National Air and
Radiation Environmental
Laboratory

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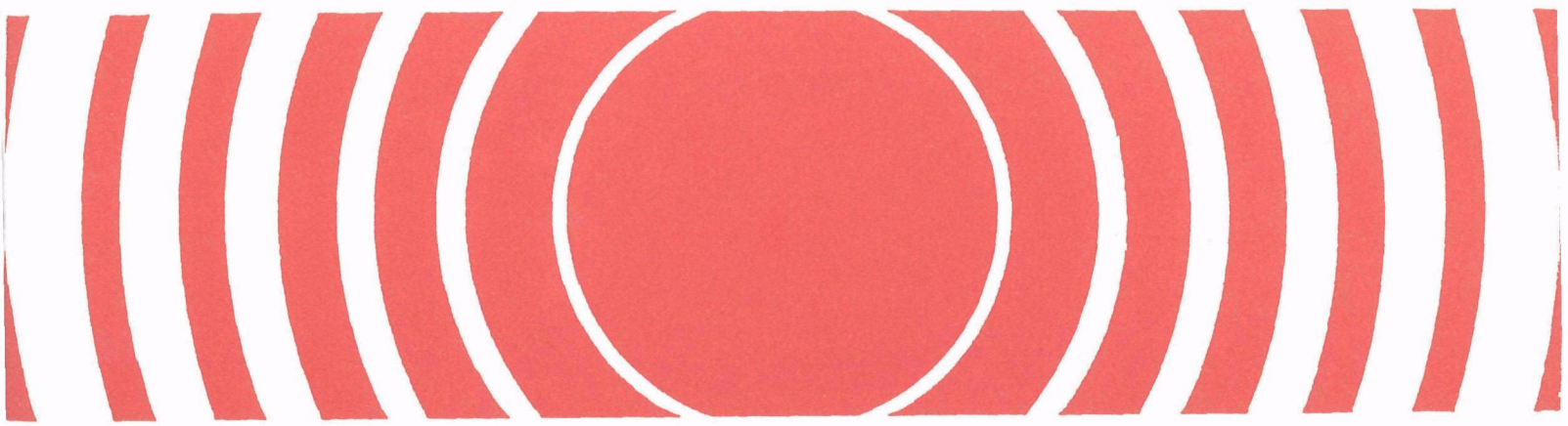
Environmental Radiation Data

Report 60

October - December 1989



ENVIRONMENTAL RADIATION DATA

REPORT 60

October - December 1989

United States Environmental Protection Agency

Office of Radiation Programs

Environmental Radiation Data (ERD) is compiled and distributed quarterly by the Office of Radiation Programs' National Air and Radiation Environmental Laboratory (NAREL) 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 NAREL 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

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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^2 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 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.

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 NAREL 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 NAREL 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 National Air and Radiation Environmental Laboratory, 1504 Avenue A, Montgomery, AL 36115-2601.

Tables 2–4 contain the data in airborne particulate samples for October December 1989. Tables 5–7 contain the data in precipitation sample for October - December 1989. Table 8 contains the data for tritium in precipitation samples for October December 1989 at the selected sites.

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† 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

October 1989

Location	Number of Samples	5-Hour Field Estimate (pCi/m^3)			NAREL Lab Measurment (pCi/m^3)		
		Max	Min	Avg	Max	Min	Avg
AL:MONTGOMERY	9	1.4	0.1	0.6	0.02	0.00	0.01
AR:LITTLE ROCK	9	0.9	0.2	0.5	0.02	0.01	0.02
AZ:PHOENIX	9	4.7	0.6	1.6	0.03	0.01	0.02
CA:BERKELEY	9	0.0	0.0	0.0	0.01	0.00	0.01
CA:LOS ANGELES	9	0.4	0.0	0.2	0.03	0.01	0.01
CO:DENVER	9	1.4	0.7	1.0	0.02	0.01	0.01
CT:HARTFORD	9	0.3	0.1	0.1	0.03	0.00	0.01
DE:WILMINGTON	9	0.5	0.0	0.2	0.02	0.00	0.01
FL:JACKSONVILLE	9	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	0.01
HI:HONOLULU	8	0.2	0.1	0.2	0.01	0.00	0.00
IA:IOWA CITY	9	0.4	0.1	0.2	0.02	0.01	0.01
ID:BOISE	9	0.8	0.0	0.4	0.02	0.00	0.01
ID:IDAHO FALLS	9	0.0	0.0	0.0	0.02	0.00	0.01
IL:CHICAGO	9	0.8	0.0	0.5	0.03	0.01	0.02
IN:INDIANAPOLIS	9	3.2	0.1	0.6	0.03	0.00	0.02
KS:TOPEKA	9	4.6	0.6	1.9	0.02	0.01	0.02
KY:FRANKFORT	4	0.6	0.3	0.5	0.03	0.01	0.01
LA:NEW ORLEANS	6	0.2	0.0	0.1	0.02	0.01	0.01
MA:LAWRENCE	9	0.5	0.1	0.2	0.03	0.00	0.01
ME:AUGUSTA	7	0.4	0.0	0.2	0.03	0.01	0.01
MI:LANSING	8	0.3	0.1	0.2	0.02	0.00	0.01
MN:MINNEAPOLIS	9	1.0	0.1	0.5	0.04	0.01	0.01
MO:JEFFERSON CITY	9	1.3	0.3	0.6	0.05	0.00	0.02
MS:JACKSON	9	0.8	0.2	0.5	0.05	0.01	0.03
NC:CHARLOTTE	9	0.4	0.0	0.1	0.03	0.00	0.02
NC:WILMINGTON	9	0.0	0.0	0.0	0.02	0.01	0.01
ND:BISMARCK	9	2.6	0.8	1.6	0.03	0.01	0.02
NE:LINCOLN	9	2.4	0.3	1.6	0.08	0.01	0.02
NH:CONCORD	9	0.3	0.0	0.2	0.02	0.00	0.01
NJ:TRENTON	9	1.2	0.1	0.5	0.03	0.00	0.01
NM:SANTA FE	4	0.2	0.0	0.1	0.01	0.01	0.01
NV:LAS VEGAS	9	0.3	0.1	0.2	0.02	0.01	0.02
NY:NEW YORK CITY	9	0.4	0.1	0.3	0.03	0.00	0.01
NY:NIAGARA FALLS	9	0.5	0.1	0.2	0.03	0.00	0.01
NY:SYRACUSE	3	0.0	0.0	0.0	0.01	0.01	0.01
NY:YAPHANK	8	1.0	0.1	0.2	0.03	0.00	0.01

Table 2 (continued)

Airborne Particulates
Gross Beta Concentrations

October 1989

Location	Number of Samples	5-Hour Field Estimate (pCi/m^3)			NAREL Lab Measurment (pCi/m^3)		
		Max	Min	Avg	Max	Min	Avg
OH:COLUMBUS	6	0.3	0.1	0.2	0.04	0.00	0.02
OH:PAINESVILLE	9	0.4	0.1	0.2	0.04	0.00	0.02
OH:TOLEDO	9	1.1	0.2	0.5	0.05	0.01	0.02
OK:OKLAHOMA CITY	9	1.0	0.2	0.5	0.02	0.01	0.01
OR:PORTLAND	8	0.0	0.0	0.0	0.01	0.00	0.01
PA:GOLDSBORO	9	1.8	0.0	0.5	0.03	0.00	0.01
PA:HARRISBURG	9	1.5	0.1	0.5	0.03	0.00	0.01
PA:PHILADELPHIA	1	0.1	0.1	0.1	0.01	0.01	0.01
PA:PITTSBURGH	9	0.1	0.1	0.1	0.03	0.01	0.02
PA:THREE MILE ISLAND	9	1.4	0.0	0.5	0.02	0.00	0.01
RI:PROVIDENCE	9	0.7	0.0	0.3	0.04	0.00	0.01
SC:BARNWELL	2	0.0	0.0	0.0	0.01	0.01	0.01
SC:COLUMBIA	9	1.0	0.1	0.3	0.04	0.01	0.02
TN:KNOXVILLE	9	1.7	0.1	0.9	0.05	0.00	0.02
TN:NASHVILLE	9	1.3	0.1	0.4	0.03	0.00	0.02
TX:AUSTIN	8	0.4	0.1	0.3	0.02	0.01	0.01
TX:EL PASO	9	0.4	0.1	0.3	0.03	0.01	0.02
UT:SALT LAKE CITY	9	0.8	0.1	0.3	0.02	0.00	0.01
VA:LYNCHBURG	9	1.0	0.1	0.4	0.03	0.00	0.01
WA:OLYMPIA	9	0.6	0.0	0.2	0.01	0.00	0.01
WA:SPOKANE	6	0.7	0.2	0.4	0.01	0.01	0.01
WI:MADISON	8	0.8	0.1	0.5	0.02	0.00	0.01
WV:CHARLESTON	8	0.4	0.1	0.2	0.03	0.01	0.02
WY:CHEYENNE	4	0.3	0.2	0.3	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

November 1989

Location	Number of Samples	5-Hour Field Estimate (pCi/m^3)			NAREL Lab Measurment (pCi/m^3)		
		Max	Min	Avg	Max	Min	Avg
AL:MONTGOMERY	6	0.6	0.1	0.3	0.02	0.01	0.01
AR:LITTLE ROCK	8	0.5	0.1	0.3	0.02	0.01	0.01
AZ:PHOENIX	8	3.3	0.3	1.5	0.05	0.01	0.02
CA:BERKELEY	7	0.0	0.0	0.0	0.04	0.01	0.02
CA:LOS ANGELES	7	0.9	0.1	0.3	0.04	0.00	0.02
CO:DENVER	9	1.4	0.3	0.8	0.02	0.00	0.01
CT:HARTFORD	9	0.1	0.0	0.1	0.01	0.00	0.01
DE:WILMINGTON	8	0.2	0.0	0.1	0.03	0.01	0.01
FL:JACKSONVILLE	2	0.3	0.2	0.3	0.02	0.01	0.01
FL:MIAMI	8	0.1	0.0	0.0	0.02	0.00	0.01
HI:HONOLULU	8	0.3	0.1	0.2	0.01	0.00	0.00
IA:IOWA CITY	9	1.0	0.1	0.3	0.03	0.01	0.02
ID:BOISE	9	0.9	0.2	0.5	0.03	0.00	0.01
ID:IDAHO FALLS	8	0.0	0.0	0.0	0.02	0.00	0.01
IL:CHICAGO	7	0.7	0.1	0.4	0.05	0.01	0.02
IN:INDIANAPOLIS	7	2.3	0.0	0.6	0.02	0.01	0.01
KS:TOPEKA	8	3.2	0.1	1.3	0.03	0.01	0.02
KY:FRANKFORT	4	0.4	0.2	0.3	0.04	0.01	0.02
LA:NEW ORLEANS	6	0.1	0.0	0.1	0.02	0.01	0.02
MA:LAWRENCE	7	0.1	0.0	0.1	0.02	0.01	0.01
ME:AUGUSTA	6	0.1	0.0	0.1	0.01	0.01	0.01
MI:LANSING	9	0.2	0.1	0.2	0.02	0.01	0.01
MN:MINNEAPOLIS	7	0.9	0.0	0.3	0.02	0.01	0.01
MO:JEFFERSON CITY	7	0.9	0.3	0.7	0.02	0.01	0.02
MS:JACKSON	8	0.8	0.1	0.3	0.03	0.01	0.02
NC:CHARLOTTE	7	0.3	0.0	0.1	0.02	0.01	0.01
NC:WILMINGTON	9	0.0	0.0	0.0	0.02	0.01	0.01
ND:BISMARCK	7	1.0	0.3	0.6	0.02	0.01	0.01
NE:LINCOLN	7	3.2	0.0	1.9	0.03	0.01	0.02
NH:CONCORD	8	0.1	0.0	0.1	0.01	0.00	0.01
NJ:TRENTON	9	0.3	0.1	0.2	0.02	0.00	0.01
NV:LAS VEGAS	8	0.6	0.1	0.3	0.19	0.01	0.04
NY:NEW YORK CITY	8	0.2	0.1	0.2	0.02	0.01	0.01
NY:NIAGARA FALLS	7	0.3	0.1	0.1	0.01	0.00	0.01
NY:SYRACUSE	1	0.1	0.1	0.1	0.01	0.01	0.01
NY:YAPHANK	7	1.1	0.0	0.2	0.01	0.01	0.01
OH:COLUMBUS	7	0.2	0.1	0.2	0.04	0.01	0.02

Table 3 (continued)

Airborne Particulates
Gross Beta Concentrations

November 1989

Location	Number of Samples	5-Hour Field Estimate (pCi/m^3)			NAREL Lab Measurment (pCi/m^3)		
		Max	Min	Avg	Max	Min	Avg
OH:PAINESVILLE	8	0.2	0.1	0.1	0.03	0.01	0.01
OH:TOLEDO	8	0.5	0.1	0.2	0.02	0.01	0.01
OK:OKLAHOMA CITY	6	1.2	0.4	0.7	0.03	0.01	0.02
OR:PORTLAND	7	0.0	0.0	0.0	0.02	0.00	0.01
PA:GOLDSBORO	8	0.9	0.0	0.3	0.02	0.01	0.01
PA:HARRISBURG	9	0.3	0.0	0.2	0.02	0.01	0.01
PA:PITTSBURGH	9	0.1	0.0	0.1	0.03	0.01	0.01
PA:THREE MILE ISLAND	8	0.4	0.0	0.2	0.01	0.01	0.01
RI:PROVIDENCE	8	0.3	0.0	0.1	0.02	0.01	0.01
SC:BARNWELL	2	1.4	0.0	0.7	0.01	0.01	0.01
SC:COLUMBIA	7	0.5	0.1	0.3	0.05	0.01	0.02
TN:KNOXVILLE	7	0.8	0.1	0.5	0.02	0.01	0.02
TN:NASHVILLE	7	0.5	0.0	0.2	0.03	0.01	0.02
TX:AUSTIN	6	0.3	0.1	0.2	0.02	0.01	0.01
TX:EL PASO	7	0.9	0.2	0.5	0.03	0.01	0.02
UT:SALT LAKE CITY	8	1.7	0.2	0.6	0.02	0.01	0.01
VA:LYNCHBURG	7	0.5	0.1	0.3	0.02	0.01	0.01
WA:OLYMPIA	7	0.2	0.0	0.1	0.01	0.00	0.00
WA:SPOKANE	9	0.6	0.1	0.3	0.02	0.00	0.01
WI:MADISON	9	0.5	0.2	0.3	0.02	0.01	0.01
WV:CHARLESTON	6	0.2	0.0	0.0	0.02	0.01	0.01
WY:CHEYENNE	4	0.3	0.1	0.2	0.01	0.00	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

December 1989

Location	Number of Samples	5-Hour Field Estimate (pCi/m^3)			NAREL Lab Measurment (pCi/m^3)		
		Max	Min	Avg	Max	Min	Avg
AL:MONTGOMERY	8	1.4	0.1	0.4	0.05	0.01	0.02
AR:LITTLE ROCK	9	0.5	0.0	0.3	0.03	0.01	0.02
AZ:PHOENIX	8	3.8	1.2	2.4	0.03	0.02	0.03
CA:BERKELEY	9	0.1	0.0	0.0	0.05	0.01	0.03
CA:LOS ANGELES	9	0.7	0.1	0.3	0.03	0.01	0.02
CO:DENVER	8	1.2	0.2	0.6	0.02	0.01	0.01
CT:HARTFORD	8	0.1	0.0	0.0	0.02	0.01	0.01
DE:WILMINGTON	9	0.2	0.0	0.1	0.02	0.01	0.01
FL:MIAMI	9	0.1	0.0	0.1	0.01	0.00	0.01
HI:HONOLULU	8	0.3	0.1	0.2	0.01	0.00	0.00
IA:IOWA CITY	8	0.3	0.0	0.2	0.04	0.01	0.02
ID:BOISE	8	1.3	0.3	0.8	0.05	0.01	0.03
ID:IDAHO FALLS	9	0.0	0.0	0.0	0.03	0.01	0.02
IL:CHICAGO	7	0.5	0.2	0.3	0.04	0.01	0.03
IN:INDIANAPOLIS	9	3.2	0.0	1.2	0.03	0.01	0.02
KS:TOPEKA	7	1.8	0.5	1.1	0.04	0.01	0.02
KY:FRANKFORT	2	0.4	0.3	0.4	0.03	0.02	0.03
LA:NEW ORLEANS	5	0.1	0.0	0.1	0.02	0.01	0.01
MA:LAWRENCE	7	0.1	0.0	0.1	0.02	0.01	0.01
ME:AUGUSTA	9	0.1	0.0	0.0	0.02	0.01	0.01
MI:LANSING	8	0.1	0.1	0.1	0.02	0.01	0.01
MN:MINNEAPOLIS	8	0.8	0.0	0.3	0.03	0.01	0.02
MO:JEFFERSON CITY	9	2.0	0.3	0.7	0.04	0.01	0.02
MS:JACKSON	8	0.3	0.1	0.2	0.02	0.01	0.02
NC:CHARLOTTE	8	0.1	0.0	0.0	0.02	0.01	0.01
NC:WILMINGTON	6	0.0	0.0	0.0	0.02	0.00	0.01
ND:BISMARCK	9	1.1	0.2	0.5	0.03	0.01	0.02
NE:LINCOLN	7	2.1	0.0	0.7	0.06	0.01	0.03
NH:CONCORD	9	0.0	0.0	0.0	0.02	0.01	0.01
NJ:TRENTON	8	0.3	0.0	0.1	0.02	0.01	0.01
NV:LAS VEGAS	8	0.6	0.1	0.3	0.06	0.01	0.02
NY:ALBANY	1	0.0	0.0	0.0	0.02	0.02	0.02
NY:NEW YORK CITY	9	0.2	0.1	0.1	0.03	0.01	0.02
NY:NIAGARA FALLS	9	0.1	0.0	0.0	0.02	0.01	0.01
NY:SYRACUSE	1	0.0	0.0	0.0	0.01	0.01	0.01
NY:YAPHANK	7	0.4	0.0	0.2	0.02	0.01	0.01
OH:COLUMBUS	4	0.2	0.0	0.1	0.02	0.01	0.02

Table 4 (continued)

Airborne Particulates
Gross Beta Concentrations

December 1989

Location	Number of Samples	5-Hour Field Estimate (pCi/m^3)			NAREL Lab Measurment (pCi/m^3)		
		Max	Min	Avg	Max	Min	Avg
OH:PAINESVILLE	9	0.2	0.0	0.1	0.03	0.01	0.02
OH:TOLEDO	7	0.2	0.1	0.1	0.04	0.01	0.02
OK:OKLAHOMA CITY	8	1.4	0.1	0.7	0.04	0.01	0.02
OR:PORTLAND	8	0.0	0.0	0.0	0.02	0.00	0.01
PA:GOLDSBORO	9	0.3	0.0	0.1	0.02	0.01	0.01
PA:HARRISBURG	8	0.3	0.1	0.2	0.03	0.01	0.02
PA:PITTSBURGH	9	0.3	0.1	0.2	0.03	0.01	0.02
PA:THREE MILE ISLAND	8	0.3	0.0	0.2	0.02	0.01	0.01
RI:PROVIDENCE	8	0.3	0.0	0.1	0.02	0.01	0.01
SC:COLUMBIA	9	0.9	0.1	0.2	0.04	0.01	0.02
SD:PIERRE	2	0.2	0.2	0.2	0.01	0.01	0.01
TN:KNOXVILLE	6	0.4	0.2	0.3	0.03	0.01	0.02
TN:NASHVILLE	8	0.4	0.1	0.2	0.05	0.01	0.02
TX:AUSTIN	6	0.7	0.2	0.3	0.02	0.01	0.01
TX:EL PASO	8	0.7	0.1	0.4	0.03	0.01	0.02
UT:SALT LAKE CITY	6	0.4	0.0	0.2	0.02	0.01	0.01
VA:LYNCHBURG	6	0.3	0.1	0.2	0.02	0.01	0.01
WA:OLYMPIA	9	0.2	0.0	0.1	0.01	0.00	0.01
WA:SPOKANE	8	0.3	0.1	0.2	0.03	0.00	0.02
WI:MADISON	7	0.4	0.1	0.2	0.03	0.01	0.02
WV:CHARLESTON	7	0.2	0.0	0.1	0.02	0.01	0.01
WY:CHEYENNE	4	0.1	0.1	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 5

Gross Beta Concentrations in Precipitation

October 1989

Location	Depth (mm)	Act.	$\pm 2\sigma$ (nCi/m^2)	Specific Gamma Activity
AL:MONTGOMERY	75.2	0.04	0.03	ND
AR:LITTLE ROCK	82.6	0.07	0.03	ND
AZ:PHOENIX	8.8	0.01	0.00	ND
CA:BERKELEY	42.0	0.12	0.03	ND
CO:DENVER	10.0	0.01	0.01	ND
CT:HARTFORD	138.0	0.42	0.08	ND
DE:WILMINGTON	140.0	0.25	0.07	ND
FL:JACKSONVILLE	62.6	0.05	0.03	ND
FL:MIAMI	81.4	0.03	0.03	ND
HI:HONOLULU	93.0	0.07	0.04	ND
ID:BOISE	37.6	0.12	0.02	ND
ID:IDAHO FALLS	3.2	0.01	0.00	ND
IL:CHICAGO	23.6	0.03	0.01	ND
LA:NEW ORLEANS	60.0	0.04	0.02	ND
MA:LAWRENCE	40.0	0.07	0.02	ND
ME:AUGUSTA	89.0	0.04	0.03	ND
MI:LANSING	38.6	0.06	0.02	ND
MN:MINNEAPOLIS	11.0	0.01	0.01	ND
MO:JEFFERSON CITY	24.0	0.02	0.01	ND
MS:JACKSON	42.0	0.01	0.02	ND
NC:CHARLOTTE	72.0	0.04	0.03	ND
NC:WILMINGTON	98.0	0.05	0.04	ND
NH:CONCORD	106.8	0.15	0.05	ND
NJ:TRENTON	80.4	0.13	0.04	ND
NY:NEW YORK CITY	27.0	0.01	0.01	ND
NY:NIAGARA FALLS	42.0	0.04	0.02	ND
NY:SYRACUSE	24.0	0.01	0.01	ND
NY:YAPHANK	37.0	0.07	0.02	ND
OH:PAINESVILLE	103.0	0.05	0.04	ND
OH:TOLEDO	30.0	0.03	0.02	ND

Table 5 (continued)

Gross Beta Concentrations in Precipitation

October 1989

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m^2)		Specific Gamma Activity
OK:OKLAHOMA CITY	38.0	0.00	0.01	ND
OR:PORTLAND	52.6	0.06	0.02	ND
PA:HARRISBURG	148.6	0.30	0.08	ND
PA:MIDDLETOWN	50.0	0.01	0.02	ND
PA:PHILADELPHIA	26.0	0.02	0.01	ND
PA:PITTSBURGH	52.6	0.09	0.03	ND
SC:BARNWELL	92.6	0.10	0.04	ND
SC:COLUMBIA	50.6	0.02	0.02	ND
TN:KNOXVILLE	66.0	0.01	0.02	ND
TN:NASHVILLE	49.2	0.02	0.02	ND
TX:AUSTIN	8.0	0.01	0.00	ND
TX:EL PASO	5.0	0.01	0.00	ND
UT:SALT LAKE CITY	28.0	0.03	0.01	ND
VA:LYNCHBURG	229.0	0.12	0.08	ND
WA:OLYMPIA	71.0	0.06	0.03	ND
WI:MADISON	24.0	0.04	0.01	ND
WV:CHARLESTON	48.0	0.06	0.02	ND

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

Table 6

Gross Beta Concentrations in Precipitation

November 1989

Location	Depth (mm)	Act.	$\pm 2\sigma$ (nCi/m^2)	Specific Gamma Activity
AL:MONTGOMERY	88.2	0.25	0.05	ND
AR:LITTLE ROCK	57.0	0.05	0.02	ND
CA:BERKELEY	32.6	0.00	0.01	ND
CT:HARTFORD	92.0	0.13	0.05	ND
DE:WILMINGTON	39.0	0.12	0.02	ND
FL:JACKSONVILLE	6.0	0.01	0.00	ND
FL:MIAMI	18.2	0.04	0.01	ND
HI:HONOLULU	14.0	0.01	0.01	ND
ID:BOISE	8.0	0.02	0.00	ND
ID:IDAHO FALLS	16.0	0.07	0.01	NA
IL:CHICAGO	53.4	0.19	0.04	ND
LA:NEW ORLEANS	33.0	0.02	0.02	ND
ME:AUGUSTA	26.0	0.03	0.01	ND
MI:LANSING	107.8	0.08	0.04	ND
MN:MINNEAPOLIS	17.2	0.03	0.01	ND
MS:JACKSON	42.0	0.01	0.02	ND
NC:CHARLOTTE	83.0	0.07	0.04	ND
NC:WILMINGTON	42.0	0.05	0.02	ND
ND:BISMARCK	5.4	0.03	0.00	ND
NH:CONCORD	70.8	0.10	0.03	ND
NJ:TRENTON	59.4	0.09	0.03	ND
NY:NEW YORK CITY	46.0	0.04	0.02	ND
NY:NIAGARA FALLS	71.0	0.09	0.03	ND
NY:SYRACUSE	16.0	0.01	0.01	ND
NY:YAPHANK	148.0	0.33	0.08	ND
OH:PAINESVILLE	97.6	0.18	0.05	ND
OH:TOLEDO	40.0	0.02	0.02	ND
OR:PORTLAND	31.0	0.03	0.01	ND
PA:HARRISBURG	60.6	0.11	0.03	ND
PA:MIDDLETOWN	54.0	0.03	0.02	ND

Table 6 (continued)

Gross Beta Concentrations in Precipitation

November 1989

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m^2)		Specific Gamma Activity
PA:PITTSBURGH	20.0	0.06	0.01	ND
RI:PROVIDENCE	8.0	0.01	0.00	ND
SC:BARNWELL	4.4	0.00	0.00	ND
SC:COLUMBIA	43.2	0.07	0.02	ND
TN:KNOXVILLE	104.0	0.03	0.04	ND
TN:NASHVILLE	111.4	0.04	0.05	ND
UT:SALT LAKE CITY	18.6	0.02	0.01	ND
VA:LYNCHBURG	71.6	0.04	0.03	ND
WA:OLYMPIA	233.0	0.09	0.09	ND
WI:MADISON	65.6	0.44	0.06	ND
WV:CHARLESTON	28.2	0.23	0.03	ND

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

Table 7

Gross Beta Concentrations in Precipitation

December 1989

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m^2)		Specific Gamma Activity
AL:MONTGOMERY	135.8	0.16	0.07	ND
AR:LITTLE ROCK	11.0	0.02	0.01	ND
DE:WILMINGTON	4.0	0.02	0.00	ND
FL:MIAMI	55.6	0.04	0.02	ND
HI:HONOLULU	35.0	0.03	0.01	ND
ID:IDAHO FALLS	2.6	0.01	0.00	ND
IL:CHICAGO	11.8	0.05	0.01	ND
LA:NEW ORLEANS	32.0	0.00	0.01	ND
MO:JEFFERSON CITY	24.0	0.02	0.01	ND
MS:JACKSON	42.0	0.01	0.02	ND
NC:CHARLOTTE	84.0	0.12	0.04	ND
NC:WILMINGTON	50.0	0.05	0.02	ND
NJ:TRENTON	4.8	0.01	0.00	ND
NY:NIAGARA FALLS	12.0	0.03	0.01	ND
OH:PAINESVILLE	17.6	0.07	0.01	ND
PA:HARRISBURG	5.2	0.02	0.00	ND
SC:COLUMBIA	105.0	0.09	0.05	ND
TN:KNOXVILLE	26.0	0.01	0.01	ND
TN:NASHVILLE	19.4	0.20	0.02	ND
TX:AUSTIN	8.0	0.00	0.00	ND
UT:SALT LAKE CITY	2.6	0.01	0.00	ND
VA:LYNCHBURG	19.0	0.05	0.01	ND
WA:OLYMPIA	158.6	0.03	0.06	ND
WI:MADISON	11.0	0.01	0.00	ND

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

Table 8

Precipitation
Tritium Concentrations

October December 1989

Location	October 1989 nCi/l	±2σ	November 1989 nCi/l	±2σ	December 1989 nCi/l	±2σ
AL:MONTGOMERY	0.1	0.2	0.3	0.2	0.2	0.2
AR:LITTLE ROCK	0.2	0.2	0.1	0.2	0.2	0.2
AZ:PHOENIX	0.2	0.2	NS		NS	
CA:BERKELEY	0.1	0.2	0.1	0.2	NS	
CO:DENVER	0.2	0.2	NS		NS	
CT:HARTFORD	0.1	0.2	0.2	0.2	NS	
DE:WILMINGTON	0.2	0.2	0.1	0.2	0.2	0.2
FL:JACKSONVILLE	0.2	0.2	0.2	0.2	NS	
FL:MIAMI	0.2	0.2	0.2	0.2	0.1	0.2
HI:HONOLULU	0.2	0.2	0.1	0.2	0.2	0.2
ID:BOISE	0.2	0.2	0.1	0.2	NS	
ID:IDAHO FALLS	0.1	0.2	0.1	0.2	0.1	0.2
IL:CHICAGO	0.5	0.2	0.2	0.2	0.1	0.2
LA:NEW ORLEANS	0.3	0.2	0.1	0.2	0.2	0.2
MA:LAWRENCE	0.1	0.2	NS		NS	
ME:AUGUSTA	0.1	0.2	0.1	0.2	NS	
MI:LANSING	0.3	0.2	0.2	0.2	NS	
MN:MINNEAPOLIS	0.2	0.2	0.6	0.2	NS	
MO:JEFFERSON CITY	0.3	0.2	NS		0.1	0.2
MS:JACKSON	0.2	0.2	0.3	0.2	0.2	0.2
NC:CHARLOTTE	0.2	0.2	0.3	0.2	0.2	0.2
NC:WILMINGTON	0.2	0.2	0.2	0.2	0.2	0.2
ND:BISMARCK	NS		0.5	0.2	NS	
NH:CONCORD	0.3	0.2	0.2	0.2	NS	
NJ:TRENTON	0.3	0.2	0.1	0.2	0.4	0.2
NY:NEW YORK CITY	0.2	0.2	0.1	0.2	NS	
NY:NIAGARA FALLS	0.4	0.2	0.1	0.2	0.3	0.2
NY:SYRACUSE	0.3	0.2	0.2	0.2	NS	
NY:YAPHANK	0.1	0.2	0.1	0.2	NS	
OH:PAINESVILLE	0.4	0.2	0.2	0.2	0.1	0.2
OH:TOLEDO	0.4	0.2	0.1	0.2	NS	
OK:OKLAHOMA CITY	0.3	0.2	NS		NS	
OR:PORTLAND	0.2	0.2	0.5	0.2	NS	
PA:HARRISBURG	0.4	0.2	0.2	0.2	0.2	0.2
PA:MIDDLETOWN	0.1	0.2	0.2	0.2	NS	
PA:PHILADELPHIA	0.2	0.2	NS		NS	
PA:PITTSBURGH	0.2	0.2	0.2	0.2	NS	

Table 8 (continued)

Precipitation
Tritium Concentrations
October - December 1989

Location	October 1989 nCi/l	±2σ	November 1989 nCi/l	±2σ	December 1989 nCi/l	±2σ
RI:PROVIDENCE	NS		0.2	0.2	NS	
SC:BARNWELL	0.8	0.2	1.4	0.2	NS	
SC:COLUMBIA	0.3	0.2	0.3	0.2	0.3	0.2
TN:KNOXVILLE	0.4	0.2	0.2	0.2	0.6	0.2
TN:NASHVILLE	0.1	0.2	0.3	0.2	0.1	0.2
TX:AUSTIN	0.2	0.2	NS		0.1	0.2
TX:EL PASO	0.2	0.2	NS		NS	
UT:SALT LAKE CITY	0.2	0.2	0.1	0.2	0.2	0.2
VA:LYNCHBURG	0.2	0.2	0.2	0.2	0.3	0.2
WA:OLYMPIA	0.3	0.2	0.1	0.2	0.1	0.2
WI:MADISON	0.3	0.2	0.1	0.2	0.1	0.2
WV:CHARLESTON	0.2	0.2	0.2	0.2	NS	

σ = Sigma Counting Error.
NS = No Sample.

Plutonium and Uranium in Airborne Particulates and Precipitation

Environmental radiation levels of plutonium and uranium are determined by the analysis of semi-annually composited samples (air filters) collected from the continuously operating airborne particulate samplers.

Concentration of the specific isotopes of plutonium–238, –239, and –240 and uranium–234, –235, and –238 are determined by alpha spectroscopy following chemical separation. The volume of air represented by the semiannual composite ranges from 25,000 to 40,000 cubic meters.

Plutonium and uranium results are published when they become available.

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 NAREL 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 October - December 1989.

Table 9

Surface Water
Tritium Concentrations

October December 1989

Location	Source	Date Collected	nCi/l	$\pm 2\sigma$
AL:DECATUR	TENNESSEE RIVER	10/04/89	0.3	0.2
AL:DOTHAN	CHATTAHOOCHEE RIVER	10/12/89	0.4	0.2
AL:SCOTTSBORO	TENNESSEE RIVER	10/05/89	0.3	0.2
AR:LITTLE ROCK	ARKANSAS RIVER	10/20/89	0.2	0.2
CA:DIABLO CANYON	PACIFIC OCEAN	10/12/89	0.1	0.2
CA:EUREKA	HUMBOLDT BAY	10/05/89	0.1	0.2
CA:SAN ONOFRE	PACIFIC OCEAN	11/20/89	0.1	0.2
CA:SAN ONOFRE	PACIFIC OCEAN	09/26/89	0.3	0.2
CO:PLATTEVILLE	SOUTH PLATTE RIVER	10/04/89	0.4	0.2
CT:EAST HADDAM	CONNECTICUT RIVER	10/10/89	0.3	0.2
CT:WATERFORD	LONG ISLAND SOUND	10/10/89	0.2	0.2
FL:CRYSTAL RIVER	GULF OF MEXICO	10/09/89	0.2	0.2
FL:FT. PIERCE	ATLANTIC OCEAN	10/03/89	0.2	0.2
FL:HOMESTEAD	BISCAYNE BAY	10/16/89	0.2	0.2
GA:BAXLEY	ALTAMAHA RIVER	10/02/89	0.3	0.2
IA:CEDAR RAPIDS	CEDAR RIVER	10/10/89	0.2	0.2
ID:BUHL	SNAKE RIVER	11/07/89	0.4	0.2
IL:E. MOLINE	MISSISSIPPI RIVER	10/05/89	0.1	0.2
IL:MORRIS	ILLINOIS RIVER	10/07/89	0.3	0.2
LA:NEW ORLEANS	MISSISSIPPI RIVER	10/13/89	0.3	0.2
MA:PLYMOUTH	CAPE COD BAY	10/03/89	0.2	0.2
MD:CONOWINGO	SUSQUEHANNA RIVER	10/17/89	0.2	0.2
MD:LUSBY	CHESAPEAKE BAY	10/17/89	0.1	0.2
ME:WISCASSET	MONTSEWAY BAY	10/12/89	0.2	0.2
MI:BRIDGMAN	LAKE MICHIGAN	10/10/89	0.2	0.2
MI:CHARLEVOIX	LAKE MICHIGAN	10/06/89	0.3	0.2
MI:MONROE	LAKE ERIE	10/09/89	0.2	0.2
MI:SOUTH HAVEN	LAKE MICHIGAN	10/10/89	0.2	0.2
MN:MONTICELLO	MISSISSIPPI RIVER	11/08/89	0.3	0.2
MN:RED WING	MISSISSIPPI RIVER	10/27/89	0.2	0.2
MS:PORT GIBSON	MISSISSIPPI RIVER	10/10/89	0.2	0.2
NC:CHARLOTTE	CATAWBA RIVER	10/11/89	0.4	0.2
NE:RULO	MISSOURI RIVER	10/20/89	0.3	0.2
NJ:BAYSIDE	DELAWARE RIVER	10/12/89	0.3	0.2
NJ:OYSTER CREEK	OYSTER CREEK	10/26/89	0.2	0.2
NV:BOULDER CITY	COLORADO RIVER	10/12/89	0.3	0.2
NY:CHELSEA	HUDSON RIVER	10/04/89	0.3	0.2

Table 9 (continued)

Surface Water
Tritium Concentrations

October December 1989

Location	Source	Date Collected	nCi/l	$\pm 2\sigma$
NY:OSSINING	HUDSON RIVER	10/11/89	0.2	0.2
OH:TOLEDO	LAKE ERIE	10/02/89	0.1	0.2
OR:BRADWOOD	COLUMBIA RIVER	10/24/89	0.2	0.2
PA:DANVILLE	SUSQUEHANNA RIVER	10/18/89	0.2	0.2
PA:PHILADELPHIA	SCHUYLKILL RIVER-QUEEN	10/13/89	0.2	0.2
PA:PHILADELPHIA	DELAWARE RIVER	10/13/89	0.3	0.2
PA:PHILADELPHIA	SCHUYLKILL RIVER-BELMONT	10/13/89	0.2	0.2
SC:ALLENDALE	SAVANNAH RIVER	10/31/89	1.5	0.2
SC:BROAD RIVER	BROAD RIVER	10/12/89	0.3	0.2
SC:HARTSVILLE	LAKE ROBINSON	10/23/89	0.5	0.2
TN:KINGSTON	CLINCH RIVER	10/10/89	2.5	0.2
TX:MATAGORDA	COLORADO RIVER	10/10/89	0.5	0.2
VA:DOSWELL	NORTH ANNA RIVER	10/05/89	3.3	0.2
VA:NEWPORT NEWS	JAMES RIVER	10/17/89	0.2	0.2
VT:VERNON	CONNECTICUT RIVER	10/24/89	0.2	0.2
WA:NORTHPORT	COLUMBIA RIVER	11/08/89	0.5	0.2
WA:RICHLAND	COLUMBIA RIVER	11/20/89	0.2	0.2
WI:TWO CREEKS	LAKE MICHIGAN	10/23/89	0.2	0.2
WI:VICTORY	MISSISSIPPI RIVER	10/09/89	0.2	0.2
WV:WHEELING	OHIO RIVER	10/02/89	0.3	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 October December 1989.

Table 10

Drinking Water
Tritium Concentrations

October December 1989

Location	Date Collected	nCi/l	$\pm 2\sigma$
AK:FAIRBANKS	10/13/89	0.3	0.2
AL:DOTHAN	10/12/89	0.3	0.2
AL:MONTGOMERY	10/03/89	0.3	0.2
AL:MUSCLE SHOALS	10/04/89	0.2	0.2
AL:SCOTTSBORO	10/05/89	0.1	0.2
AR:LITTLE ROCK	10/27/89	0.2	0.2
CA:BERKELEY	10/03/89	0.1	0.2
CA:LOS ANGELES	10/05/89	0.1	0.2
CO:DENVER	10/02/89	0.3	0.2
CO:PLATTEVILLE	10/04/89	0.1	0.2
CT:HARTFORD	10/02/89	0.3	0.2
DC:WASHINGTON	10/06/89	0.2	0.2
DE:DOVER	10/04/89	0.1	0.2
FL:MIAMI	10/19/89	0.2	0.2
FL:TAMPA	10/05/89	0.1	0.2
GA:BAXLEY	10/02/89	0.1	0.2
GA:SAVANNAH	12/04/89	0.1	0.2
HI:HONOLULU	10/17/89	0.1	0.2
IA:CEDAR RAPIDS	10/03/89	0.4	0.2
ID:BOISE	10/04/89	0.1	0.2
ID:IDAHO FALLS	10/13/89	0.5	0.2
IL:MORRIS	10/04/89	0.1	0.2
IL:W. CHICAGO	10/02/89	0.3	0.2
KS:TOPEKA	10/02/89	0.3	0.2
LA:NEW ORLEANS	10/10/89	0.3	0.2
MA:LAWRENCE	10/02/89	0.1	0.2
MD:BALTIMORE	10/04/89	0.2	0.2
MD:CONOWINGO	10/17/89	0.3	0.2
ME:AUGUSTA	10/03/89	0.3	0.2
MI:GRAND RAPIDS	10/06/89	0.2	0.2
MN:MINNEAPOLIS	10/17/89	0.1	0.2
MN:RED WING	10/10/89	0.1	0.2
MO:JEFFERSON CITY	10/02/89	0.4	0.2
MS:JACKSON	10/10/89	0.1	0.2
MS:PORT GIBSON	10/24/89	0.1	0.2

Table 10 (continued)

Drinking Water
Tritium Concentrations

October December 1989

Location	Date Collected	nCi/l	$\pm 2\sigma$
MT:HELENA	10/04/89	0.2	0.2
NC:CHARLOTTE	10/11/89	0.5	0.2
NC:WILMINGTON	12/07/89	0.2	0.2
ND:BISMARCK	10/02/89	0.4	0.2
NE:LINCOLN	10/01/89	0.2	0.2
NH:CONCORD	10/09/89	0.2	0.2
NJ:TRENTON	10/23/89	0.2	0.2
NJ:WARETOWN	10/26/89	0.1	0.2
NM:SANTA FE	10/04/89	0.1	0.2
NM:SANTA FE	11/29/89	0.1	0.2
NV:LAS VEGAS	10/12/89	0.3	0.2
NY:ALBANY	10/02/89	0.1	0.2
NY:NEW YORK CITY	10/02/89	0.3	0.2
NY:NIAGARA FALLS	10/06/89	0.3	0.2
OH:CINCINNATI	10/03/89	0.2	0.2
OH:COLUMBUS	10/10/89	0.2	0.2
OH:EAST LIVERPOOL	10/25/89	0.2	0.2
OH:PAINESVILLE	10/04/89	0.3	0.2
OH:TOLEDO	10/02/89	0.3	0.2
OK:OKLAHOMA CITY	10/04/89	0.1	0.2
OR:PORTLAND	10/13/89	0.1	0.2
PA:COLUMBIA	10/04/89	0.2	0.2
PA:HARRISBURG	10/11/89	0.4	0.2
PA:P'DELPHIA-BAXTER	10/13/89	0.4	0.2
PA:P'DELPHIA-QUEEN	10/13/89	0.3	0.2
PA:PHILADELPHIA	10/13/89	0.4	0.2
PA:PITTSBURGH	10/23/89	0.1	0.2
PC:CRISTOBAL	10/03/89	0.1	0.2
RI:PROVIDENCE	10/10/89	0.2	0.2
SC:BARNWELL	10/26/89	0.1	0.2
SC:COLUMBIA	10/04/89	0.3	0.2
SC:HARTSVILLE	10/23/89	0.2	0.2
SC:JENKINSVILLE	10/06/89	0.2	0.2
SC:SENECA	10/31/89	0.2	0.2
TN:CHATTANOOGA	12/22/89	0.5	0.2

Table 10 (continued)

Drinking Water
Tritium Concentrations

October - December 1989

Location	Date Collected	nCi/l	$\pm 2\sigma$
TN:KNOXVILLE	10/03/89	0.2	0.2
TX:AUSTIN	11/01/89	0.3	0.2
VA:DOSWELL	10/02/89	0.2	0.2
VA:LYNCHBURG	10/03/89	0.1	0.2
VA:VIRGINIA BEACH	10/20/89	0.1	0.2
VI:ST. THOMAS	12/11/89	0.1	0.2
WA:RICHLAND	11/20/89	0.1	0.2
WA:SEATTLE	10/03/89	0.2	0.2
WI:GENOA CITY	10/09/89	0.1	0.2
WI:MADISON	10/06/89	0.2	0.2

σ = Sigma Counting Error.

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 NAREL 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.

Publication of EGAMP data has been temporarily suspended until problems with the data are resolved.

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

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 11-13 contain the concentrations of radionuclides in pasteurized milk for October December 1989. Table 14 contains the concentrations of strontium-90 and strontium-89 in pasteurized milk EPA Regional Composites for October December 1989.

Table 11

Concentrations of Radionuclides in Pasteurized Milk

October 1989

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	10/06/89	1.52	0.13	2	9	3	9	1	7
AR:LITTLE ROCK	10/03/89	1.56	0.13	11	9	-2	9	4	7
AZ:PHOENIX	10/05/89	1.52	0.13	1	9	0	9	2	7
CA:LOS ANGELES	10/06/89	1.69	0.13	-2	7	-1	8	-7	7
CA:SACRAMENTO	10/02/89	1.57	0.13	5	9	1	9	1	7
CA:SAN FRANCISCO	10/30/89	1.50	0.09	2	6	-2	6	4	5
CT:HARTFORD	10/02/89	1.45	0.06	8	6	2	6	3	5
DE:WILMINGTON	10/18/89	1.27	0.12	6	9	1	9	5	7
FL:TAMPA	10/11/89	1.45	0.12	1	9	-5	9	3	7
GA:ATLANTA	10/10/89	1.57	0.12	3	7	-4	8	0	7
HI:HONOLULU	10/03/89	1.54	0.12	4	7	1	8	2	7
IA:DES MOINES	10/04/89	1.62	0.12	5	7	-7	8	-1	7
ID:IDAHO FALLS	10/03/89	1.63	0.12	0	7	-4	8	1	7
IL:CHICAGO	10/02/89	1.69	0.23	14	14	1	19	6	15
IN:INDIANAPOLIS	10/02/89	1.33	0.12	2	9	0	9	4	7
KS:WICHITA	10/30/89	1.54	0.13	7	9	-2	9	9	7
KY:LOUISVILLE	10/03/89	1.60	0.08	5	5	-3	6	0	5
LA:NEW ORLEANS	10/06/89	1.46	0.12	7	7	-5	8	-6	7
MA:BOSTON	10/04/89	1.43	0.12	3	9	-3	9	6	7
MD:BALTIMORE	10/06/89	1.65	0.12	-1	7	-7	8	2	7
MI:DETROIT	10/06/89	1.77	0.23	2	14	2	19	7	15
MI:GRAND RAPIDS	10/02/89	1.53	0.13	12	9	0	9	2	7
MN:MINNEAPOLIS	10/02/89	1.53	0.13	5	9	2	9	7	7
MN:ST. PAUL	10/03/89	1.58	0.09	4	6	-5	6	3	5
MO:KANSAS CITY	10/06/89	1.55	0.12	4	7	-5	8	3	7
MO:ST. LOUIS	10/04/89	1.43	0.09	7	6	-3	6	5	5
MS:JACKSON	10/03/89	1.44	0.12	6	9	-2	9	8	7
MT:HELENA	10/13/89	1.46	0.13	7	9	3	9	6	7
NC:CHARLOTTE	10/09/89	1.57	0.22	-3	14	-3	19	2	15
ND:MINOT	10/25/89	1.44	0.08	2	6	1	6	6	5
NE:OMAHA	10/06/89	1.28	0.12	3	9	-1	9	1	7
NH:MANCHESTER	10/10/89	1.32	0.12	1	9	-1	9	1	7
NJ:TRENTON	10/05/89	1.45	0.13	-1	9	6	9	4	7
NM:ALBUQUERQUE	10/11/89	1.48	0.13	1	9	-3	9	1	7
NV:LAS VEGAS	10/10/89	1.58	0.08	-1	5	-9	6	-3	5
NY:BUFFALO	10/10/89	1.43	0.12	-5	9	-4	9	5	7
NY:NEW YORK CITY	10/02/89	1.60	0.08	-1	5	-1	6	3	5

Table 11 (continued)

Concentrations of Radionuclides in Pasteurized Milk

October 1989

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	10/03/89	1.55	0.13	6	9	-11	9	3	7
OH:CINCINNATI	10/31/89	1.56	0.12	2	7	-6	8	0	7
OH:CLEVELAND	10/24/89	1.47	0.13	1	9	-2	9	1	7
OK:OKLAHOMA CITY	10/09/89	1.35	0.07	7	5	-4	5	-3	6
OR:PORTLAND	10/31/89	1.49	0.09	1	6	1	6	1	5
PA:PHILADELPHIA	10/02/89	1.56	0.12	-1	7	-6	8	7	7
PA:PITTSBURGH	10/02/89	1.51	0.08	2	6	-4	6	4	5
PC:CRISTOBAL	10/26/89	1.53	0.09	14	6	-4	6	7	5
PR:SAN JUAN	10/16/89	1.45	0.12	15	9	-5	9	0	7
SD:RAPID CITY	10/02/89	1.50	0.13	11	9	-2	9	9	7
TN:CHATTANOOGA	10/02/89	1.52	0.13	6	9	3	9	5	7
TN:KNOXVILLE	10/02/89	1.38	0.12	14	9	-1	9	3	7
TN:MEMPHIS	10/30/89	1.56	0.12	4	7	-5	8	5	7
TX:AUSTIN	10/03/89	1.56	0.12	-3	6	-6	8	-3	7
TX:FT. WORTH	10/03/89	1.55	0.13	7	9	-4	9	4	7
VA:NORFOLK	10/27/89	1.47	0.13	5	9	3	9	-1	7
VT:BURLINGTON	10/06/89	1.56	0.13	-1	9	1	9	5	7
WA:SEATTLE	10/02/89	1.59	0.13	12	9	2	9	9	7
WA:SPOKANE	10/09/89	1.66	0.09	3	5	-4	6	-4	5
WV:CHARLESTON	10/18/89	1.40	0.12	2	9	-3	9	5	7
WY:LARAMIE	10/03/89	1.44	0.12	6	9	9	9	7	7

σ = Sigma Counting Error.

Table 12

Concentrations of Radionuclides in Pasteurized Milk

November 1989

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	11/08/89	1.49	0.12	1	7	-1	8	1	7
AR:LITTLE ROCK	11/05/89	1.47	0.13	6	9	-1	9	7	7
AZ:PHOENIX	11/08/89	1.59	0.08	1	5	-3	6	-2	5
CA:LOS ANGELES	11/03/89	1.46	0.13	5	9	1	9	2	7
CA:SACRAMENTO	11/01/89	1.52	0.13	6	9	-1	9	7	7
CO:DENVER	11/01/89	1.43	0.13	5	8	2	11	5	8
CT:HARTFORD	11/06/89	1.45	0.12	3	9	-1	9	6	7
DE:WILMINGTON	11/15/89	1.38	0.12	5	9	-2	9	6	7
FL:TAMPA	11/14/89	1.41	0.12	9	9	-5	9	8	7
GA:ATLANTA	11/13/89	1.42	0.12	2	9	-6	9	-1	7
HI:HONOLULU	11/07/89	1.50	0.09	2	6	-3	6	7	5
IA:DES MOINES	11/02/89	1.51	0.12	-3	7	-2	8	1	7
ID:IDAHO FALLS	11/07/89	1.65	0.12	6	7	-2	8	7	7
IL:CHICAGO	11/06/89	1.79	0.23	7	14	3	19	-9	14
IN:INDIANAPOLIS	11/06/89	1.63	0.12	0	7	-1	8	3	7
KS:WICHITA	11/20/89	1.32	0.08	4	6	0	6	5	5
KY:LOUISVILLE	11/07/89	1.51	0.13	3	9	1	9	6	7
LA:NEW ORLEANS	11/17/89	1.41	0.08	10	6	-1	6	4	5
MA:BOSTON	11/08/89	1.43	0.09	2	6	-2	6	2	5
MD:BALTIMORE	11/03/89	1.47	0.13	2	9	-3	9	1	7
ME:PORTLAND	11/07/89	1.66	0.12	6	7	-6	8	2	7
MI:DETROIT	11/15/89	1.46	0.12	0	9	-6	9	4	7
MI:GRAND RAPIDS	11/09/89	1.54	0.13	2	9	-5	9	2	7
MN:MINNEAPOLIS	11/06/89	1.63	0.09	2	5	-8	6	-1	5
MN:ST. PAUL	11/08/89	1.50	0.13	-2	9	0	9	1	7
MO:KANSAS CITY	11/08/89	1.57	0.12	-2	7	-4	8	-3	7
MO:ST. LOUIS	11/08/89	1.70	0.13	-2	7	-4	8	-2	7
MS:JACKSON	11/06/89	1.48	0.09	8	6	-4	6	3	5
MT:HELENA	11/07/89	1.33	0.12	5	9	-10	9	5	7
NC:CHARLOTTE	11/14/89	1.60	0.23	1	14	-1	19	5	15
ND:MINOT	11/28/89	1.36	0.12	6	9	-6	9	4	7
NE:OMAHA	11/08/89	1.47	0.12	-1	7	-5	8	0	7
NJ:TRENTON	11/09/89	1.52	0.12	-3	6	-3	8	-4	7
NV:LAS VEGAS	11/06/89	1.54	0.12	0	7	-5	8	5	7
NY:BUFFALO	11/28/89	1.32	0.12	4	9	-6	9	10	7
NY:NEW YORK CITY	11/06/89	1.38	0.12	3	9	1	9	4	7
NY:SYRACUSE	11/08/89	1.40	0.12	6	9	-2	9	4	7

Table 12 (continued)

Concentrations of Radionuclides in Pasteurized Milk

November 1989

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	11/13/89	1.38	0.12	1	9	3	9	-1	7
OH:CLEVELAND	11/14/89	1.50	0.09	6	6	-7	6	4	5
PA:PHILADELPHIA	11/06/89	1.54	0.12	3	7	-8	8	5	7
PA:PITTSBURGH	11/06/89	1.48	0.13	9	9	-2	9	7	7
PC:CRISTOBAL	11/21/89	1.43	0.12	13	9	2	9	3	7
PR:SAN JUAN	11/14/89	1.58	0.13	1	9	-9	9	5	7
SD:RAPID CITY	11/01/89	1.65	0.12	-3	7	1	8	-1	7
TN:CHATTANOOGA	11/06/89	1.48	0.12	-1	7	-6	8	3	7
TN:KNOXVILLE	11/06/89	1.34	0.12	5	9	-6	9	10	7
TN:MEMPHIS	11/27/89	1.39	0.12	4	9	-1	9	2	7
TX:AUSTIN	11/06/89	1.45	0.09	4	6	-1	6	4	5
WA:SEATTLE	11/01/89	1.46	0.09	4	6	-4	6	6	5
WV:CHARLESTON	11/13/89	1.76	0.23	5	14	2	19	-5	14
WY:LARAMIE	11/07/89	1.53	0.12	6	7	-1	8	4	7

σ = Sigma Counting Error.

Table 13

Concentrations of Radionuclides in Pasteurized Milk

December 1989

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	12/08/89	1.48	0.13	6	9	-1	9	0	7
AR:LITTLE ROCK	12/18/89	1.58	0.12	-3	7	-2	8	-3	7
AZ:PHOENIX	12/14/89	1.53	0.12	-1	7	-4	8	1	7
CA:LOS ANGELES	12/07/89	1.59	0.08	1	5	-4	6	-2	5
CA:SACRAMENTO	12/05/89	1.45	0.12	6	9	-3	9	6	7
CA:SAN FRANCISCO	12/07/89	1.68	0.13	7	7	9	8	3	7
CO:DENVER	12/28/89	1.51	0.16	8	10	-12	13	4	10
CT:HARTFORD	12/11/89	1.61	0.12	2	7	-3	8	-2	7
DE:WILMINGTON	12/06/89	1.45	0.09	6	6	-4	6	4	5
FL:TAMPA	12/19/89	1.58	0.23	14	14	5	19	7	15
GA:ATLANTA	12/01/89	1.38	0.08	2	6	-2	6	7	5
HI:HONOLULU	12/04/89	1.62	0.12	4	7	1	8	1	7
IA:DES MOINES	12/12/89	1.61	0.08	-1	5	-4	6	0	5
ID:IDAHO FALLS	12/07/89	1.43	0.12	4	9	7	9	2	7
IL:CHICAGO	12/07/89	1.62	0.23	11	14	-13	19	1	14
IN:INDIANAPOLIS	12/04/89	1.56	0.13	-3	9	7	9	7	7
KS:WICHITA	12/22/89	1.55	0.13	2	9	1	9	9	7
KY:LOUISVILLE	12/05/89	1.47	0.13	7	9	-3	9	2	7
LA:NEW ORLEANS	12/01/89	1.41	0.09	11	6	-3	6	8	5
MA:BOSTON	12/06/89	1.63	0.12	1	7	-1	8	-3	7
MD:BALTIMORE	12/01/89	1.50	0.13	4	9	-12	9	9	7
ME:PORTLAND	12/05/89	1.50	0.12	4	7	-1	8	2	7
MI:DETROIT	12/07/89	1.60	0.09	6	6	-3	6	4	5
MI:GRAND RAPIDS	12/03/89	1.68	0.13	4	7	-5	8	5	7
MN:MINNEAPOLIS	12/04/89	1.60	0.12	5	7	3	8	-2	7
MN:ST. PAUL	12/07/89	1.45	0.12	4	9	-6	9	8	7
MO:ST. LOUIS	12/06/89	1.57	0.13	6	9	-3	9	2	7
MS:JACKSON	12/13/89	1.42	0.12	9	9	-2	9	8	7
NC:CHARLOTTE	12/11/89	1.54	0.22	15	14	-1	19	2	15
ND:MINOT	12/20/89	1.45	0.12	3	9	-5	9	7	7
NE:OMAHA	12/06/89	1.21	0.12	3	9	1	9	2	7
NJ:TRENTON	12/06/89	1.60	0.08	0	5	-5	6	2	5
NM:ALBUQUERQUE	12/18/89	1.27	0.12	7	9	-3	9	4	7
NV:LAS VEGAS	12/13/89	1.38	0.08	1	6	2	6	5	5
NY:BUFFALO	12/18/89	1.64	0.12	3	7	-8	8	3	7
NY:NEW YORK CITY	12/04/89	1.53	0.12	1	7	-4	8	0	7
NY:SYRACUSE	12/04/89	1.56	0.13	9	9	2	9	8	7

Table 13 (continued)

Concentrations of Radionuclides in Pasteurized Milk

December 1989

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	12/29/89	1.31	0.12	2	9	-2	9	1	7
OK:OKLAHOMA CITY	12/18/89	1.33	0.12	5	9	-1	9	4	7
OR:PORTLAND	12/06/89	1.59	0.09	0	5	-2	6	1	5
PA:PHILADELPHIA	12/04/89	1.49	0.13	8	9	-2	9	6	7
PA:PITTSBURGH	12/04/89	1.62	0.12	3	7	-4	8	1	7
PR:SAN JUAN	12/08/89	1.36	0.12	3	9	-2	9	5	7
SC:CHARLESTON	12/14/89	1.38	0.12	6	9	-5	9	4	7
SD:RAPID CITY	12/06/89	1.50	0.08	1	6	-5	6	3	5
TN:CHATTANOOGA	12/11/89	1.52	0.12	0	7	-7	8	2	7
TX:AUSTIN	12/04/89	1.55	0.12	2	7	-4	8	1	7
TX:FT. WORTH	12/29/89	1.52	0.09	3	6	-1	6	6	5
VA:NORFOLK	12/01/89	1.51	0.08	4	6	-1	6	3	5
WA:SEATTLE	12/01/89	1.59	0.12	0	7	-7	8	-3	7
WV:CHARLESTON	12/13/89	1.43	0.22	0	14	0	19	7	15

σ = Sigma Counting Error.

Table 14

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

October December 1989

EPA Region	Date	^{90}Sr pCi/l	$\pm 2\sigma$	^{89}Sr pCi/l	$\pm 2\sigma^*$
I	10/06/89	1.3	0.5	1	2
II	10/06/89	2.2	1.7	-1	6
III	10/12/89	1.2	0.9	2	3
IV	10/08/89	1.9	0.8	0	3
V	10/09/89	2.5	0.6	-2	2
VI	10/06/89	1.0	1.1	5	7
VII	10/10/89	0.9	0.9	5	5
VIII	10/09/89	1.8	0.6	-1	4
IX	10/05/89	0.0	0.6	4	4
X	10/04/89	1.1	1.0	3	7

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 converting the released carbon dioxide through a series of chemical conversions to benzene and finally measured by liquid scintillation.

The samples undergo three main steps in the chemical conversions to benzene prior to liquid scintillation counting. They include (1) combustion of the sample to carbon dioxide, (2) conversion of the carbon dioxide to acetylene, and (3) trimerizations of the acetlyene to benzene. The last carbon–14 results were for samples collected during 1983-1986. 1982 and March–May 1987. They were published in *Environmental Radiation Data: Report 59.*

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