	0.01	0.01
CT:HARTFORD	8	0.1	0.0	0.1	0.01	0.00	0.01
DE:WILMINGTON	9	0.4	0.1	0.2	0.03	0.00	0.01
FL:JACKSONVILLE	8	0.1	0.0	0.1	0.02	0.01	0.01
FL:MIAMI	9	0.1	0.0	0.0	0.01	0.00	0.01
GA:ATLANTA	5	0.6	0.2	0.5	0.02	0.01	0.01
HI:HONOLULU	9	0.2	0.1	0.1	0.01	0.00	0.00
IA:IOWA CITY	9	0.6	0.0	0.2	0.02	0.01	0.01
ID:BOISE	9	1.1	0.1	0.4	0.01	0.01	0.01
ID:IDAHO FALLS	9	0.0	0.0	0.0	0.01	0.01	0.01
IL:CHICAGO	8	0.6	0.0	0.2	0.02	0.01	0.01
IN:INDIANAPOLIS	9	0.7	0.2	0.4	0.05	0.01	0.02
KS:TOPEKA	8	3.3	0.4	1.6	0.02	0.01	0.01
KY:FRANKFORT	4	0.4	0.2	0.3	0.03	0.01	0.02
LA:NEW ORLEANS	3	0.1	0.1	0.1	0.02	0.01	0.02
MA:LAWRENCE	9	0.2	0.0	0.1	0.01	0.00	0.01
ME:AUGUSTA	6	0.1	0.0	0.1	0.01	0.00	0.00
MI:LANSING	9	0.5	0.1	0.3	0.01	0.01	0.01
MN:MINNEAPOLIS	9	0.6	0.0	0.3	0.04	0.01	0.02
MO:JEFFERSON CITY	8	2.0	0.2	0.8	0.02	0.01	0.01
MS:JACKSON	7	0.7	0.1	0.3	0.03	0.01	0.02
NC:CHARLOTTE	9	0.4	0.0	0.2	0.02	0.01	0.01
NC:WILMINGTON	9	0.0	0.0	0.0	0.01	0.01	0.01
ND:BISMARCK	9	1.7	0.3	0.9	0.06	0.01	0.02
NE:LINCOLN	7	2.6	0.5	1.2	0.03	0.01	0.01
NH:CONCORD	9	0.1	0.0	0.1	0.01	0.00	0.00
NJ:TRENTON	9	0.5	0.1	0.2	0.01	0.00	0.01
NM:SANTA FE	8	0.4	0.2	0.3	0.01	0.01	0.01
NV:LAS VEGAS	9	0.2	0.1	0.1	0.02	0.01	0.02
NY:ALBANY	5	0.1	0.0	0.1	0.01	0.01	0.01
NY:NEW YORK CITY	4	0.2	0.0	0.1	0.01	0.00	0.01
NY:NIAGARA FALLS	9	0.9	0.1	0.3	0.05	0.00	0.02

Table 3 (continued)

Airborne Particulates
Gross Beta Concentrations

May 1988

Location	Number of Samples	5-Hour Field Estimate (pCi/m^3)			EERF Lab Measurment (pCi/m^3)		
		Max	Min	Avg	Max	Min	Avg
NY:SYRACUSE	4	1.1	0.0	0.3	0.02	0.00	0.01
NY:YAPHANK	8	0.4	0.1	0.2	0.01	0.00	0.01
OH:COLUMBUS	8	0.5	0.1	0.2	0.01	0.00	0.01
OH:PAINESVILLE	9	0.4	0.1	0.2	0.04	0.01	0.01
OH:TOLEDO	9	0.4	0.1	0.2	0.05	0.01	0.02
OK:OKLAHOMA CITY	9	1.1	0.3	0.5	0.02	0.01	0.01
OR:PORTLAND	9	0.0	0.0	0.0	0.01	0.00	0.00
PA:GOLDSBORO	9	0.8	0.1	0.3	0.02	0.00	0.01
PA:HARRISBURG	9	0.4	0.1	0.2	0.01	0.00	0.01
PA:PHILADELPHIA	7	0.5	0.0	0.2	0.01	0.00	0.01
PA:PITTSBURGH	9	0.0	0.0	0.0	0.02	0.00	0.01
PA:THREE MILE ISLAND	9	0.9	0.0	0.2	0.01	0.00	0.01
RI:PROVIDENCE	9	0.2	0.0	0.1	0.02	0.00	0.01
SC:BARNWELL	2	0.0	0.0	0.0	0.01	0.01	0.01
SC:COLUMBIA	9	0.5	0.1	0.3	0.03	0.01	0.02
SD:PIERRE	9	0.5	0.1	0.3	0.02	0.01	0.01
TN:KNOXVILLE	6	0.4	0.1	0.2	0.01	0.01	0.01
TN:NASHVILLE	8	0.8	0.1	0.4	0.02	0.01	0.01
TX:AUSTIN	8	0.3	0.1	0.2	0.05	0.01	0.02
TX:EL PASO	7	0.6	0.3	0.4	0.02	0.01	0.02
VA:LYNCHBURG	9	0.6	0.0	0.3	0.01	0.00	0.01
WA:OLYMPIA	9	0.1	0.0	0.0	0.01	0.00	0.00
WA:SPOKANE	9	0.4	0.1	0.2	0.01	0.01	0.01
WI:MADISON	9	0.6	0.2	0.4	0.04	0.01	0.02
WV:CHARLESTON	8	0.3	0.2	0.3	0.02	0.01	0.01

Minimum Detectable Limit for field estimates – 0.1 pCi/m^3.
Minimum Detectable Limit for laboratory measurement – 0.01 pCi/m^3.

Table 4

Airborne Particulates
Gross Beta Concentrations

June 1988

Location	Number of Samples	5-Hour Field Estimate (pCi/m³)			EERF Lab Measurment (pCi/m³)		
		Max	Min	Avg	Max	Min	Avg
AL:MONTGOMERY	8	1.5	0.3	0.8	0.06	0.01	0.02
AR:LITTLE ROCK	8	1.3	0.3	0.6	0.02	0.01	0.01
AZ:PHOENIX	3	3.1	0.1	1.2	0.01	0.01	0.01
CA:BERKELEY	8	0.0	0.0	0.0	0.01	0.00	0.00
CA:LOS ANGELES	8	0.3	0.0	0.1	0.02	0.00	0.01
CO:DENVER	8	1.4	0.2	0.7	0.01	0.01	0.01
CT:HARTFORD	7	0.4	0.0	0.1	0.02	0.00	0.01
DE:WILMINGTON	8	0.8	0.1	0.3	0.02	0.00	0.01
FL:JACKSONVILLE	8	0.2	0.0	0.1	0.01	0.00	0.01
FL:MIAMI	8	0.1	0.0	0.0	0.01	0.00	0.00
GA:ATLANTA	1	0.6	0.6	0.6	0.02	0.02	0.02
HI:HONOLULU	8	0.3	0.1	0.2	0.00	0.00	0.00
IA:IOWA CITY	9	0.8	0.1	0.3	0.02	0.00	0.01
ID:BOISE	9	0.4	0.2	0.3	0.02	0.00	0.01
ID:IDAHO FALLS	8	0.0	0.0	0.0	0.01	0.01	0.01
IL:CHICAGO	9	1.3	0.1	0.5	0.02	0.01	0.01
IN:INDIANAPOLIS	8	0.6	0.2	0.4	0.02	0.01	0.02
KS:TOPEKA	8	3.8	1.1	2.3	0.03	0.01	0.02
KY:FRANKFORT	5	0.9	0.3	0.7	0.03	0.01	0.02
LA:NEW ORLEANS	4	0.1	0.0	0.1	0.01	0.01	0.01
MA:LAWRENCE	6	0.4	0.1	0.2	0.02	0.00	0.01
ME:AUGUSTA	8	0.3	0.1	0.2	0.02	0.00	0.01
MI:LANSING	9	0.4	0.2	0.3	0.02	0.00	0.01
MN:MINNEAPOLIS	8	0.7	0.2	0.4	0.03	0.01	0.02
MO:JEFFERSON CITY	7	2.0	0.3	1.0	0.03	0.01	0.02
MS:JACKSON	7	0.5	0.2	0.4	0.02	0.01	0.02
NC:CHARLOTTE	8	0.4	0.0	0.2	0.04	0.01	0.02
NC:WILMINGTON	8	0.0	0.0	0.0	0.02	0.00	0.01
ND:BISMARCK	7	1.3	0.4	0.8	0.05	0.01	0.02
NE:LINCOLN	8	2.4	0.7	1.7	0.03	0.01	0.02
NH:CONCORD	8	0.3	0.1	0.2	0.02	0.00	0.01
NJ:TRENTON	9	0.8	0.1	0.4	0.02	0.00	0.01
NM:SANTA FE	5	0.3	0.1	0.2	0.01	0.01	0.01
NV:LAS VEGAS	9	0.3	0.1	0.2	0.03	0.00	0.01
NY:ALBANY	4	0.1	0.0	0.1	0.02	0.01	0.01
NY:NEW YORK CITY	5	0.8	0.1	0.4	0.02	0.01	0.01
NY:NIAGARA FALLS	8	1.0	0.0	0.4	0.02	0.01	0.01

Table 4 (continued)

Airborne Particulates
Gross Beta Concentrations

June 1988

Location	Number of Samples	5-Hour Field Estimate (pCi/m^3)			EERF Lab Measurment (pCi/m^3)		
		Max	Min	Avg	Max	Min	Avg
NY:SYRACUSE	3	0.2	0.1	0.1	0.01	0.00	0.01
NY:YAPHANK	8	0.3	0.1	0.2	0.02	0.01	0.01
OH:COLUMBUS	6	0.5	0.2	0.3	0.02	0.01	0.01
OH:PAINESVILLE	8	0.4	0.1	0.3	0.03	0.01	0.02
OH:TOLEDO	9	0.9	0.1	0.4	0.02	0.01	0.01
OK:OKLAHOMA CITY	8	0.8	0.2	0.6	0.02	0.01	0.01
OR:PORTLAND	7	0.0	0.0	0.0	0.00	0.00	0.00
PA:GOLDSBORO	8	1.1	0.1	0.5	0.02	0.01	0.01
PA:HARRISBURG	8	0.3	0.1	0.2	0.02	0.01	0.01
PA:PHILADELPHIA	2	0.1	0.1	0.1	0.01	0.01	0.01
PA:PITTSBURGH	8	0.0	0.0	0.0	0.02	0.01	0.01
PA:THREE MILE ISLAND	8	1.4	0.1	0.5	0.02	0.01	0.01
RI:PROVIDENCE	8	0.2	0.0	0.1	0.02	0.01	0.01
SC:BARNWELL	2	0.0	0.0	0.0	0.01	0.00	0.00
SC:COLUMBIA	8	0.5	0.1	0.3	0.04	0.01	0.02
SD:PIERRE	8	1.0	0.2	0.5	0.03	0.01	0.02
TN:KNOXVILLE	9	0.8	0.3	0.4	0.02	0.01	0.02
TN:NASHVILLE	9	1.2	0.2	0.6	0.02	0.01	0.02
TX:AUSTIN	8	0.4	0.1	0.2	0.01	0.01	0.01
TX:EL PASO	8	0.8	0.1	0.4	0.02	0.01	0.02
VA:LYNCHBURG	9	0.7	0.2	0.5	0.02	0.00	0.01
WA:OLYMPIA	7	0.1	0.0	0.0	0.01	0.00	0.00
WA:SPOKANE	9	0.4	0.1	0.2	0.03	0.00	0.01
WI:MADISON	8	0.9	0.3	0.6	0.02	0.01	0.01
WV:CHARLESTON	9	0.8	0.1	0.3	0.02	0.01	0.01

Minimum Detectable Limit for field estimates - 0.1 pCi/m^3.
Minimum Detectable Limit for laboratory measurement - 0.01 pCi/m^3.

Table 5

Gross Beta Concentrations in Precipitation

April 1988

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m^2)		Specific Gamma Activity
AL:MONTGOMERY	110.8	0.23	0.05	ND
AR:LITTLE ROCK	123.0	0.13	0.05	ND
AZ:PHOENIX	16.0	0.04	0.01	ND
CA:BERKELEY	60.8	0.05	0.03	ND
CO:DENVER	16.8	0.03	0.01	ND
CT:HARTFORD	42.0	0.15	0.03	ND
DE:WILMINGTON	24.0	0.06	0.01	ND
FL:JACKSONVILLE	14.0	0.00	0.01	ND
FL:MIAMI	29.0	0.03	0.01	ND
ID:BOISE	43.6	0.02	0.02	ND
ID:IDAHO FALLS	3.2	0.06	0.00	ND
IL:CHICAGO	94.8	0.06	0.03	ND
LA:NEW ORLEANS	38.0	0.01	0.01	ND
MA:LAWRENCE	40.0	0.05	0.02	ND
ME:AUGUSTA	41.0	0.05	0.02	^{214}Bi: 56 ±79 %
MI:LANSING	99.8	0.08	0.05	ND
MN:MINNEAPOLIS	31.6	0.02	0.01	ND
MO:JEFFERSON CITY	88.0	0.16	0.04	ND
NC:CHARLOTTE	51.0	0.10	0.03	ND
NC:WILMINGTON	156.0	0.13	0.07	ND
NH:CONCORD	66.6	0.08	0.03	ND
NJ:TRENTON	56.8	0.13	0.03	ND
NM:SANTA FE	20.0	0.01	0.01	ND
NV:LAS VEGAS	8.0	0.01	0.00	ND
NY:ALBANY	49.2	0.10	0.02	ND
NY:NEW YORK CITY	32.4	0.05	0.02	ND
NY:NIAGARA FALLS	37.0	0.02	0.01	ND
NY:YAPHANK	54.0	0.13	0.03	ND
OH:COLUMBUS	37.0	0.00	0.01	^{214}Bi: 126 ±79 %
OH:PAINESVILLE	75.0	0.06	0.03	ND
OH:TOLEDO	32.0	0.02	0.01	ND
OR:PORTLAND	100.8	0.10	0.04	ND
PA:HARRISBURG	60.2	0.08	0.03	ND
PA:PHILADELPHIA	22.0	0.04	0.01	ND
PA:THREE MILE ISLAND	29.6	0.02	0.01	ND
RI:PROVIDENCE	8.0	0.01	0.00	ND
SC:BARNWELL	37.0	0.02	0.01	ND

Table 5 (continued)

Gross Beta Concentrations in Precipitation

April 1988

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m^2)		Specific Gamma Activity
SC:COLUMBIA	72.8	0.17	0.04	ND
SD:PIERRE	22.0	0.04	0.02	ND
TN:KNOXVILLE	65.0	0.12	0.05	ND
TN:NASHVILLE	69.6	0.12	0.04	ND
TX:AUSTIN	36.0	0.04	0.02	ND
VA:LYNCHBURG	43.8	0.04	0.02	ND
WA:OLYMPIA	151.0	0.11	0.06	ND
WI:MADISON	60.6	0.05	0.03	ND
WV:CHARLESTON	47.6	0.04	0.02	ND

σ = Sigma Counting Error.
NA = Not Analyzed.
ND = No Gamma Activity Detectable.

Table 6

Gross Beta Concentrations in Precipitation

May 1988

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m^2)		Specific Gamma Activity
AL:MONTGOMERY	47.8	0.12	0.03	ND
AR:LITTLE ROCK	46.4	0.03	0.02	ND
CA:BERKELEY	22.0	0.01	0.01	ND
CO:DENVER	46.4	0.03	0.02	ND
CT:HARTFORD	108.0	0.31	0.06	ND
DE:WILMINGTON	103.0	0.36	0.07	ND
FL:JACKSONVILLE	66.2	0.07	0.03	ND
FL:MIAMI	130.4	0.15	0.06	ND
ID:BOISE	47.0	0.08	0.02	ND
ID:IDAHO FALLS	97.4	0.40	0.07	ND
IL:CHICAGO	47.0	0.03	0.02	ND
LA:NEW ORLEANS	42.0	0.04	0.02	ND
MA:LAWRENCE	80.0	0.25	0.05	ND
ME:AUGUSTA	71.0	0.11	0.04	ND
MI:LANSING	15.0	0.01	0.01	ND
MN:MINNEAPOLIS	39.0	0.11	0.02	ND
MO:JEFFERSON CITY	89.0	0.05	0.03	ND
MS:JACKSON	13.0	0.01	0.01	ND
NC:CHARLOTTE	78.8	0.11	0.03	ND
NC:WILMINGTON	130.0	0.26	0.08	ND
ND:BISMARCK	22.4	0.09	0.01	ND
NH:CONCORD	94.2	0.28	0.05	ND
NJ:TRENTON	99.0	0.16	0.05	ND
NY:ALBANY	87.8	0.22	0.05	ND
NY:NEW YORK CITY	28.8	0.01	0.01	ND
NY:NIAGARA FALLS	40.0	0.02	0.02	ND
NY:SYRACUSE	14.0	0.01	0.01	ND
NY:YAPHANK	59.6	0.10	0.03	ND
OH:COLUMBUS	15.0	0.01	0.01	ND
OH:PAINESVILLE	45.0	0.08	0.02	ND
OH:TOLEDO	16.0	0.04	0.01	ND
OR:PORTLAND	61.2	0.05	0.03	ND
PA:HARRISBURG	131.2	0.15	0.06	ND
PA:MIDDLETOWN	77.0	0.08	0.03	ND
PA:PHILADELPHIA	104.0	0.25	0.06	ND
PA:PITTSBURGH	71.4	0.18	0.04	ND
SC:COLUMBIA	34.6	0.08	0.02	ND

Table 6 (continued)

Gross Beta Concentrations in Precipitation

May 1988

Location	Depth (mm)	Act.	$\pm 2\sigma$ (nCi/m^2)	Specific Gamma Activity
SD:PIERRE	90.0	0.07	0.03	ND
TN:KNOXVILLE	92.4	0.10	0.04	ND
TN:NASHVILLE	58.2	0.05	0.03	ND
TX:AUSTIN	56.0	0.10	0.03	ND
VA:LYNCHBURG	56.6	0.38	0.04	ND
WA:OLYMPIA	116.4	0.08	0.05	ND
WI:MADISON	20.0	0.02	0.01	ND
WV:CHARLESTON	40.6	0.17	0.03	ND

σ = Sigma Counting Error.
NA = Not Analyzed.
ND = No Gamma Activity Detectable.

Table 7

Gross Beta Concentrations in Precipitation

June 1988

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m^2)		Specific Gamma Activity
AL:MONTGOMERY	65.8	0.11	0.03	ND
AR:LITTLE ROCK	14.0	0.02	0.01	ND
CA:BERKELEY	17.2	0.00	0.01	ND
CO:DENVER	9.0	0.02	0.01	ND
CT:HARTFORD	10.0	0.05	0.01	^{214}Bi: 149 ±67 %
DE:WILMINGTON	7.0	0.02	0.00	ND
FL:JACKSONVILLE	39.4	0.06	0.02	ND
FL:MIAMI	142.4	0.03	0.05	ND
ID:BOISE	4.0	0.00	0.00	ND
ID:IDAHO FALLS	0.3	0.01	0.00	NA
IL:CHICAGO	64.0	0.06	0.03	ND
LA:NEW ORLEANS	42.0	0.03	0.02	ND
MA:LAWRENCE	37.0	0.17	0.03	ND
ME:AUGUSTA	71.0	0.15	0.04	ND
MN:MINNEAPOLIS	2.0	0.01	0.00	ND
NC:CHARLOTTE	55.8	0.21	0.04	ND
NC:WILMINGTON	44.0	0.15	0.03	ND
ND:BISMARCK	5.4	0.01	0.00	ND
NH:CONCORD	10.6	0.04	0.01	ND
NJ:TRENTON	23.4	0.04	0.01	ND
NY:ALBANY	5.0	0.01	0.00	ND
NY:NEW YORK CITY	8.0	0.01	0.00	ND
NY:NIAGARA FALLS	23.0	0.01	0.01	ND
NY:SYRACUSE	15.0	0.03	0.01	ND
NY:YAPHANK	26.0	0.10	0.02	ND
OH:COLUMBUS	7.6	0.01	0.00	^{214}Bi: 113 ±87 %
OH:PAINESVILLE	42.0	0.03	0.02	ND
OR:PORTLAND	59.0	0.02	0.03	ND
PA:HARRISBURG	28.8	0.06	0.01	ND
PA:MIDDLETOWN	55.0	0.17	0.03	ND
PA:PHILADELPHIA	4.0	0.00	0.00	ND
PA:PITTSBURGH	3.0	0.00	0.00	ND
SC:COLUMBIA	69.2	0.07	0.04	ND
SD:PIERRE	20.8	0.03	0.01	ND
TN:KNOXVILLE	41.0	0.08	0.02	ND
TX:AUSTIN	52.0	0.02	0.02	ND
VA:LYNCHBURG	85.0	0.27	0.05	ND

Table 7 (continued)

Gross Beta Concentrations in Precipitation

June 1988

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m^2)	Specific Gamma Activity
WA:OLYMPIA	48.0	0.03 0.02	ND
WV:CHARLESTON	15.6	0.04 0.01	ND

σ = Sigma Counting Error.
NA = Not Analyzed.
ND = No Gamma Activity Detectable.

Table 8

Precipitation
Tritium Concentrations

April - June 1988

Location	April 1988 nCi/l	April 1988 $\pm 2\sigma$	May 1988 nCi/l	May 1988 $\pm 2\sigma$	June 1988 nCi/l	June 1988 $\pm 2\sigma$
AL:MONTGOMERY	0.1	0.2	0.2	0.2	0.1	0.2
AR:LITTLE ROCK	0.1	0.2	0.1	0.2	0.2	0.2
AZ:PHOENIX	0.2	0.2	NS		NS	
CA:BERKELEY	0.2	0.2	0.2	0.2	0.2	0.2
CO:DENVER	0.1	0.2	0.2	0.2	0.2	0.2
CT:HARTFORD	0.2	0.2	0.1	0.2	0.2	0.2
DE:WILMINGTON	0.2	0.2	0.1	0.2	0.1	0.2
FL:JACKSONVILLE	0.0	0.2	0.2	0.2	0.2	0.2
FL:MIAMI	0.1	0.2	0.1	0.2	0.1	0.2
ID:BOISE	0.2	0.2	0.3	0.2	0.2	0.2
ID:IDAHO FALLS	0.1	0.2	0.1	0.2	1.6	0.2
IL:CHICAGO	0.1	0.2	0.1	0.2	0.2	0.2
LA:NEW ORLEANS	0.1	0.2	0.2	0.2	0.2	0.2
MA:LAWRENCE	0.1	0.2	0.1	0.2	0.1	0.2
ME:AUGUSTA	0.2	0.2	0.3	0.2	0.2	0.2
MI:LANSING	0.2	0.2	0.1	0.2	NS	
MN:MINNEAPOLIS	0.2	0.2	0.2	0.2	0.3	0.2
MO:JEFFERSON CITY	0.1	0.2	0.2	0.2	NS	
MS:JACKSON	NS		0.3	0.2	NS	
NC:CHARLOTTE	0.2	0.2	0.3	0.2	0.4	0.2
NC:WILMINGTON	0.3	0.2	0.2	0.2	0.3	0.2
ND:BISMARCK	NS		0.2	0.2	0.1	0.2
NH:CONCORD	0.1	0.2	0.2	0.2	0.1	0.2
NJ:TRENTON	0.2	0.2	0.2	0.2	0.2	0.2
NM:SANTA FE	0.2	0.2	NS		NS	
NV:LAS VEGAS	0.3	0.2	NS		NS	
NY:ALBANY	0.1	0.2	0.3	0.2	0.1	0.2
NY:NEW YORK CITY	0.2	0.2	0.1	0.2	0.1	0.2
NY:NIAGARA FALLS	0.4	0.2	0.3	0.2	0.3	0.2
NY:SYRACUSE	NS		0.2	0.2	0.1	0.2
NY:YAPHANK	0.2	0.2	0.2	0.2	0.2	0.2
OH:COLUMBUS	0.2	0.2	0.1	0.2	0.1	0.2
OH:PAINESVILLE	0.2	0.2	0.2	0.2	0.1	0.2
OH:TOLEDO	0.1	0.2	0.2	0.2	NS	
OR:PORTLAND	0.2	0.2	0.2	0.2	0.1	0.2
PA:HARRISBURG	0.2	0.2	0.3	0.2	0.1	0.2
PA:MIDDLETOWN	NS		0.2	0.2	0.2	0.2

Table 8 (continued)

Precipitation
Tritium Concentrations
April - June 1988

Location	April 1988		May 1988		June 1988	
	nCi/l	$\pm 2\sigma$	nCi/l	$\pm 2\sigma$	nCi/l	$\pm 2\sigma$
PA:PHILADELPHIA	0.1	0.2	0.3	0.2	0.1	0.2
PA:PITTSBURGH	NS		0.4	0.2	0.2	0.2
PA:THREE MILE ISLAND	0.1	0.2	NS		NS	
RI:PROVIDENCE	0.1	0.2	NS		NS	
SC:BARNWELL	0.2	0.2	NS		NS	
SC:COLUMBIA	0.2	0.2	0.4	0.2	0.1	0.2
SD:PIERRE	0.3	0.2	0.2	0.2	0.2	0.2
TN:KNOXVILLE	0.1	0.2	0.1	0.2	0.2	0.2
TN:NASHVILLE	0.3	0.2	0.2	0.2	NS	
TX:AUSTIN	0.1	0.2	0.2	0.2	0.2	0.2
VA:LYNCHBURG	0.1	0.2	0.3	0.2	0.2	0.2
WA:OLYMPIA	0.1	0.2	0.1	0.2	0.2	0.2
WI:MADISON	0.1	0.2	0.1	0.2	NS	
WV:CHARLESTON	0.2	0.2	0.2	0.2	0.2	0.2

σ = Sigma Counting Error.
NS = No Sample.

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 reprocessing, weapons tests, and research and defense related activities. 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. Krypton-85 in the atmosphere has been monitored 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 and shipped to the EERF where the krypton-85 is cryogenically separated and counted in a liquid scintillation system.

The last Kr-85 results were for 1976, 1977, and 1979. They were published in ***Environmental Radiation Data:*** *Report 30.*

ENVIRONMENTAL RADIATION AMBIENT MONITORING SYSTEM (ERAMS)

Section II. Water Program

The ERAMS water program provides data on ambient radiation levels in the nation's rivers, streams, and drinking water supplies.

Surface Water

Quarterly grab samples are taken downstream from operating or future nuclear facilities at 58 stations.

Surface water samples are analyzed for tritium quarterly and specific gamma activity annually. Tritium is a primary radioactive pollutant from nuclear power plants and weapons production activities.

Tritium concentrations are determined by liquid scintillation counting of distilled samples. Gamma scans are performed annually to determine levels of gamma emitting radionuclides.

Table 9 contains the data for tritium concentrations for April June 1988.

Table 9

Surface Water
Tritium Concentrations

April - June 1988

Location	Source	Date Collected	nCi/l	$\pm 2\sigma$
AL:DECATUR	TENNESSEE RIVER	04/05/88	0.5	0.2
AL:DOTHAN	CHATTAHOOCHEE RIVER	04/12/88	0.1	0.2
AL:SCOTTSBORO	TENNESSEE RIVER	04/07/88	0.3	0.2
AR:LITTLE ROCK	ARKANSAS RIVER	04/06/88	0.1	0.2
CA:DIABLO CANYON	PACIFIC OCEAN	05/15/88	0.2	0.2
CA:EUREKA	HUMBOLDT BAY	06/30/88	0.1	0.2
CA:SAN ONOFRE	PACIFIC OCEAN	05/20/88	0.1	0.2
CO:PLATTEVILLE	SOUTH PLATTE RIVER	04/04/88	0.2	0.2
CT:EAST HADDAM	CONNECTICUT RIVER	06/09/88	0.2	0.2
CT:WATERFORD	LONG ISLAND SOUND	06/09/88	0.2	0.2
FL:CRYSTAL RIVER	GULF OF MEXICO	03/28/88	0.2	0.2
FL:FT. PIERCE	ATLANTIC OCEAN	03/29/88	0.3	0.2
FL:HOMESTEAD	BISCAYNE BAY	04/11/88	0.2	0.2
GA:BAXLEY	ALTAMAHA RIVER	04/05/88	0.2	0.2
IA:CEDAR RAPIDS	CEDAR RIVER	03/22/88	0.1	0.2
ID:BUHL	SNAKE RIVER	04/21/88	0.2	0.2
IL:E. MOLINE	MISSISSIPPI RIVER	04/06/88	0.3	0.2
IL:MORRIS	ILLINOIS RIVER	04/24/88	0.1	0.2
IL:ZION	LAKE MICHIGAN	05/15/88	0.2	0.2
KS:LEROY	NEOSHO RIVER	05/15/88	0.2	0.2
LA:NEW ORLEANS	MISSISSIPPI RIVER	04/11/88	0.2	0.2
MA:PLYMOUTH	CAPE COD BAY	04/06/88	0.1	0.2
MA:ROWE	DEERFIELD RIVER	05/15/88	0.2	0.2
MD:CONOWINGO	SUSQUEHANNA RIVER	04/26/88	0.2	0.2
MD:LUSBY	CHESAPEAKE BAY	03/22/88	0.2	0.2
ME:WISCASSET	MONTSEWAY BAY	04/05/88	0.2	0.2
MI:BRIDGMAN	LAKE MICHIGAN	04/06/88	0.2	0.2
MI:CHARLEVOIX	LAKE MICHIGAN	03/26/88	0.3	0.2
MI:MONROE	LAKE ERIE	03/28/88	0.4	0.2
MI:SO. HAVEN	LAKE MICHIGAN	04/07/88	0.2	0.2
MN:MONTICELLO	MISSISSIPPI RIVER	04/05/88	0.2	0.2
MN:RED WING	MISSISSIPPI RIVER	04/14/88	0.2	0.2
MS:PORT GIBSON	MISSISSIPPI RIVER	04/14/88	0.1	0.2
NC:CHARLOTTE	CATAWBA RIVER	04/06/88	0.6	0.2
NC:SOUTHPORT	ATLANTIC OCEAN	04/05/88	0.3	0.2
NE:RULO	MISSOURI RIVER	04/07/88	0.1	0.2
NJ:BAYSIDE	DELAWARE RIVER	05/10/88	0.1	0.2

Table 9 (continued)

Surface Water
Tritium Concentrations

April - June 1988

Location	Source	Date Collected	nCi/l	$\pm 2\sigma$
NJ:OYSTER CREEK	OYSTER CREEK	04/21/88	0.1	0.2
NV:BOULDER CITY	COLORADO RIVER	04/04/88	0.2	0.2
NY:CHELSEA	HUDSON RIVER	03/22/88	0.3	0.2
NY:OSSINING	HUDSON RIVER	04/27/88	0.3	0.2
NY:OSWEGO	LAKE ONTARIO	04/28/88	0.5	0.2
OH:TOLEDO	LAKE ERIE	06/29/88	0.2	0.2
OR:BRADWOOD	COLUMBIA RIVER	04/21/88	0.2	0.2
PA:DANVILLE	SUSQUEHANNA RIVER	04/27/88	0.1	0.2
SC:ALLENDALE	SAVANNAH RIVER	04/28/88	3.7	0.2
SC:BROAD RIVER	BROAD RIVER	04/20/88	0.6	0.2
SC:HARTSVILLE	LAKE ROBINSON	04/19/88	1.7	0.2
TN:DAISY	TENNESSEE RIVER	04/05/88	0.3	0.2
TN:KINGSTON	CLINCH RIVER	04/05/88	5.0	0.3
TN:OAK RIDGE	CLINCH RIVER	05/15/88	3.5	0.2
TX:EL PASO	RIO GRANDE	03/21/88	0.1	0.2
TX:MATAGORDA	COLORADO RIVER	04/14/88	0.1	0.2
VA:DOSWELL	NORTH ANNA RIVER	04/14/88	3.6	0.2
VA:NEWPORT NEWS	JAMES RIVER	04/12/88	0.4	0.2
WA:NORTHPORT	COLUMBIA RIVER	05/18/88	0.2	0.2
WA:RICHLAND	COLUMBIA RIVER	05/10/88	0.2	0.2
WI:TWO CREEKS	LAKE MICHIGAN	04/04/88	0.2	0.2
WI:VICTORY	MISSISSIPPI RIVER	04/11/88	0.2	0.2
WV:WHEELING	OHIO RIVER	06/09/88	0.1	0.2

σ = Sigma Counting Error.

Drinking Water

This program monitors ambient radiation levels in drinking water at 78 sites. 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 the 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; (c) radium-226 if the gross alpha exceeds 2 pCi/l and radium-228 if the radium-226 falls between 3 and 5 pCi/l; (d) specific iodine-131 on one quarterly sample per year for each station; and (e) an annual composite for plutonium-238, -239, and -240 and uranium-234, -235, and -238 for stations that demonstrate gross alpha levels greater than 2 pCi/l.

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

Table 10 contains the data in drinking water for April - June 1988. Table 11 contains the data on gross alpha, gross beta, strontium-90, and radium-226 in drinking water for January December 1987. Table 12 contains the plutonium and uranium in drinking water data for January - December 1987.

Table 10

Drinking Water
Tritium Concentrations

April - June 1988

Location	Date Collected	nCi/l	$\pm 2\sigma$
AK:FAIRBANKS	03/30/88	0.3	0.2
AL:DOTHAN	04/13/88	0.1	0.2
AL:MONTGOMERY	04/04/88	0.2	0.2
AL:MUSCLE SHOALS	04/05/88	0.2	0.2
AL:SCOTTSBORO	04/07/88	0.2	0.2
AR:LITTLE ROCK	04/06/88	0.2	0.2
CA:BERKELEY	04/06/88	0.2	0.2
CA:LOS ANGELES	04/01/88	0.2	0.2
CO:DENVER	04/05/88	0.3	0.2
CO:PLATTEVILLE	04/04/88	0.2	0.2
CT:HARTFORD	03/28/88	0.1	0.2
DC:WASHINGTON	03/25/88	0.2	0.2
DE:DOVER	06/28/88	0.2	0.2
FL:MIAMI	04/01/88	0.1	0.2
FL:TAMPA	03/28/88	0.1	0.2
GA:BAXLEY	04/05/88	0.1	0.2
HI:HONOLULU	04/12/88	0.1	0.2
IA:CEDAR RAPIDS	03/22/88	0.1	0.2
ID:BOISE	04/07/88	0.2	0.2
ID:IDAHO FALLS	05/03/88	0.2	0.2
IL:MORRIS	04/11/88	0.1	0.2
IL:W. CHICAGO	04/01/88	0.3	0.2
KS:TOPEKA	04/01/88	0.4	0.2
LA:NEW ORLEANS	03/26/88	0.2	0.2
MA:LAWRENCE	04/20/88	0.1	0.2
MD:BALTIMORE	06/03/88	0.2	0.2
MD:CONOWINGO	04/26/88	0.2	0.2
ME:AUGUSTA	05/06/88	0.2	0.2
MI:DETROIT	03/28/88	0.3	0.2
MI:GRAND RAPIDS	03/25/88	0.2	0.2
MN:MINNEAPOLIS	04/05/88	0.2	0.2
MN:RED WING	04/14/88	0.1	0.2
MS:JACKSON	04/14/88	0.2	0.2
MS:PORT GIBSON	04/14/88	0.1	0.2
MT:HELENA	04/04/88	0.2	0.2
NC:CHARLOTTE	04/06/88	0.7	0.2
NC:WILMINGTON	04/05/88	0.1	0.2
ND:BISMARCK	03/21/88	0.2	0.2

Table 10 (continued)

Drinking Water
Tritium Concentrations
April - June 1988

Location	Date Collected	nCi/l	$\pm 2\sigma$
NE:LINCOLN	04/05/88	0.2	0.2
NJ:WARETOWN	05/12/88	0.1	0.2
NV:LAS VEGAS	04/01/88	0.2	0.2
NY:ALBANY	04/11/88	0.2	0.2
NY:NEW YORK CITY	04/06/88	0.2	0.2
NY:NIAGARA FALLS	04/06/88	0.2	0.2
NY:SYRACUSE	06/30/88	0.2	0.2
OH:CINCINNATI	06/23/88	0.2	0.2
OH:COLUMBUS	04/06/88	0.1	0.2
OH:EAST LIVERPOOL	04/12/88	0.1	0.2
OH:PAINESVILLE	03/23/88	0.2	0.2
OH:TOLEDO	06/28/88	0.2	0.2
OK:OKLAHOMA CITY	04/01/88	0.2	0.2
OR:PORTLAND	04/08/88	0.2	0.2
PA:COLUMBIA	04/07/88	0.2	0.2
PA:HARRISBURG	05/12/88	0.2	0.2
PA:PITTSBURGH	04/11/88	0.1	0.2
PC:ANCON	03/28/88	0.2	0.2
RI:PROVIDENCE	04/05/88	0.1	0.2
SC:BARNWELL	04/14/88	0.1	0.2
SC:COLUMBIA	04/04/88	0.4	0.2
SC:HARTSVILLE	04/19/88	0.1	0.2
SC:JENKINSVILLE	04/18/88	0.2	0.2
SC:SENECA	04/27/88	0.1	0.2
TN:CHATTANOOGA	04/18/88	0.4	0.2
TN:KNOXVILLE	03/18/88	0.2	0.2
TX:AUSTIN	03/29/88	0.2	0.2
VA:DOSWELL	03/27/88	0.2	0.2
VA:LYNCHBURG	03/25/88	0.2	0.2
VA:VIRGINIA BEACH	04/12/88	0.2	0.2
VI:ST. THOMAS	04/12/88	0.1	0.2
WA:RICHLAND	05/10/88	0.2	0.2
WA:SEATTLE	04/07/88	0.2	0.2
WI:GENOA CITY	04/11/88	0.1	0.2
WI:MADISON	04/08/88	0.1	0.2

σ = Sigma Counting Error.

Table 11

Drinking Water
Alpha, Beta, Gamma, Sr-90, and Ra-226 Concentrations

January - December 1987 Composites

Location	Total Solids (mg/l)	Gross Beta pCi/l	±2σ	Gross Alpha pCi/l	±2σ	^{90}Sr pCi/l	±2σ	^{226}Ra pCi/l	±2σ	Specific Gamma Activity
AK:FAIRBANKS	255.0	2.2	1.6	-0.5	0.9	-0.2	0.4	NA		ND
AL:DOTHAN	267.5	1.9	1.2	0.2	0.8	-0.1	0.3	NA		ND
AL:MONTGOMERY	60.4	1.6	0.9	-0.1	0.2	-0.2	0.2	NA		ND
AL:MUSCLE SHOALS	156.8	1.1	0.9	-0.1	0.5	0.3	0.6	NA		ND
AL:SCOTTSBORO	223.0	2.1	1.2	-0.2	0.7	0.1	0.3	NA		ND
AR:LITTLE ROCK	53.4	1.2	0.9	0.2	0.3	0.0	0.8	NA		ND
CA:BERKELEY	64.2	1.2	0.8	0.1	0.2	-0.2	0.6	NA		ND
CA:LOS ANGELES	504.7	5.8	3.1	0.8	2.0	-0.4	0.9	NA		ND
CO:DENVER	156.5	2.0	1.1	-0.1	0.6	-0.3	0.6	NA		ND
CO:PLATTEVILLE	959.0	7.6	3.8	9.3	4.8	0.1	0.1	0.4	0.0	ND
CT:HARTFORD	83.8	1.5	0.7	1.5	0.6	-0.1	0.2	NA		ND
DC:WASHINGTON	213.7	2.0	1.9	-3.1	1.2	NA		NA		ND
DE:DOVER	342.8	5.4	1.6	-1.4	0.9	0.0	0.1	NA		ND
FL:MIAMI	229.8	2.1	1.3	-1.1	1.0	0.1	0.1	NA		ND
FL:TAMPA	261.0	1.8	1.4	-0.1	0.9	0.2	0.5	NA		ND
GA:BAXLEY	275.7	1.8	1.4	0.6	1.5	-0.1	0.4	NA		ND
GA:SAVANNAH	126.2	1.3	0.9	0.3	0.3	0.1	0.4	NA		ND
HI:HONOLULU	269.3	2.1	1.0	2.2	1.1	-0.1	0.3	0.0	0.0	ND
IA:CEDAR RAPIDS	158.4	2.8	1.0	0.2	0.3	-0.3	0.2	NA		ND
ID:BOISE	92.0	0.4	0.7	0.2	0.3	0.3	0.1	NA		ND
ID:IDAHO FALLS	452.0	2.6	1.9	1.1	1.3	-0.3	0.5	NA		ND
IL:MORRIS	452.0	16.1	2.8	2.4	1.7	-0.2	0.3	5.3	0.1	ND
IL:W. CHICAGO	389.6	15.7	2.7	9.0	2.4	-0.2	0.4	7.7	0.2	ND
KS:TOPEKA	400.0	6.2	2.2	0.1	1.0	0.0	0.2	NA		ND
LA:NEW ORLEANS	207.2	2.9	1.1	0.8	0.8	0.2	0.4	NA		ND
MA:LAWRENCE	134.2	1.0	0.9	-0.1	0.2	0.0	0.5	NA		ND
MD:BALTIMORE	156.0	3.4	0.9	3.4	1.0	-0.2	0.3	0.0	0.0	ND
MD:CONOWINGO	238.3	1.2	1.0	0.6	0.5	0.2	0.3	NA		ND
ME:AUGUSTA	53.6	0.1	1.5	-0.1	0.2	0.1	0.5	NA		ND
MI:DETROIT	166.8	1.9	1.0	0.1	0.4	0.5	0.4	NA		ND
MI:GRAND RAPIDS	209.0	2.4	1.2	-0.7	0.6	-0.1	0.5	NA		ND
MN:MINNEAPOLIS	93.8	1.8	1.0	-0.4	0.3	-0.4	0.2	NA		ND
MN:RED WING	438.7	7.4	2.0	0.9	1.3	-0.6	0.1	NA		ND
MO:JEFFERSON CITY	253.6	7.1	2.1	0.2	0.8	NA		NA		ND
MS:JACKSON	117.6	4.2	1.4	-0.5	0.5	0.3	0.4	NA		ND
MS:PORT GIBSON	540.4	4.8	2.1	1.5	1.4	-0.1	0.4	NA		ND
MT:HELENA	194.8	4.2	1.2	0.2	0.8	0.0	0.2	NA		ND

Table 11 (continued)

Drinking Water
Alpha, Beta, Gamma, Sr-90, and Ra-226 Concentrations

January December 1987 Composites

Location	Total Solids (mg/l)	Gross Beta pCi/l	±2σ	Gross Alpha pCi/l	±2σ	^{90}Sr pCi/l	±2σ	^{226}Ra pCi/l	±2σ	Specific Gamma Activity
NC:CHARLOTTE	76.0	0.6	0.8	0.1	0.2	-0.1	0.3	NA		ND
NC:WILMINGTON	138.2	2.6	1.0	0.3	0.4	0.1	0.3	NA		ND
ND:BISMARCK	370.4	4.7	1.3	-0.4	0.6	0.1	0.4	NA		ND
NE:LINCOLN	522.0	10.4	2.4	2.0	1.7	0.1	0.6	0.1	0.0	ND
NH:CONCORD	75.6	0.9	0.8	0.1	0.2	-0.2	0.4	NA		ND
NJ:TRENTON	166.0	1.1	0.9	0.1	0.4	-0.3	0.8	NA		ND
NJ:WARETOWN	78.8	0.1	0.4	0.5	0.4	0.1	0.3	NA		ND
NM:SANTA FE	336.4	5.2	1.8	4.2	1.9	-0.2	0.3	0.2	0.0	ND
NV:LAS VEGAS	618.7	6.7	2.8	7.0	3.1	0.4	0.5	0.8	0.0	ND
NY:ALBANY	129.0	1.1	0.9	-0.2	0.2	-0.4	0.7	NA		ND
NY:NEW YORK CITY	64.8	1.1	0.9	0.1	0.2	0.1	0.4	NA		ND
NY:NIAGARA FALLS	214.6	1.1	1.0	0.0	0.0	0.5	0.3	NA		ND
NY:SYRACUSE	217.2	2.4	0.9	-0.1	0.3	0.2	0.2	NA		ND
OH:CINCINNATI	265.6	2.3	1.1	0.2	0.6	0.0	0.6	NA		ND
OH:COLUMBUS	267.5	3.7	1.4	-0.6	0.8	-0.1	0.3	NA		ND
OH:EAST LIVERPOOL	289.5	2.6	1.3	-0.1	0.8	-0.7	1.4	NA		ND
OH:PAINESVILLE	267.0	2.4	1.4	-0.2	0.6	-0.2	1.5	NA		ND
OH:TOLEDO	198.4	1.7	1.0	-0.3	0.5	0.3	0.4	NA		ND
OK:OKLAHOMA CITY	137.8	2.1	1.0	-0.1	0.4	-0.2	0.9	NA		ND
OR:PORTLAND	66.8	0.6	0.9	-0.1	0.4	0.2	1.4	NA		ND
PA:COLUMBIA	264.0	1.2	1.0	-0.2	0.4	0.7	1.8	NA		ND
PA:HARRISBURG	50.8	0.6	0.7	0.2	0.3	0.0	0.1	NA		ND
PA:PITTSBURGH	221.6	1.7	1.0	0.1	0.4	0.0	0.5	NA		ND
PC:ANCON	121.4	0.8	0.9	0.0	0.0	-0.8	0.9	NA		ND
RI:PROVIDENCE	95.8	1.0	1.0	0.0	0.3	-0.3	1.1	NA		ND
SC:BARNWELL	72.6	0.4	0.6	0.4	0.3	-1.3	1.5	NA		ND
SC:COLUMBIA	81.3	2.0	1.1	-0.1	0.4	-0.4	1.3	NA		ND
SC:HARTSVILLE	175.4	1.3	1.1	-0.1	0.3	-0.5	0.7	NA		ND
SC:JENKINSVILLE	290.0	4.3	1.0	15.8	2.5	-0.7	1.4	0.3	0.0	ND
SC:SENECA	41.6	1.0	0.9	-0.2	0.2	-0.6	1.6	NA		ND
TN:CHATTANOOGA	173.2	3.9	1.1	0.3	0.7	0.4	1.3	NA		ND
TN:KNOXVILLE	80.6	1.5	0.8	0.7	0.4	0.1	1.5	NA		ND
TX:AUSTIN	295.0	2.8	1.0	0.4	0.6	-0.7	1.1	NA		ND
VA:DOSWELL	217.0	4.3	1.2	0.1	0.3	-0.3	1.5	NA		ND
VA:LYNCHBURG	85.2	1.0	0.8	0.1	0.3	-0.3	0.5	NA		ND
VA:VIRGINIA BEACH	155.0	2.6	1.0	0.3	0.5	0.2	0.3	NA		ND
VI:ST. THOMAS	52.4	0.1	0.5	0.1	0.2	-0.6	0.8	NA		ND

Table 11 (continued)

Drinking Water
Alpha, Beta, Gamma, Sr-90, and Ra-226 Concentrations

January - December 1987 Composites

Location	Total Solids (mg/l)	Gross Beta pCi/l	±2σ	Gross Alpha pCi/l	±2σ	^{90}Sr pCi/l	±2σ	^{226}Ra pCi/l	±2σ	Specific Gamma Activity
WA:RICHLAND	142.6	1.9	0.9	0.5	0.5	-0.4	0.8	NA		ND
WA:SEATTLE	55.0	1.2	0.8	0.1	0.2	-0.4	0.9	NA		ND
WI:GENOA CITY	55.0	0.8	0.8	0.0	0.1	0.0	0.4	NA		ND
WI:MADISON	238.5	1.2	1.0	1.0	0.7	-0.3	0.1	NA		ND

σ = Sigma Counting Error.
NA = No Analysis.
ND = No Gamma Activity Detectable.

Table 12

Plutonium and Uranium Analyses
Selected Drinking Water Composite Samples

January - December 1987

Location	^{238}Pu		$^{239-240}Pu$		^{234}U		^{235}U		^{238}U	
	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$
CO:PLATTEVILLE	0.007	0.007	-0.002	0.006	6.109	0.422	0.211	0.028	4.342	0.306
CT:HARTFORD	0.006	0.012	-0.004	0.007	0.043	0.019	0.000	0.005	0.020	0.013
HI:HONOLULU	0.002	0.009	0.000	0.001	0.027	0.020	0.013	0.012	0.031	0.015
ID:IDAHO FALLS	0.013	0.010	0.007	0.007	0.836	0.065	0.027	0.007	0.411	0.038
IL:MORRIS	0.007	0.008	0.003	0.005	0.388	0.037	0.006	0.004	0.048	0.010
IL:W. CHICAGO	0.005	0.008	0.001	0.002	1.689	0.149	0.012	0.008	0.110	0.025
MD:BALTIMORE	0.003	0.012	0.000	0.000	0.042	0.024	0.002	0.011	0.044	0.018
MS:PORT GIBSON	0.015	0.015	0.001	0.005	0.035	0.025	0.021	0.014	0.028	0.017
NE:LINCOLN	0.013	0.011	0.001	0.007	6.265	0.528	0.095	0.030	3.872	0.345
NM:SANTA FE	0.022	0.041	0.005	0.009	5.195	0.379	0.149	0.030	3.350	0.257
NV:LAS VEGAS	0.013	0.011	0.001	0.005	1.817	0.142	0.051	0.012	1.162	0.097
SC:JENKINSVILLE	0.000	0.009	0.002	0.006	18.120	1.172	0.171	0.021	4.445	0.299

σ = Sigma Counting Error.

Minimum Detectable Level for individual isotopes is 0.015 pCi/sample.

ENVIRONMENTAL RADIATION AMBIENT MONITORING SYSTEM (ERAMS)

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 are 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. The program consists of approximately 22 sites representing wide geographic coverage throughout the country.[1] Although exposure measurements at these few sites are not totally representative of nationwide exposures, they do indicate national trends.

The monitoring program utilizes CaF_2:Mn thermoluminescent dosimeters (TLD's). These dosimeters are commercially available glass-bulb type dosimeters with energy compensating shields. A group of three 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 approximately every three months. 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.

Table 13 contains the data for environmental gamma ambient monitoring program April - June 1988.

[1] Some of these sites may not return dosimeters each period and consequently the number of sites listed may vary slightly.

Table 13

Environmental Gamma Ambient Monitoring Program

April June 1988

Location	Date Range	Integrated Exposure mR	Exposure Rate μR/hr	$\pm 2\sigma$
AL:MONTGOMERY	04/13/88-07/01/88	17.0	8.9	5.6
CA:BERKELEY	04/05/88-07/06/88	13.9	6.3	7.4
CO:DENVER	04/06/88-07/06/88	32.2	14.8	11.1
FL:ORLANDO	03/31/88-06/30/88	12.8	5.8	8.7
ID:BOISE	03/31/88-06/28/88	24.5	11.5	5.7
IL:CHICAGO	04/11/88-06/29/88	15.7	8.3	8.3
ND:BISMARCK	04/04/88-07/01/88	20.1	9.5	18.3
NJ:TRENTON	04/08/88-06/30/88	23.9	12.0	7.6
NM:SANTA FE	04/07/88-07/05/88	31.3	14.7	5.9
NV:LAS VEGAS	04/01/88-06/30/88	15.0	7.0	7.3
NY:NEW YORK	04/19/88-07/25/88	24.0	10.3	7.3
OH:COLUMBUS	04/19/88-08/01/88	18.6	7.5	8.8
OK:OKLAHOMA CITY	04/01/88-06/28/88	16.9	8.0	7.5
OR:PORTLAND	04/01/88-06/30/88	18.6	8.6	3.9
PA:HARRISBURG	04/05/88-07/08/88	15.6	6.9	11.1
PA:PITTSBURGH	04/05/88-07/05/88	25.5	11.7	7.9
RI:PROVIDENCE	04/01/88-07/05/88	23.4	10.3	6.1
SC:BARNWELL	04/14/88-06/30/88	15.6	8.5	7.0
SC:COLUMBIA	03/31/88-06/28/88	21.8	10.2	8.1
TN:KNOXVILLE	04/04/88-06/29/88	26.0	12.6	6.6
VA:RICHMOND	04/12/88-07/30/88	16.8	8.9	30.1
VT:MONTPELIER	04/12/88-07/13/88	18.9	8.6	5.5

σ = Sigma Counting Error (in percent).

ENVIRONMENTAL RADIATION AMBIENT MONITORING SYSTEM (ERAMS)

Section IV. Milk Program

Pasteurized Milk

This is a cooperative program with the Dairy and Lipid Products Branch, Milk Sanitation Section, Food and Drug Administration. Milk is a reliable indicator of the general population's intake of radionuclides since it is consumed fresh by a large segment of the population and can contain several of the biologically important radionuclides that result 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 Zone. The samples are composited, according to production, from the major milk suppliers representing more than 80 percent of the milk consumed in a given population center.

The samples are analyzed for gamma emitting nuclides, which include iodine–131, barium–140, cesium–137, and potassium. All samples collected in July are analyzed 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 that has been chemically separated by ion exchange.

Tables 14–16 contain the concentrations of radionuclides in pasteurized milk for April - June 1988. Table 17 contains the concentrations of strontium-90 and strontium-89 in pasteurized milk EPA Regional Composites for April - June 1988.

Table 14

Concentrations of Radionuclides in Pasteurized Milk

April 1988

Location	Date Collected	K		^{137}Cs		^{140}Ba		^{131}I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
AK:ANCHORAGE	04/26/88	1.28	0.12	5	9	-6	9	5	7
AL:MONTGOMERY	04/08/88	1.55	0.13	7	7	8	9	4	7
AR:LITTLE ROCK	04/11/88	1.26	0.12	10	9	3	9	10	7
AZ:PHOENIX	04/06/88	1.65	0.09	-1	5	1	6	1	5
CA:LOS ANGELES	04/01/88	1.65	0.13	4	7	1	9	5	7
CA:SACRAMENTO	04/04/88	1.46	0.13	-1	9	-3	9	5	7
CA:SAN FRANCISCO	04/06/88	1.37	0.12	10	9	-2	9	9	7
CO:DENVER	04/29/88	1.51	0.13	7	9	9	10	2	7
CT:HARTFORD	04/04/88	1.48	0.13	6	9	2	9	2	7
DC:WASHINGTON	04/12/88	1.62	0.13	7	7	-5	9	5	7
DE:WILMINGTON	04/05/88	1.44	0.09	10	6	-4	6	3	5
FL:TAMPA	04/06/88	1.50	0.09	11	5	-3	6	6	5
GA:ATLANTA	04/25/88	1.33	0.12	1	9	-7	9	5	7
HI:HONOLULU	04/05/88	1.44	0.13	7	9	-3	9	3	7
IA:DES MOINES	04/05/88	1.43	0.13	8	9	0	9	2	7
IL:CHICAGO	04/04/88	1.37	0.12	2	9	3	9	2	7
IN:INDIANAPOLIS	04/04/88	1.44	0.13	1	9	-4	9	3	7
KS:WICHITA	04/22/88	1.34	0.12	9	9	9	10	8	7
KY:LOUISVILLE	04/05/88	1.44	0.13	1	9	-2	9	6	7
LA:NEW ORLEANS	04/08/88	1.43	0.12	4	7	3	9	4	7
MD:BALTIMORE	04/08/88	1.44	0.13	3	9	1	9	5	7
ME:PORTLAND	04/04/88	1.44	0.13	11	9	0	9	1	7
MI:DETROIT	04/07/88	1.66	0.13	6	9	5	10	3	7
MI:GRAND RAPIDS	04/04/88	1.51	0.13	3	7	-4	9	2	7
MN:MINNEAPOLIS	04/04/88	1.62	0.09	3	5	1	6	2	5
MN:ST. PAUL	04/04/88	1.54	0.13	3	7	-4	9	6	7
MO:KANSAS CITY	04/08/88	1.42	0.12	2	7	6	9	5	7
MO:ST. LOUIS	04/06/88	1.47	0.12	4	7	0	9	6	7
MS:JACKSON	04/05/88	1.51	0.13	7	9	-7	9	5	7
NC:CHARLOTTE	04/11/88	1.63	0.24	11	18	8	19	0	14
ND:MINOT	04/27/88	1.37	0.09	9	6	-2	6	5	5
NE:OMAHA	04/08/88	1.27	0.08	14	6	5	7	4	5
NH:MANCHESTER	04/04/88	1.53	0.09	6	6	2	7	4	5
NJ:TRENTON	04/06/88	1.48	0.13	6	9	3	10	8	7
NM:ALBUQUERQUE	04/04/88	1.48	0.13	3	9	-4	9	6	7
NY:BUFFALO	04/05/88	1.59	0.09	4	5	2	6	-1	5
NY:NEW YORK CITY	04/04/88	1.46	0.13	0	9	8	10	3	7

Table 14 (continued)

Concentrations of Radionuclides in Pasteurized Milk

April 1988

Location	Date Collected	K		^{137}Cs		^{140}Ba		^{131}I	
		g/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$
NY:SYRACUSE	04/04/88	1.60	0.13	6	7	-6	9	-1	7
OH:CINCINNATI	04/26/88	1.45	0.13	2	9	-4	9	5	7
OK:OKLAHOMA CITY	04/26/88	1.54	0.23	11	14	-4	20	-2	15
OR:PORTLAND	04/04/88	1.43	0.09	6	6	2	6	1	5
PA:PHILADELPHIA	04/04/88	1.44	0.13	-1	9	1	9	-2	7
PA:PITTSBURGH	04/08/88	1.48	0.12	9	7	-5	9	3	7
PC:CRISTOBAL	04/27/88	1.25	0.12	17	7	2	9	2	7
PR:SAN JUAN	04/18/88	1.55	0.13	4	9	-5	9	2	7
SD:RAPID CITY	04/04/88	1.47	0.13	10	9	-6	9	1	7
TN:CHATTANOOGA	04/04/88	1.52	0.13	3	7	8	9	6	7
TN:KNOXVILLE	04/04/88	1.66	0.13	5	7	-1	9	3	7
TN:MEMPHIS	04/11/88	1.49	0.13	3	9	-4	9	4	7
TX:AUSTIN	04/29/88	1.43	0.09	4	6	-2	6	6	5
VA:NORFOLK	04/29/88	1.39	0.13	7	9	-10	9	4	7
VT:BURLINGTON	04/30/88	1.48	0.13	2	9	-2	9	4	7
WA:SEATTLE	04/07/88	1.53	0.13	8	9	4	10	5	7
WV:CHARLESTON	04/26/88	1.65	0.24	2	18	1	19	-3	14
WY:LARAMIE	04/06/88	1.58	0.13	-1	7	3	9	1	7

σ = Sigma Counting Error.

Table 15

Concentrations of Radionuclides in Pasteurized Milk

May 1988

Location	Date Collected	K		^{137}Cs		^{140}Ba		^{131}I	
		g/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$
AL:MONTGOMERY	05/06/88	1.47	0.08	10	5	2	6	9	5
AR:LITTLE ROCK	05/03/88	0.94	0.12	7	9	3	9	7	7
AZ:PHOENIX	05/04/88	1.72	0.13	1	7	-4	8	1	7
CA:LOS ANGELES	05/03/88	1.64	0.13	12	9	-10	9	9	7
CA:SACRAMENTO	05/03/88	1.46	0.13	8	9	2	9	2	7
CA:SAN FRANCISCO	05/16/88	1.48	0.13	6	9	2	9	6	7
CO:DENVER	05/31/88	1.48	0.13	0	9	-5	9	4	7
CT:HARTFORD	05/02/88	1.42	0.09	8	6	-1	6	6	5
DC:WASHINGTON	05/06/88	1.10	0.12	9	9	-1	9	4	7
DE:WILMINGTON	05/02/88	1.53	0.13	9	9	1	9	5	7
FL:TAMPA	05/03/88	1.45	0.13	11	9	-2	9	1	7
GA:ATLANTA	05/09/88	1.57	0.12	1	7	-1	8	-5	7
HI:HONOLULU	05/05/88	1.38	0.13	-3	9	-5	9	4	7
IA:DES MOINES	05/02/88	1.27	0.12	5	9	-2	9	6	7
IL:CHICAGO	05/02/88	1.52	0.13	2	9	4	10	1	7
IN:INDIANAPOLIS	05/02/88	1.39	0.13	0	9	2	9	1	7
KY:LOUISVILLE	05/03/88	1.32	0.12	8	7	-4	9	9	7
LA:NEW ORLEANS	05/27/88	1.70	0.13	0	7	-4	8	-1	7
MD:BALTIMORE	05/06/88	1.54	0.13	1	9	-3	9	1	7
ME:PORTLAND	05/10/88	1.36	0.12	6	9	-1	9	4	7
MI:DETROIT	05/12/88	1.59	0.13	-2	7	-2	8	-2	7
MI:GRAND RAPIDS	05/02/88	1.39	0.09	8	6	5	7	1	5
MN:MINNEAPOLIS	05/02/88	1.46	0.13	1	9	4	9	4	7
MN:ST. PAUL	05/02/88	1.46	0.13	15	9	2	10	7	7
MO:KANSAS CITY	05/06/88	1.44	0.09	7	6	-2	6	6	5
MO:ST. LOUIS	05/04/88	1.47	0.12	9	7	5	9	5	7
MS:JACKSON	05/04/88	1.42	0.13	18	9	-5	9	8	7
MT:HELENA	05/05/88	1.54	0.09	6	6	-7	6	2	5
NC:CHARLOTTE	05/09/88	1.57	0.23	-3	14	2	20	-1	15
ND:MINOT	05/25/88	1.54	0.12	-3	7	-4	8	-1	7
NE:OMAHA	05/05/88	1.26	0.12	6	9	-4	9	3	7
NH:MANCHESTER	05/16/88	1.40	0.13	3	9	-4	9	-1	7
NJ:TRENTON	05/05/88	1.52	0.13	5	9	-6	9	1	7
NM:ALBUQUERQUE	05/02/88	1.36	0.12	3	9	-1	9	5	7
NV:LAS VEGAS	05/23/88	1.46	0.09	4	6	-5	6	7	5
NY:BUFFALO	05/03/88	1.56	0.13	2	9	-5	9	5	7
NY:NEW YORK CITY	05/02/88	1.50	0.09	5	6	2	6	6	5

Table 15 (continued)

Concentrations of Radionuclides in Pasteurized Milk

May 1988

Location	Date Collected	K		^{137}Cs		^{140}Ba		^{131}I	
		g/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$
NY:SYRACUSE	05/02/88	1.48	0.13	6	9	3	9	1	7
OH:CINCINNATI	05/24/88	1.39	0.13	-1	9	-6	9	3	7
OK:OKLAHOMA CITY	05/09/88	1.39	0.09	4	6	3	6	3	5
OR:PORTLAND	05/05/88	1.38	0.12	5	9	-7	9	5	7
PA:PHILADELPHIA	05/02/88	1.53	0.13	5	9	-3	9	7	7
PA:PITTSBURGH	05/02/88	1.47	0.09	3	6	-5	6	7	5
PC:CRISTOBAL	05/27/88	1.40	0.13	16	9	-2	9	3	7
PR:SAN JUAN	05/17/88	1.52	0.13	1	9	1	9	1	7
SC:CHARLESTON	05/05/88	1.55	0.12	0	7	0	8	-1	7
SD:RAPID CITY	05/02/88	1.51	0.13	1	9	-6	9	2	7
TN:CHATTANOOGA	05/02/88	1.42	0.13	4	9	-4	9	3	7
TN:KNOXVILLE	05/02/88	1.50	0.13	6	9	-5	9	4	7
TN:MEMPHIS	05/23/88	1.60	0.13	1	7	-5	8	0	7
TX:FT. WORTH	05/03/88	1.65	0.13	-3	7	-2	8	0	7
WA:SEATTLE	05/02/88	1.42	0.08	6	6	-1	6	5	5
WV:CHARLESTON	05/31/88	1.43	0.22	3	14	-6	20	4	15
WY:LARAMIE	05/04/88	1.62	0.13	0	7	-3	8	-2	7

σ = Sigma Counting Error.

Table 16

Concentrations of Radionuclides in Pasteurized Milk

June 1988

Location	Date Collected	K		^{137}Cs		^{140}Ba		^{131}I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
AL:MONTGOMERY	06/14/88	1.27	0.12	8	9	-9	9	3	7
AR:LITTLE ROCK	06/06/88	1.46	0.12	-6	7	0	8	0	7
AZ:PHOENIX	06/08/88	1.55	0.12	-2	7	-3	8	0	7
CA:LOS ANGELES	06/09/88	1.53	0.13	-1	9	-4	9	2	7
CA:SACRAMENTO	06/01/88	1.51	0.13	6	9	-1	9	7	7
CO:DENVER	06/30/88	1.40	0.09	1	6	-6	6	2	5
CT:HARTFORD	06/06/88	1.43	0.12	0	7	-3	8	0	7
DC:WASHINGTON	06/02/88	1.40	0.09	6	6	-1	6	7	5
DE:WILMINGTON	06/08/88	1.58	0.13	6	7	-4	8	7	7
FL:TAMPA	06/01/88	1.56	0.12	4	7	-6	8	-1	7
GA:ATLANTA	06/10/88	1.37	0.09	2	6	-9	6	3	5
HI:HONOLULU	06/06/88	1.57	0.08	1	5	-6	6	1	5
IA:DES MOINES	06/06/88	1.61	0.09	2	5	2	6	1	5
ID:IDAHO FALLS	06/06/88	1.50	0.09	6	6	2	7	5	5
IL:CHICAGO	06/06/88	1.59	0.13	5	7	-4	8	9	7
IN:INDIANAPOLIS	06/06/88	1.57	0.12	4	7	1	8	0	7
KS:WICHITA	06/13/88	1.28	0.12	3	9	-1	9	5	7
KY:LOUISVILLE	06/07/88	1.67	0.13	-2	7	4	8	-6	7
MA:BOSTON	06/08/88	1.21	0.12	5	9	-3	9	3	7
MD:BALTIMORE	06/03/88	1.44	0.13	5	9	1	9	3	7
ME:PORTLAND	06/02/88	1.55	0.13	10	9	1	9	3	7
MI:DETROIT	06/07/88	1.43	0.09	9	6	-5	6	4	5
MI:GRAND RAPIDS	06/06/88	1.45	0.13	10	9	-1	9	0	7
MN:MINNEAPOLIS	06/06/88	1.61	0.13	0	7	-5	8	-4	7
MN:ST. PAUL	06/01/88	1.36	0.12	8	9	-4	9	8	7
MO:KANSAS CITY	06/10/88	1.43	0.13	7	9	-5	9	2	7
MS:JACKSON	06/08/88	1.03	0.12	11	9	-3	9	7	7
MT:HELENA	06/09/88	1.34	0.12	0	9	-4	9	2	7
NC:CHARLOTTE	06/13/88	1.53	0.23	5	14	1	20	6	15
ND:MINOT	06/29/88	1.49	0.13	5	9	-1	9	6	7
NE:OMAHA	06/09/88	1.13	0.12	11	9	-1	9	2	7
NJ:TRENTON	06/08/88	1.33	0.12	6	9	-6	9	5	7
NM:ALBUQUERQUE	06/06/88	1.33	0.09	6	6	2	7	4	5
NV:LAS VEGAS	06/14/88	1.46	0.13	-1	9	2	9	7	7
NY:BUFFALO	06/03/88	1.45	0.13	2	9	2	9	7	7
NY:NEW YORK CITY	06/06/88	1.57	0.12	-1	7	-6	8	-5	7
NY:SYRACUSE	06/06/88	1.58	0.12	-3	7	-7	8	0	7

Table 16 (continued)

Concentrations of Radionuclides in Pasteurized Milk

June 1988

Location	Date Collected	K		^{137}Cs		^{140}Ba		^{131}I	
		g/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$
OH:CINCINNATI	06/29/88	1.37	0.13	1	9	1	9	1	7
OK:OKLAHOMA CITY	06/06/88	1.63	0.09	4	6	1	7	3	5
OR:PORTLAND	06/06/88	1.56	0.08	2	5	2	6	0	5
PA:PHILADELPHIA	06/06/88	1.50	0.13	13	9	4	10	5	7
PA:PITTSBURGH	06/07/88	1.50	0.12	6	7	-3	8	0	7
PC:CRISTOBAL	06/30/88	1.45	0.13	15	9	0	9	-5	7
PR:SAN JUAN	06/10/88	1.68	0.13	3	7	-4	8	-3	7
SC:CHARLESTON	06/21/88	1.49	0.13	0	9	-2	9	2	7
SD:RAPID CITY	06/06/88	1.50	0.13	10	9	-1	9	1	7
TN:CHATTANOOGA	06/06/88	1.47	0.13	3	9	1	9	9	7
TN:KNOXVILLE	06/06/88	1.37	0.13	8	9	5	10	7	7
TN:MEMPHIS	06/21/88	1.51	0.13	11	9	4	10	7	7
TX:DALLAS	06/01/88	1.39	0.13	4	9	0	9	7	7
TX:FT. WORTH	06/07/88	1.60	0.13	1	7	-6	8	-2	7
VA:NORFOLK	06/03/88	1.41	0.13	8	9	0	9	4	7
VT:BURLINGTON	06/02/88	1.64	0.16	-3	10	-5	14	-7	11
WA:SEATTLE	06/06/88	1.65	0.13	5	7	-6	8	2	7
WA:SPOKANE	06/06/88	1.58	0.13	5	7	-2	8	-2	7
WV:CHARLESTON	06/21/88	1.63	0.23	-7	14	3	20	1	15
WY:LARAMIE	06/09/88	1.73	0.09	-5	5	-5	6	-3	5

σ = Sigma Counting Error.

Table 17

Strontium-90 and Strontium-89 in Pasteurized Milk EPA Regional Composites

April – June 1988

EPA Region	Date	^{90}Sr pCi/l	$\pm 2\sigma$	^{89}Sr pCi/l	$\pm 2\sigma'$
I	04/03/88	2.0	0.7	-1	1
II	04/07/88	2.0	0.5	-1	1
III	04/09/88	1.5	1.0	1	2
IV	04/08/88	2.0	0.4	-1	1
V	04/08/88	2.5	0.6	-2	1
VI	04/09/88	1.6	0.5	1	1
VII	04/10/88	1.8	0.4	-1	1
VIII	04/17/88	2.2	0.5	-1	1
IX	04/04/88	0.5	0.4	1	1
X	04/12/88	1.7	0.5	-1	1

σ = Sigma Counting Error.

σ' = Analytical Error Term.

Carbon-14 in Milk

Nine stations, chosen for wide geographical distribution, contribute milk samples for annual analysis of carbon-14. These samples are monitored for carbon-14 levels in the food chain resulting from nuclear testing. The pasteurized milk is freeze-dried and the resulting powder is pelletized for ease of combustion. Analysis consists of combusting the samples and measuring released carbon dioxide through liquid scintillation. The last carbon-14 results were for samples collected during May 1975 and May 1979. They were published in *Environmental Radiation Data: Report 29.*

Tables 18–19 contain the results of carbon-14 analysis on samples collected during 1982 and 1987.

Table 18

Carbon-14 in Milk

April–May 1982

Location	Date Collected	dpm/g C	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$
AK:ANCHORAGE	04/22/82	16.81	0.4	452	10
AL:MONTGOMERY	04/08/82	17.15	0.4	461	10
CA:LOS ANGELES	04/05/82	16.88	0.4	454	10
HI:HONOLULU	05/04/82	16.79	0.2	452	6
HI:HONOLULU	04/06/82	16.77	0.2	451	7
ID:IDAHO FALLS	04/07/82	15.26	1.5	410	39
IL:CHICAGO	05/03/82	17.34	0.4	466	10
LA:NEW ORLEANS	04/19/82	17.02	0.5	458	15
NH:MANCHESTER	05/03/82	17.54	0.6	472	16
SC:CHARLESTON	04/27/82	17.11	0.3	460	7

σ = Sigma Counting Error.

Table 19

Carbon-14 in Milk

March-May 1987

Location	Date Collected	dpm/g C	$\pm 2\sigma$	pCi/l	$\pm 2\sigma$
AK:ANCHORAGE	03/04/87	16.02	0.5	431	13
AL:MONTGOMERY	04/10/87	15.86	0.2	426	5
CA:LOS ANGELES	04/02/87	15.92	0.4	428	10
HI:HONOLULU	04/06/87	15.95	0.3	429	7
ID:IDAHO FALLS	04/13/87	15.99	0.3	430	8
IL:CHICAGO	04/06/87	16.12	0.2	433	6
LA:NEW ORLEANS	04/01/87	16.12	0.3	433	7
OR:PORTLAND	04/06/87	16.17	0.3	435	7
SC:CHARLESTON	05/11/87	15.74	0.3	423	8

σ Sigma Counting Error.

AUGAFB., AL. (891994) 500

☆ U.S. GOVERNMENT PRINTING OFFICE 1989--631-002/86321 Region #4

Environmental Radiation Data (ERD) is published quarterly (January, April, July, October) by the U.S. Environmental Protection Agency's Office of Radiation Programs.

Requests for information concerning publication and distribution of ERD should be directed to:

Charles M. Petko
Technical Support Branch
Eastern Environmental Radiation Facility
1890 Federal Drive
Montgomery, Alabama 36109

Requests for information concerning the operation of ERAMS should be directed to:

Jon A. Broadway, Chief
Monitoring and Analytical Services Branch
Eastern Environmental Radiation Facility
1890 Federal Drive
Montgomery, Alabama 36109

or to:

Robert S. Dyer, Chief
Environmental Studies and Statistics Branch
Analysis and Support Division (ANR-461)
U. S. Environmental Protection Agency
Waterside Mall East
401 M Street, SW
Washington, DC 20460

***