

United States
Environmental Protection
Agency
Office of Radiation Programs

National Air and Radiation
Environmental Laboratory
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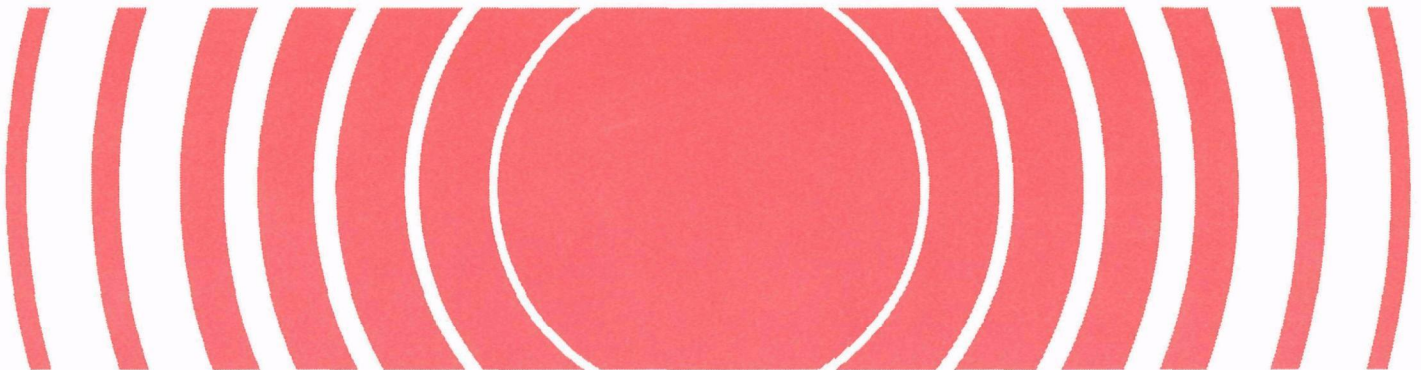
Radiation



Environmental Radiation Data

Report 63

July - September 1990



ENVIRONMENTAL

RADIATION

DATA

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United States Environmental Protection Agency

Office of Radiation Programs

Preface

Environmental Radiation Data (ERD) is compiled and distributed quarterly by the Office of Radiation Programs' 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/m² would be dependent on precipitation (mm).

†† This value of MDL for air in terms of pCi/m³ 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/m³ 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/m³. 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 July - September 1990. Tables 5-7 contain the data in precipitation samples for July - September 1990. Table 8 contains the data for tritium in precipitation samples for July - September 1990 at the selected sites.

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

Table 2
Gross Beta in Airborne Particulates
July 1990

Location	Number of Samples	5-Hour Field Estimate			NAREL Lab Measurement		
		Max	Min	Avg	Max	Min	Avg
AL:MONTGOMERY	9	1.4	0.0	0.4	0.08	0.01	0.02
AR:LITTLE ROCK	9	1.8	0.1	0.9	0.04	0.02	0.03
AZ:PHOENIX	9	3.0	0.3	1.5	0.04	0.01	0.02
CA:BERKELEY	8	0.0	0.0	0.0	0.01	0.00	0.00
CA:LOS ANGELES	9	0.5	0.1	0.3	0.01	0.01	0.01
CO:DENVER	8	3.2	0.2	1.6	0.03	0.01	0.02
CT:HARTFORD	10	0.2	0.0	0.1	0.01	0.00	0.00
DE:WILMINGTON	9	0.7	0.0	0.3	0.02	0.00	0.01
FL:JACKSONVILLE	9	0.2	0.0	0.1	0.02	0.00	0.01
FL:MIAMI	9	0.1	0.0	0.0	0.01	0.00	0.00
HI:HONOLULU	9	0.2	0.1	0.2	0.00	0.00	0.00
IA:IOWA CITY	9	0.4	0.1	0.2	0.02	0.01	0.02
ID:BOISE	7	2.2	0.2	0.9	0.04	0.02	0.02
ID:IDAHO FALLS	9	0.0	0.0	0.0	0.03	0.02	0.02
IL:CHICAGO	9	0.9	0.2	0.4	0.03	0.01	0.01
IN:INDIANAPOLIS	9	*	*	*	0.04	0.02	0.02
KS:TOPEKA	9	4.7	2.1	3.2	0.03	0.02	0.02
KY:FRANKFORT	3	1.4	0.4	1.0	0.05	0.01	0.03
LA:NEW ORLEANS	5	0.2	0.1	0.1	0.02	0.01	0.02
ME:AUGUSTA	9	0.8	0.1	0.3	0.02	0.00	0.01
MI:LANSING	9	1.3	0.2	0.6	0.02	0.01	0.01
MN:MINNEAPOLIS	9	1.1	0.1	0.5	0.03	0.01	0.02
MO:JEFFERSON CITY	8	1.0	0.6	0.8	0.06	0.02	0.03
MS:JACKSON	9	1.9	0.4	0.8	0.05	0.01	0.03
NC:CHARLOTTE	8	1.6	0.3	0.6	0.05	0.01	0.03
NC:WILMINGTON	8	0.0	0.0	0.0	0.01	0.01	0.01
ND:BISMARCK	8	0.8	0.3	0.6	0.02	0.01	0.01
NE:LINCOLN	9	4.7	0.0	2.4	0.03	0.02	0.02
NH:CONCORD	9	0.7	0.1	0.4	0.02	0.00	0.01
NJ:TRENTON	9	2.8	0.2	1.0	0.02	0.01	0.01
NM:SANTA FE	5	0.9	0.4	0.7	0.02	0.01	0.01
NV:LAS VEGAS	9	1.2	0.2	0.6	0.05	0.02	0.03
NY:ALBANY	1	0.1	0.1	0.1	0.01	0.01	0.01
NY:NEW YORK CITY	9	1.3	0.3	0.7	0.01	0.01	0.01
NY:NIAGARA FALLS	9	0.9	0.4	0.5	0.02	0.01	0.01
NY:SYRACUSE	4	0.3	0.0	0.1	0.02	0.01	0.01
NY:YAPHANK	8	0.4	0.1	0.3	0.01	0.01	0.01

Table 2 (continued)
Gross Beta in Airborne Particulates
July 1990

Location	Number of Samples	5-Hour Field Estimate			NAREL Lab Measurement		
		Max	Min	Avg	Max	Min	Avg
OH:COLUMBUS	6	0.4	0.3	0.4	0.03	0.02	0.03
OH:PAINESVILLE	9	0.6	0.2	0.4	0.03	0.01	0.02
OH:ROSS	3	0.0	0.0	0.0	0.03	0.01	0.02
OH:TOLEDO	9	0.6	0.1	0.3	0.02	0.01	0.01
OK:OKLAHOMA CITY	9	2.0	0.5	1.1	0.03	0.02	0.02
OR:PORTLAND	9	0.0	0.0	0.0	0.02	0.00	0.01
PA:HARRISBURG	9	0.6	0.1	0.3	0.01	0.00	0.01
PA:PITTSBURGH	9	0.3	0.1	0.2	0.02	0.00	0.01
RI:PROVIDENCE	9	0.4	0.1	0.3	0.01	0.00	0.01
SC:BARNWELL	2	0.1	0.0	0.1	0.01	0.01	0.01
SC:COLUMBIA	9	0.8	0.2	0.4	0.05	0.01	0.02
SD:PIERRE	7	1.1	0.3	0.8	0.04	0.01	0.03
TN:KNOXVILLE	8	2.7	0.3	1.1	0.04	0.01	0.02
TN:NASHVILLE	9	1.2	0.1	0.6	0.08	0.01	0.03
TX:AUSTIN	9	0.4	0.2	0.3	0.02	0.01	0.01
TX:EL PASO	9	9.6	0.2	1.6	0.04	0.02	0.03
UT:SALT LAKE CITY	8	0.9	0.3	0.5	0.05	0.03	0.04
VA:LYNCHBURG	9	0.9	0.0	0.4	0.01	0.00	0.01
WA:OLYMPIA	9	0.7	0.1	0.3	0.01	0.00	0.01
WA:SPOKANE	9	0.9	0.3	0.6	0.02	0.01	0.01
WI:MADISON	7	1.5	0.3	0.8	0.02	0.01	0.02
WV:CHARLESTON	8	0.8	0.1	0.3	0.02	0.01	0.01

* Instrumentation defective, no reading reported.

Minimum Detectable Limit for field estimates - 0.1 pCi/m³.

Minimum Detectable Limit for laboratory measurement - 0.01 pCi/m³.

Table 3
Gross Beta in Airborne Particulates
August 1990

Location	Number of Samples	5-Hour Field Estimate			NAREL Lab Measurement		
		Max	Min	Avg	Max	Min	Avg
		(pCi/m ³)			(pCi/m ³)		
AL:MONTGOMERY	9	0.1	0.0	0.1	0.03	0.01	0.01
AR:LITTLE ROCK	9	2.0	0.4	1.3	0.05	0.02	0.03
AZ:PHOENIX	9	3.4	0.9	1.9	0.02	0.01	0.02
CA:BERKELEY	6	0.0	0.0	0.0	0.02	0.00	0.01
CA:LOS ANGELES	9	0.6	0.0	0.2	0.01	0.01	0.01
CO:DENVER	9	4.4	0.5	1.9	0.03	0.02	0.02
CT:HARTFORD	9	0.3	0.1	0.2	0.02	0.00	0.01
DE:WILMINGTON	9	0.5	0.1	0.3	0.02	0.01	0.01
FL:JACKSONVILLE	9	0.2	0.1	0.1	0.02	0.01	0.01
FL:MIAMI	9	0.1	0.0	0.1	0.02	0.00	0.01
HI:HONOLULU	9	0.3	0.1	0.2	0.01	0.00	0.00
IA:IOWA CITY	9	0.7	0.2	0.4	0.02	0.01	0.02
ID:BOISE	9	1.4	0.3	0.8	0.05	0.02	0.03
ID:IDAHO FALLS	9	0.0	0.0	0.0	0.04	0.02	0.03
IL:CHICAGO	9	0.9	0.1	0.4	0.03	0.01	0.02
IN:INDIANAPOLIS	9	*	*	*	0.03	0.01	0.02
KS:TOPEKA	8	3.7	2.2	2.9	0.03	0.02	0.02
KY:FRANKFORT	5	1.1	0.2	0.8	0.04	0.01	0.03
LA:NEW ORLEANS	5	0.4	0.2	0.3	0.03	0.02	0.02
ME:AUGUSTA	8	0.9	0.0	0.4	0.02	0.00	0.01
MI:LANSING	9	1.1	0.1	0.5	0.03	0.00	0.02
MN:MINNEAPOLIS	8	1.1	0.1	0.5	0.03	0.01	0.02
MO:JEFFERSON CITY	9	3.3	0.4	1.5	0.05	0.01	0.03
MS:JACKSON	9	1.9	0.2	1.1	0.14	0.02	0.06
NC:CHARLOTTE	9	0.9	0.1	0.5	0.08	0.02	0.03
NC:WILMINGTON	8	0.0	0.0	0.0	0.02	0.01	0.01
ND:BISMARCK	8	1.3	0.5	1.0	0.02	0.01	0.01
NE:LINCOLN	7	2.0	0.0	1.0	0.02	0.01	0.02
NH:CONCORD	9	0.7	0.2	0.4	0.01	0.01	0.01
NJ:TRENTON	9	2.0	0.2	0.9	0.02	0.00	0.01
NM:SANTA FE	8	1.1	0.1	0.6	0.02	0.01	0.02
NV:LAS VEGAS	9	0.9	0.4	0.6	0.06	0.02	0.03
NY:ALBANY	4	0.2	0.0	0.1	0.01	0.01	0.01
NY:NEW YORK CITY	9	1.0	0.1	0.5	0.02	0.00	0.01
NY:NIAGARA FALLS	9	1.0	0.3	0.6	0.04	0.01	0.02
NY:SYRACUSE	3	0.4	0.2	0.3	0.02	0.01	0.02
NY:YAPHANK	7	0.6	0.1	0.4	0.01	0.00	0.01

Table 3 (continued)
Gross Beta in Airborne Particulates
August 1990

Location	Number of Samples	5-Hour Field Estimate			NAREL Lab Measurement		
		Max	Min	Avg	Max	Min	Avg
OH:COLUMBUS	8	1.2	0.2	0.5	0.05	0.02	0.04
OH:PAINESVILLE	9	0.8	0.1	0.4	0.03	0.00	0.02
OH:ROSS	8	0.0	0.0	0.0	0.03	0.01	0.02
OH:TOLEDO	9	0.8	0.1	0.3	0.03	0.00	0.01
OK:OKLAHOMA CITY	8	1.7	0.4	0.9	0.03	0.01	0.02
OR:PORTLAND	9	0.0	0.0	0.0	0.02	0.01	0.01
PA:HARRISBURG	9	1.0	0.1	0.4	0.02	0.00	0.01
PA:PITTSBURGH	9	0.6	0.4	0.5	0.03	0.00	0.02
RI:PROVIDENCE	9	0.7	0.1	0.4	0.02	0.01	0.01
SC:BARNWELL	2	0.1	0.0	0.1	0.02	0.02	0.02
SC:COLUMBIA	9	0.9	0.0	0.4	0.06	0.02	0.03
SD:PIERRE	6	1.1	0.2	0.8	0.04	0.02	0.03
TN:KNOXVILLE	9	1.6	0.2	1.1	0.05	0.01	0.03
TN:NASHVILLE	9	2.1	0.3	1.2	0.04	0.02	0.03
TX:AUSTIN	9	0.6	0.1	0.4	0.02	0.01	0.02
TX:EL PASO	9	1.5	0.1	0.5	0.05	0.01	0.03
UT:SALT LAKE CITY	9	1.7	0.5	0.8	0.05	0.03	0.03
VA:LYNCHBURG	8	1.2	0.2	0.7	0.02	0.00	0.01
WA:OLYMPIA	9	0.6	0.1	0.3	0.02	0.00	0.01
WA:SPOKANE	9	1.1	0.3	0.7	0.03	0.01	0.02
WI:MADISON	9	1.5	0.1	0.7	0.03	0.01	0.02
WV:CHARLESTON	9	1.0	0.0	0.4	0.02	0.01	0.02

* Instrumentation defective, no reading reported.

Minimum Detectable Limit for field estimates - 0.1 pCi/m³.

Minimum Detectable Limit for laboratory measurement - 0.01 pCi/m³.

Table 4
Gross Beta in Airborne Particulates
 September 1990

Location	Number of Samples	5-Hour Field Estimate			NAREL Lab Measurement		
		Max	Min	Avg	Max	Min	Avg
AL:MONTGOMERY	8	0.2	0.0	0.1	0.02	0.01	0.02
AR:LITTLE ROCK	8	2.4	0.6	1.3	0.06	0.02	0.04
AZ:PHOENIX	8	4.2	0.9	2.4	0.05	0.02	0.03
CA:BERKELEY	8	0.3	0.0	0.1	0.02	0.01	0.01
CA:LOS ANGELES	8	0.6	0.1	0.3	0.02	0.01	0.02
CO:DENVER	8	2.9	1.8	2.3	0.03	0.02	0.03
CT:HARTFORD	8	0.4	0.1	0.2	0.02	0.01	0.01
DE:WILMINGTON	7	0.7	0.0	0.3	0.03	0.01	0.02
FL:JACKSONVILLE	7	0.4	0.1	0.2	0.03	0.02	0.02
FL:MIAMI	8	0.2	0.1	0.1	0.04	0.01	0.02
HI:HONOLULU	6	0.4	0.2	0.3	0.01	0.01	0.01
IA:IOWA CITY	8	0.9	0.2	0.4	0.04	0.01	0.02
ID:BOISE	7	1.2	0.2	0.7	0.04	0.03	0.03
ID:IDAHO FALLS	8	0.0	0.0	0.0	0.04	0.02	0.03
IL:CHICAGO	8	1.1	0.1	0.5	0.04	0.01	0.02
IN:INDIANAPOLIS	8	*	*	*	0.04	0.01	0.03
KS:TOPEKA	8	6.2	2.4	3.5	0.04	0.02	0.03
KY:FRANKFORT	4	1.0	0.5	0.7	0.03	0.02	0.03
LA:NEW ORLEANS	5	0.4	0.1	0.3	0.03	0.01	0.02
ME:AUGUSTA	8	0.4	0.1	0.3	0.01	0.01	0.01
MI:LANSING	7	1.5	0.0	0.7	0.03	0.01	0.02
MN:MINNEAPOLIS	8	1.7	0.3	0.9	0.04	0.01	0.03
MO:JEFFERSON CITY	7	1.8	0.8	1.3	0.10	0.02	0.04
MS:JACKSON	8	3.3	0.6	1.3	0.05	0.03	0.04
NC:CHARLOTTE	8	1.4	0.1	0.6	0.06	0.02	0.04
NC:WILMINGTON	8	0.0	0.0	0.0	0.03	0.01	0.02
ND:BISMARCK	8	2.5	0.3	1.1	0.02	0.01	0.01
NE:LINCOLN	7	4.2	0.3	2.1	0.03	0.01	0.02
NH:CONCORD	8	0.6	0.2	0.4	0.02	0.01	0.01
NJ:TRENTON	8	0.5	0.5	0.5	0.02	0.01	0.02
NM:SANTA FE	6	1.2	0.1	0.7	0.02	0.01	0.02
NV:LAS VEGAS	8	1.3	0.2	0.7	0.06	0.03	0.04
NY:ALBANY	4	0.1	0.0	0.1	0.01	0.01	0.01
NY:NEW YORK CITY	8	0.7	0.1	0.3	0.02	0.01	0.01
NY:NIAGARA FALLS	8	0.8	0.3	0.5	0.04	0.01	0.02
NY:SYRACUSE	2	0.1	0.1	0.1	0.02	0.01	0.01
NY:YAPHANK	8	0.9	0.2	0.5	0.02	0.01	0.01

Table 4 (continued)
Gross Beta in Airborne Particulates
September 1990

Location	Number of Samples	5-Hour Field Estimate			NAREL Lab Measurement		
		Max	Min	Avg	Max	Min	Avg
OH:COLUMBUS	6	0.7	0.2	0.5	0.06	0.02	0.04
OH:PAINESVILLE	8	0.7	0.2	0.4	0.03	0.01	0.02
OH:ROSS	8	0.0	0.0	0.0	0.04	0.02	0.03
OH:TOLEDO	8	1.3	0.1	0.4	0.02	0.01	0.01
OK:OKLAHOMA CITY	5	1.9	0.3	1.1	0.04	0.01	0.02
OR:PORTLAND	8	0.0	0.0	0.0	0.02	0.01	0.01
PA:HARRISBURG	8	1.1	0.2	0.5	0.02	0.01	0.01
PA:PITTSBURGH	8	0.3	0.3	0.3	0.03	0.01	0.02
RI:PROVIDENCE	7	0.4	0.1	0.2	0.01	0.01	0.01
SC:BARNWELL	2	0.1	0.1	0.1	0.05	0.03	0.04
SC:COLUMBIA	8	0.9	0.3	0.6	0.06	0.02	0.04
SD:PIERRE	6	1.6	0.3	1.2	0.04	0.02	0.03
TN:KNOXVILLE	7	2.1	0.5	1.2	0.03	0.02	0.03
TN:NASHVILLE	8	2.9	0.5	1.1	0.04	0.02	0.03
TX:AUSTIN	8	0.8	0.1	0.4	0.03	0.00	0.01
TX:EL PASO	8	1.6	0.0	0.6	0.04	0.01	0.03
UT:SALT LAKE CITY	8	1.7	0.1	0.9	0.05	0.02	0.04
VA:LYNCHBURG	8	2.7	0.1	1.1	0.02	0.01	0.01
WA:OLYMPIA	8	0.9	0.4	0.7	0.04	0.01	0.02
WA:SPOKANE	8	1.7	0.4	1.2	0.05	0.01	0.03
WI:MADISON	8	2.2	0.4	1.1	0.04	0.01	0.02
WV:CHARLESTON	7	2.0	0.1	0.6	0.03	0.02	0.02

* Instrumentation defective, no reading reported.

Minimum Detectable Limit for field estimates - 0.1 pCi/m³.

Minimum Detectable Limit for laboratory measurement - 0.01 pCi/m³.

Table 5
Gross Beta in Precipitation
July 1990

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m ²)	Specific Gamma Activity (pCi/l)
AL:MONTGOMERY	72.4	0.16 0.03	ND
AR:LITTLE ROCK	42.0	0.04 0.01	ND
AZ:PHOENIX	16.0	0.03 0.01	ND
CO:DENVER	2.2	0.02 0.00	ND
CT:HARTFORD	76.0	0.07 0.03	ND
DE:WILMINGTON	95.0	0.31 0.05	ND
FL:JACKSONVILLE	115.6	0.17 0.04	ND
FL:MIAMI	107.2	0.04 0.04	ND
HI:HONOLULU	5.0	0.01 0.00	ND
IL:CHICAGO	85.4	0.06 0.03	ND
LA:NEW ORLEANS	43.0	0.09 0.02	ND
ME:AUGUSTA	105.6	0.52 0.06	ND
MI:LANSING	95.4	0.16 0.04	ND
MN:MINNEAPOLIS	115.0	0.11 0.04	ND
MO:JEFFERSON CITY	32.0	0.03 0.01	ND
MS:JACKSON	101.0	0.05 0.04	ND
NC:CHARLOTTE	34.0	0.06 0.01	ND
NC:WILMINGTON	76.2	0.08 0.03	ND
ND:BISMARCK	44.6	0.04 0.02	ND
NH:CONCORD	54.0	0.27 0.03	ND
NJ:TRENTON	64.4	0.15 0.03	ND
NM:SANTA FE	80.2	0.12 0.03	ND
NV:LAS VEGAS	11.4	0.01 0.00	ND
NY:ALBANY	11.0	0.01 0.00	ND
NY:NEW YORK CITY	37.2	0.09 0.02	ND
NY:NIAGARA FALLS	56.0	0.05 0.02	ND
NY:SYRACUSE	32.0	0.01 0.01	ND
NY:YAPHANK	99.0	0.24 0.05	ND
OH:PAINESVILLE	64.6	0.10 0.02	ND
OH:TOLEDO	81.0	0.15 0.03	ND

Table 5 (continued)
Gross Beta in Precipitation
July 1990

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m ²)	Specific Gamma Activity (pCi/l)
OK:OKLAHOMA CITY	23.0	0.02 0.01	ND
OR:PORTLAND	24.8	0.02 0.01	ND
PA:HARRISBURG	66.0	0.23 0.03	ND
SC:BARNWELL	126.8	0.51 0.06	ND
SC:COLUMBIA	75.2	0.09 0.03	ND
TN:KNOXVILLE	61.0	0.06 0.02	ND
TN:NASHVILLE	29.2	0.03 0.01	ND
TX:AUSTIN	40.0	0.03 0.01	ND
TX:EL PASO	78.2	0.12 0.03	ND
UT:SALT LAKE CITY	21.6	0.03 0.01	ND
VA:LYNCHBURG	78.8	0.36 0.04	ND
WA:OLYMPIA	5.6	0.01 0.00	ND
WI:MADISON	38.8	0.04 0.01	²¹⁴ Bi: 12 ± 60 %
WI:MADISON	38.8	0.04 0.01	²¹⁴ Pb: 8 ± 88 %
WV:CHARLESTON	46.0	0.16 0.02	ND

σ = Counting Error.

NA = Not Analyzed.

ND = No Gamma Activity Detectable.

Table 6
Gross Beta in Precipitation
August 1990

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m ²)	Specific Gamma Activity (pCi/l)
AL: MONTGOMERY	42.0	0.05 0.01	ND
AR: LITTLE ROCK	78.6	0.26 0.04	ND
AZ: PHOENIX	8.0	0.00 0.00	ND
CO: DENVER	7.2	0.01 0.00	²¹⁴ Bi: 10 $\pm 92\%$
CT: HARTFORD	120.0	0.03 0.04	ND
DE: WILMINGTON	146.0	0.30 0.06	ND
FL: JACKSONVILLE	152.0	0.42 0.07	ND
FL: MIAMI	178.2	0.10 0.05	ND
ID: BOISE	11.0	0.04 0.01	ND
ID: IDAHO FALLS	28.0	0.10 0.01	ND
IL: CHICAGO	87.6	0.08 0.03	ND
ME: AUGUSTA	50.0	0.03 0.02	ND
MI: LANSING	32.2	0.04 0.01	ND
MN: MINNEAPOLIS	45.8	0.04 0.02	ND
MO: JEFFERSON CITY	16.0	0.01 0.01	ND
MS: JACKSON	32.0	0.07 0.01	ND
NC: CHARLOTTE	59.0	0.36 0.04	ND
NC: WILMINGTON	145.0	0.43 0.07	ND
ND: BISMARCK	28.0	0.03 0.01	ND
NH: CONCORD	183.0	0.28 0.07	ND
NJ: TRENTON	141.2	0.40 0.06	ND
NM: SANTA FE	70.0	0.26 0.03	ND
NY: ALBANY	108.0	0.21 0.04	ND
NY: NEW YORK CITY	59.2	0.10 0.02	ND
NY: NIAGARA FALLS	83.0	0.16 0.03	ND
NY: SYRACUSE	24.0	0.05 0.01	ND
NY: YAPHANK	116.0	0.14 0.04	ND
OH: PAINESVILLE	81.8	0.32 0.04	ND
OH: TOLEDO	85.0	0.19 0.04	ND
OK: OKLAHOMA CITY	30.0	0.01 0.01	ND

Table 6 (continued)
Gross Beta in Precipitation
August 1990

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m ²)	Specific Gamma Activity (pCi/l)
OR:PORTLAND	10.0	0.01 0.00	ND
PA:HARRISBURG	135.2	0.39 0.06	²¹⁴ Bi: 4 $\pm 88\%$
SC:BARNWELL	93.4	0.17 0.04	ND
SC:COLUMBIA	75.2	0.23 0.04	ND
SD:PIERRE	1.0	0.00 0.00	ND
TN:KNOXVILLE	75.0	0.15 0.03	ND
TN:NASHVILLE	24.0	0.08 0.01	ND
TX:EL PASO	42.0	0.06 0.02	ND
UT:SALT LAKE CITY	10.6	0.03 0.00	²¹⁴ Bi: 4 $\pm 75\%$
VA:LYNCHBURG	40.6	0.27 0.02	ND
WA:OLYMPIA	50.2	0.03 0.02	ND
WI:MADISON	115.4	0.11 0.04	ND
WV:CHARLESTON	77.0	0.37 0.04	ND

σ = Counting Error.

NA = Not Analyzed.

ND = No Gamma Activity Detectable.

Table 7
Gross Beta in Precipitation
September 1990

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m ²)	Specific Gamma Activity (pCi/l)
AL:MONTGOMERY	27.0	0.11 0.01	ND
AR:LITTLE ROCK	102.6	0.17 0.04	ND
AZ:PHOENIX	22.0	0.02 0.01	ND
CA:BERKELEY	3.0	0.07 0.00	ND
CO:DENVER	44.0	0.09 0.02	ND
CT:HARTFORD	53.0	0.07 0.02	ND
DE:WILMINGTON	68.0	0.11 0.03	ND
FL:JACKSONVILLE	41.4	0.05 0.02	ND
FL:MIAMI	69.8	0.07 0.02	ND
HI:HONOLULU	21.2	0.02 0.01	ND
ID:BOISE	18.0	0.04 0.01	ND
ID:IDAHO FALLS	6.2	0.02 0.00	ND
IL:CHICAGO	64.4	0.03 0.02	ND
LA:NEW ORLEANS	43.0	0.07 0.02	ND
ME:AUGUSTA	88.0	0.29 0.05	ND
MI:LANSING	100.0	0.10 0.03	ND
MN:MINNEAPOLIS	34.0	0.06 0.01	ND
MO:JEFFERSON CITY	16.0	0.01 0.01	ND
MS:JACKSON	42.0	0.04 0.01	ND
NC:CHARLOTTE	53.0	0.04 0.02	ND
NC:WILMINGTON	42.0	0.31 0.03	ND
ND:BISMARCK	47.0	0.04 0.02	ND
NH:CONCORD	56.2	0.18 0.03	ND
NJ:TRENTON	32.6	0.09 0.01	ND
NM:SANTA FE	26.0	0.03 0.01	ND
NV:LAS VEGAS	3.0	0.02 0.00	ND
NY:ALBANY	23.0	0.08 0.01	ND
NY:NEW YORK CITY	28.6	0.03 0.01	ND
NY:NIAGARA FALLS	41.0	0.04 0.01	ND
NY:SYRACUSE	8.0	0.00 0.00	ND

Table 7 (continued)
Gross Beta in Precipitation
September 1990

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m ²)	Specific Gamma Activity (pCi/l)
NY:YAPHANK	33.0	0.11 0.02	ND
OH:PAINESVILLE	99.0	0.14 0.03	ND
OH:TOLEDO	51.0	0.06 0.02	ND
OR:PORTLAND	12.6	0.02 0.01	ND
PA:HARRISBURG	40.4	0.16 0.02	ND
RI:PROVIDENCE	8.0	0.02 0.00	ND
SC:COLUMBIA	42.0	0.08 0.02	ND
SD:PIERRE	2.0	0.00 0.00	ND
TN:KNOXVILLE	55.0	0.07 0.02	ND
TN:NASHVILLE	55.0	0.06 0.02	ND
TX:AUSTIN	40.0	0.03 0.01	ND
TX:EL PASO	49.0	0.05 0.02	ND
UT:SALT LAKE CITY	13.8	0.03 0.01	ND
VA:LYNCHBURG	45.4	0.33 0.03	ND
WI:MADISON	46.0	0.06 0.02	ND
WV:CHARLESTON	41.0	0.15 0.02	ND

σ = Counting Error.

NA = Not Analyzed.

ND = No Gamma Activity Detectable.

Table 8
Tritium in Precipitation
July - September 1990

Location	July 1990		August 1990		September 1990	
	nCi/l	$\pm 2\sigma$	nCi/l	$\pm 2\sigma$	nCi/l	$\pm 2\sigma$
AL:MONTGOMERY	0.1	0.2	0.1	0.2	0.1	0.2
AR:LITTLE ROCK	0.2	0.2	0.2	0.2	0.1	0.2
AZ:PHOENIX	0.1	0.2	0.2	0.2	0.1	0.2
CA:BERKELEY	NS		NS		0.2	0.2
CO:DENVER	0.2	0.2	0.2	0.2	0.1	0.2
CT:HARTFORD	0.2	0.2	0.1	0.2	0.3	0.2
DE:WILMINGTON	0.3	0.2	0.1	0.2	0.2	0.2
FL:JACKSONVILLE	0.3	0.2	0.2	0.2	0.1	0.2
FL:MIAMI	0.1	0.2	0.2	0.2	0.1	0.2
HI:HONOLULU	0.2	0.2	NS		0.1	0.2
ID:BOISE	NS		0.2	0.2	0.2	0.2
ID:IDAHO FALLS	NS		0.1	0.2	0.2	0.2
IL:CHICAGO	0.2	0.2	0.2	0.2	0.1	0.2
LA:NEW ORLEANS	0.2	0.2	NS		0.1	0.2
ME:AUGUSTA	0.3	0.2	0.1	0.2	0.3	0.2
MI:LANSING	0.2	0.2	0.2	0.2	0.1	0.2
MN:MINNEAPOLIS	0.1	0.2	0.2	0.2	0.2	0.2
MO:JEFFERSON CITY	0.1	0.2	0.2	0.2	0.2	0.2
MS:JACKSON	0.1	0.2	0.1	0.2	0.1	0.2
NC:CHARLOTTE	0.2	0.2	0.2	0.2	0.2	0.2
NC:WILMINGTON	0.2	0.2	0.1	0.2	0.1	0.2
ND:BISMARCK	0.1	0.2	0.2	0.2	0.3	0.2
NH:CONCORD	0.2	0.2	0.2	0.2	0.2	0.2
NJ:TRENTON	0.1	0.2	0.2	0.2	0.2	0.2
NM:SANTA FE	0.2	0.2	0.2	0.2	0.1	0.2
NV:LAS VEGAS	0.2	0.2	NS		0.3	0.2
NY:ALBANY	0.1	0.2	0.2	0.2	0.2	0.2
NY:NEW YORK CITY	0.2	0.2	0.2	0.2	0.1	0.2
NY:NIAGARA FALLS	0.3	0.2	0.1	0.2	0.2	0.2
NY:SYRACUSE	0.2	0.2	0.2	0.2	0.1	0.2
NY:YAPHANK	0.2	0.2	0.2	0.2	0.2	0.2
OH:PAINESVILLE	0.2	0.2	0.3	0.2	0.2	0.2
OH:TOLEDO	0.1	0.2	0.2	0.2	0.2	0.2
OK:OKLAHOMA CITY	0.2	0.2	0.2	0.2	NS	
OR:PORTLAND	0.3	0.2	0.2	0.2	0.2	0.2
PA:HARRISBURG	0.2	0.2	0.1	0.2	0.1	0.2
RI:PROVIDENCE	NS		NS		0.2	0.2

Table 8 (continued)
Tritium in Precipitation
July - September 1990

Location	July 1990		August 1990		September 1990	
	nCi/l	$\pm 2\sigma$	nCi/l	$\pm 2\sigma$	nCi/l	$\pm 2\sigma$
SC:BARNWELL	0.1	0.2	0.2	0.2	NS	
SC:COLUMBIA	0.2	0.2	0.4	0.2	0.2	0.2
SD:PIERRE	NS		0.2	0.2	0.2	0.2
TN:KNOXVILLE	0.1	0.2	0.1	0.2	0.1	0.2
TN:NASHVILLE	0.1	0.2	0.2	0.2	0.1	0.2
TX:AUSTIN	0.1	0.2	NS		0.1	0.2
TX:EL PASO	0.2	0.2	0.2	0.2	0.1	0.2
UT:SALT LAKE CITY	0.2	0.2	0.2	0.2	0.1	0.2
VA:LYNCHBURG	0.2	0.2	0.1	0.2	0.1	0.2
WA:OLYMPIA	0.4	0.2	0.1	0.2	NS	
WI:MADISON	0.2	0.2	0.2	0.2	0.2	0.2
WV:CHARLESTON	0.2	0.2	0.1	0.2	0.1	0.2

σ = 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 July September 1990.

Table 9
Tritium in Surface Water
July - September 1990

Location	Source	Date Collected	nCi/l	$\pm 2\sigma$
AL:DECATUR	TENNESSEE RIVER	07/04/90	0.2	0.2
AL:DOTHAN	CHATTAHOOCHEE RIVER	07/12/90	0.2	0.2
AL:SCOTTSBORO	TENNESSEE RIVER	07/05/90	0.2	0.2
AR:LITTLE ROCK	ARKANSAS RIVER	07/19/90	0.2	0.2
CA:DIABLO CANYON	PACIFIC OCEAN	09/26/90	0.1	0.2
CA:EUREKA	HUMBOLDT BAY	07/19/90	0.1	0.2
CA:SAN ONOFRE	PACIFIC OCEAN	08/23/90	0.2	0.2
CO:PLATTEVILLE	SOUTH PLATTE RIVER	07/09/90	0.2	0.2
CT:EAST HADDAM	CONNECTICUT RIVER	07/16/90	0.2	0.2
CT:WATERFORD	LONG ISLAND SOUND	07/16/90	0.1	0.2
FL:CRYSTAL RIVER	GULF OF MEXICO	07/09/90	0.1	0.2
FL:FT. PIERCE	ATLANTIC OCEAN	07/11/90	0.1	0.2
FL:HOMESTEAD	BISCAYNE BAY	07/11/90	0.2	0.2
GA:BAXLEY	ALTAMAHA RIVER	07/16/90	0.2	0.2
IA:CEDAR RAPIDS	CEDAR RIVER	07/12/90	0.2	0.2
ID:BUHL	SNAKE RIVER	07/11/90	0.3	0.2
IL:E. MOLINE	MISSISSIPPI RIVER	07/05/90	0.2	0.2
IL:MORRIS	ILLINOIS RIVER	08/06/90	0.3	0.2
IL:ZION	LAKE MICHIGAN	08/15/90	0.2	0.2
KS:LEROY	NEOSHO RIVER	05/15/90	0.1	0.2
LA:NEW ORLEANS	MISSISSIPPI RIVER	07/30/90	0.3	0.2
MA:PLYMOUTH	CAPE COD BAY	07/05/90	0.1	0.2
MD:CONOWINGO	SUSQUEHANNA RIVER	07/10/90	0.2	0.2
MD:LUSBY	CHESAPEAKE BAY	07/09/90	0.2	0.2
ME:WISCASSET	MONTSEWAY BAY	07/10/90	0.2	0.2
MI:BRIDGMAN	LAKE MICHIGAN	07/17/90	0.2	0.2
MI:CHARLEVOIX	LAKE MICHIGAN	07/13/90	0.1	0.2
MI:MONROE	LAKE ERIE	07/23/90	0.3	0.2
MI:SOUTH HAVEN	LAKE MICHIGAN	07/17/90	0.4	0.2
MN:MONTICELLO	MISSISSIPPI RIVER	07/18/90	0.2	0.2
MN:RED WING	MISSISSIPPI RIVER	07/24/90	0.2	0.2
MS:PORT GIBSON	MISSISSIPPI RIVER	07/03/90	0.1	0.2
NC:CHARLOTTE	CATAWBA RIVER	07/16/90	0.5	0.2
NC:SOUTHPORT	ATLANTIC OCEAN	07/05/90	0.2	0.2
NE:RULO	MISSOURI RIVER	07/17/90	0.2	0.2
NJ:BAYSIDE	DELAWARE RIVER	07/17/90	0.2	0.2
NJ:OYSTER CREEK	OYSTER CREEK	07/19/90	0.2	0.2

Table 9 (continued)
Tritium in Surface Water
July - September 1990

Location	Source	Date Collected	nCi/l	$\pm 2\sigma$
NV:BOULDER CITY	COLORADO RIVER	08/03/90	0.1	0.2
NY:CHELSEA	HUDSON RIVER	07/05/90	0.2	0.2
NY:OSSINING	HUDSON RIVER	08/02/90	0.4	0.2
NY:OSWEGO	LAKE ONTARIO	08/01/90	0.2	0.2
OH:TOLEDO	LAKE ERIE	07/01/90	0.3	0.2
OR:BRADWOOD	COLUMBIA RIVER	07/23/90	0.2	0.2
PA:DANVILLE	SUSQUEHANNA RIVER	07/03/90	0.2	0.2
PA:PHILADELPHIA	DELAWARE RIVER-BAXTER	07/12/90	0.1	0.2
PA:PHILADELPHIA	SCHUYLKILL RIVER-QUEEN	07/12/90	0.2	0.2
PA:PHILADELPHIA	SCHUYLKILL RIVER-BELMONT	07/12/90	0.2	0.2
SC:ALLEDALE	SAVANNAH RIVER	07/30/90	1.7	0.2
SC:BROAD RIVER	BROAD RIVER	07/05/90	0.1	0.2
SC:HARTSVILLE	LAKE ROBINSON	07/16/90	2.9	0.2
TN:DAISY	TENNESSEE RIVER	07/10/90	0.2	0.2
TN:KINGSTON	CLINCH RIVER	08/15/90	0.3	0.2
TX:MATAGORDA	COLORADO RIVER	08/08/90	0.2	0.2
VA:DOSWELL	NORTH ANNA RIVER	07/27/90	2.7	0.2
VA:NEWPORT NEWS	JAMES RIVER	07/23/90	0.2	0.2
VT:VERNON	CONNECTICUT RIVER	07/26/90	0.2	0.2
WA:NORTHPORT	COLUMBIA RIVER	07/19/90	0.2	0.2
WA:RICHLAND	COLUMBIA RIVER	09/11/90	0.3	0.2
WI:TWO CREEKS	LAKE MICHIGAN	07/16/90	0.2	0.2
WI:VICTORY	MISSISSIPPI RIVER	07/05/90	0.1	0.2
WV:WHEELING	OHIO RIVER	07/11/90	0.2	0.2

σ = 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 July - September 1990. Table 11 contains the I-131 in drinking water results for January - December 1990.

Table 10
Tritium in Drinking Water
July - September 1990

Location	Date Collected	nCi/l	$\pm 2\sigma$
AK:FAIRBANKS	07/06/90	0.1	0.2
AL:DOTHAN	07/12/90	0.1	0.2
AL:MONTGOMERY	07/10/90	0.1	0.2
AL:MUSCLE SHOALS	07/04/90	0.4	0.2
AL:SCOTTSBORO	07/05/90	0.1	0.2
AR:LITTLE ROCK	07/19/90	0.3	0.2
CA:BERKELEY	07/03/90	0.1	0.2
CA:LOS ANGELES	07/05/90	0.1	0.2
CO:DENVER	07/09/90	0.2	0.2
CO:PLATTEVILLE	07/09/90	0.2	0.2
CT:HARTFORD	07/05/90	0.1	0.2
DC:WASHINGTON	07/06/90	0.1	0.2
DE:DOVER	07/02/90	0.3	0.2
FL:MIAMI	07/06/90	0.1	0.2
FL:TAMPA	07/13/90	0.2	0.2
GA:BAXLEY	07/16/90	0.2	0.2
GA:SAVANNAH	09/11/90	0.1	0.2
HI:HONOLULU	07/05/90	0.1	0.2
IA:CEDAR RAPIDS	07/12/90	0.1	0.2
ID:BOISE	07/05/90	0.1	0.2
ID:IDAHO FALLS	07/15/90	0.2	0.2
IL:MORRIS	07/09/90	0.2	0.2
IL:W. CHICAGO	07/02/90	0.2	0.2
KS:TOPEKA	07/05/90	0.1	0.2
LA:NEW ORLEANS	07/11/90	0.1	0.2
MA:LAWRENCE	07/10/90	0.2	0.2
MD:BALTIMORE	07/03/90	0.3	0.2
MD:CONOWINGO	07/10/90	0.2	0.2
ME:AUGUSTA	07/11/90	0.1	0.2
MI:DETROIT	08/24/90	0.2	0.2
MI:GRAND RAPIDS	07/17/90	0.2	0.2
MN:MINNEAPOLIS	07/19/90	0.1	0.2
MN:RED WING	07/11/90	0.2	0.2
MO:JEFFERSON CITY	07/02/90	0.3	0.2
MS:JACKSON	07/03/90	0.1	0.2
MS:PORT GIBSON	07/05/90	0.2	0.2
MT:HELENA	07/12/90	0.2	0.2
NC:CHARLOTTE	07/16/90	0.4	0.2
NC:WILMINGTON	07/05/90	0.1	0.2
ND:BISMARCK	07/03/90	0.3	0.2
NE:LINCOLN	07/02/90	0.2	0.2

Table 10 (continued)
Tritium in Drinking Water
July - September 1990

Location	Date Collected	nCi/l	$\pm 2\sigma$
NH:CONCORD	07/06/90	0.1	0.2
NJ:TRENTON	07/19/90	0.1	0.2
NJ:WARETOWN	07/05/90	0.1	0.2
NM:SANTA FE	07/03/90	0.3	0.2
NV:LAS VEGAS	07/05/90	0.2	0.2
NY:ALBANY	07/02/90	0.2	0.2
NY:NEW YORK CITY	07/12/90	0.2	0.2
NY:NIAGARA FALLS	07/06/90	0.3	0.2
NY:SYRACUSE	08/17/90	0.3	0.2
OH:CINCINNATI	09/28/90	0.2	0.2
OH:COLUMBUS	07/17/90	0.1	0.2
OH:EAST LIVERPOOL	08/08/90	0.3	0.2
OH:PAINESVILLE	07/26/90	0.3	0.2
OH:TOLEDO	07/03/90	0.3	0.2
OK:OKLAHOMA CITY	07/06/90	0.1	0.2
OR:PORTLAND	07/03/90	0.2	0.2
PA:COLUMBIA	07/05/90	0.2	0.2
PA:HARRISBURG	07/06/90	0.2	0.2
PA:P'DELPHIA-BAXTER	07/12/90	0.1	0.2
PA:P'DELPHIA-QUEEN	07/12/90	0.2	0.2
PA:PHILADELPHIA	07/12/90	0.2	0.2
PA:PITTSBURGH	08/08/90	0.3	0.2
PC:COROZAL	07/03/90	0.1	0.2
RI:PROVIDENCE	07/23/90	0.2	0.2
SC:BARNWELL	07/05/90	0.1	0.2
SC:COLUMBIA	07/03/90	0.3	0.2
SC:HARTSVILLE	07/16/90	0.1	0.2
SC:JENKINSVILLE	08/10/90	0.3	0.2
SC:SENECA	07/18/90	0.2	0.2
TN:CHATTANOOGA	08/06/90	0.3	0.2
TN:KNOXVILLE	07/03/90	0.2	0.2
TX:AUSTIN	07/23/90	0.2	0.2
VA:DOSWELL	07/10/90	0.1	0.2
VA:LYNCHBURG	07/03/90	0.3	0.2
VA:VIRGINIA BEACH	07/10/90	0.2	0.2
WA:RICHLAND	09/11/90	0.3	0.2
WA:SEATTLE	07/02/90	0.1	0.2
WI:GENOA CITY	07/02/90	0.2	0.2
WI:MADISON	07/03/90	0.1	0.2

σ = Counting Error.

Table 11
Iodine-131 in Drinking Water
 January - December 1990

Location	Date Collected	pCi/l	$\pm 2\sigma$
AK:FAIRBANKS	01/11/90	0.0	0.1
AL:DOTHAN	10/09/90	0.0	0.1
AL:MONTGOMERY	11/02/90	0.0	0.1
AL:MUSCLE SHOALS	10/03/90	0.0	0.2
AL:SCOTTSBORO	10/03/90	0.0	0.2
AR:LITTLE ROCK	10/03/90	0.0	0.1
CA:BERKELEY	10/03/90	0.0	0.1
CA:LOS ANGELES	10/04/90	0.0	0.1
CO:DENVER	10/01/90	0.0	0.2
CO:PLATTEVILLE	10/09/90	0.0	0.1
CT:HARTFORD	10/02/90	0.0	0.1
DC:WASHINGTON	11/02/90	-0.5	0.3
DE:DOVER	10/03/90	0.1	0.1
FL:MIAMI	01/03/90	-0.1	0.1
FL:TAMPA	07/13/90	0.2	0.2
GA:BAXLEY	07/16/90	0.0	0.1
GA:SAVANNAH	09/11/90	0.0	0.1
HI:HONOLULU	10/26/90	0.0	0.0
IA:CEDAR RAPIDS	07/12/90	0.1	0.1
ID:BOISE	10/15/90	0.1	0.1
ID:IDAHO FALLS	07/15/90	0.1	0.1
IL:W. CHICAGO	10/02/90	0.1	0.1
KS:TOPEKA	10/01/90	0.0	0.1
LA:NEW ORLEANS	01/11/90	0.2	0.1
MA:LAWRENCE	07/10/90	0.2	0.1
MD:BALTIMORE	10/02/90	-0.3	0.1
MD:CONOWINGO	01/02/90	0.1	0.1
MD:CONOWINGO	07/10/90	0.2	0.1
ME:AUGUSTA	10/09/90	0.0	0.2
MI:DETROIT	10/03/90	0.0	0.0
MI:GRAND RAPIDS	01/11/90	0.6	0.1
MN:MINNEAPOLIS	07/19/90	0.0	0.1
MN:RED WING	07/11/90	0.6	0.1
MO:JEFFERSON CITY	10/09/90	-0.5	0.1
MS:JACKSON	01/02/90	-0.8	0.1
MS:PORT GIBSON	01/02/90	0.5	0.1
MT:HELENA	07/12/90	0.4	0.1
NC:CHARLOTTE	07/16/90	0.1	0.1
NC:WILMINGTON	10/04/90	-0.3	0.2
ND:BISMARCK	01/02/90	0.1	0.1

Table 11 (continued)
Iodine-131 in Drinking Water
January - December 1990

Location	Date Collected	pCi/l	$\pm 2\sigma$
NE:LINCOLN	10/01/90	-0.1	0.1
NH:CONCORD	10/11/90	0.1	0.1
NJ:TRENTON	07/19/90	0.1	0.1
NJ:WARETOWN	10/04/90	0.0	0.1
NM:SANTA FE	10/04/90	0.0	0.1
NV:LAS VEGAS	10/05/90	0.0	0.1
NY:ALBANY	10/09/90	-0.1	0.3
NY:NEW YORK CITY	07/12/90	0.3	0.1
NY:NIAGARA FALLS	01/09/90	0.0	0.1
NY:SYRACUSE	10/16/90	-0.2	0.2
OH:CINCINNATI	01/03/90	-0.3	0.1
OH:COLUMBUS	11/15/90	-0.5	0.5
OH:EAST LIVERPOOL	11/02/90	0.2	0.1
OH:PAINESVILLE	10/05/90	0.0	0.2
OH:TOLEDO	10/03/90	-0.1	0.1
OK:OKLAHOMA CITY	10/26/90	-0.1	0.3
OR:PORTLAND	01/03/90	0.0	0.2
PA:COLUMBIA	10/11/90	0.3	0.1
PA:HARRISBURG	01/04/90	0.0	0.0
PA:PHILADELPHIA	10/15/90	-0.1	0.1
PA:PHILADELPHIA	10/15/90	0.2	0.1
PA:PHILADELPHIA	10/15/90	0.2	0.1
PA:PITTSBURGH	11/02/90	0.0	0.1
RI:PROVIDENCE	07/23/90	0.2	0.1
SC:BARNWELL	10/08/90	0.4	0.2
SC:COLUMBIA	01/02/90	0.1	0.1
SC:HARTSVILLE	07/16/90	0.1	0.1
SC:JENKINSVILLE	10/12/90	0.0	0.1
SC:SENECA	07/18/90	0.1	0.1
TN:CHATTANOOGA	11/01/90	-0.1	0.1
TN:KNOXVILLE	01/02/90	0.1	0.1
TX:AUSTIN	07/23/90	0.5	0.1
VA:DOSWELL	07/10/90	0.1	0.1
VA:LYNCHBURG	01/02/90	0.0	0.0
VA:VIRGINIA BEACH	01/03/90	-0.2	0.1
WA:RICHLAND	09/11/90	-0.3	0.1
WA:SEATTLE	10/05/90	0.1	0.4
WI:GENOA CITY	10/09/90	0.0	0.2
WI:MADISON	10/05/90	0.0	0.1

σ = 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.[†] Although exposure measurements at these few sites are not totally representative of nationwide exposures, they do indicate national trends.

The monitoring program utilizes $\text{CaF}_2:\text{Mn}$ thermoluminescent dosimeters (TLD's). These dosimeters are commercially available glass-bulb type dosimeters with energy compensating shields. A group of 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.

[†] 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 12-14 contain the concentrations of radionuclides in pasteurized milk for July - September 1990. The last Strontium-90 and Strontium-89 in Milk results were published in *Environmental Radiation Data: Report 60*.

Table 12
Radionuclides in Pasteurized Milk
July 1990

Location	Date Collected	K		¹³⁷ Cs		¹⁴⁰ Ba		¹³¹ I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
AL:MONTGOMERY	07/05/90	1.58	0.12	6	7	-1	8	3	7
AR:LITTLE ROCK	07/03/90	1.28	0.10	ND		ND		ND	
AZ:PHOENIX	07/05/90	1.72	0.12	2	7	-1	8	7	7
CA:LOS ANGELES	07/18/90	1.67	0.12	6	7	-1	8	7	7
CA:SACRAMENTO	07/03/90	1.53	0.22	13	14	-3	19	5	14
CO:DENVER	07/31/90	1.22	0.07	ND		ND		ND	
CT:HARTFORD	07/02/90	1.60	0.06	7	2	4	3	9	2
DE:WILMINGTON	07/11/90	1.65	0.08	0	4	-1	6	0	5
FL:TAMPA	07/11/90	1.59	0.22	-2	14	-5	19	6	14
GA:ATLANTA	07/16/90	1.57	0.12	1	6	4	8	2	7
HI:HONOLULU	07/02/90	1.57	0.12	3	6	-7	8	5	7
IA:DES MOINES	07/09/90	1.66	0.12	7	7	4	8	9	7
ID:IDAHO FALLS	07/31/90	1.66	0.12	8	7	-2	8	5	7
IL:CHICAGO	07/05/90	1.67	0.12	7	7	2	8	8	7
IN:INDIANAPOLIS	07/03/90	1.35	0.07	ND		ND		ND	
KS:WICHITA	07/15/90	1.68	0.12	6	7	0	8	9	7
KY:LOUISVILLE	07/03/90	1.51	0.22	5	14	-14	19	13	14
LA:NEW ORLEANS	07/13/90	1.48	0.09	ND		ND		ND	
MA:BOSTON	07/07/90	1.51	0.09	ND		ND		ND	
MD:BALTIMORE	07/06/90	1.73	0.13	7	7	-3	8	6	7
ME:PORTLAND	07/03/90	1.41	0.07	3	1	ND		ND	
MI:DETROIT	07/05/90	1.72	0.12	6	7	-7	8	7	7
MI:GRAND RAPIDS	07/03/90	1.48	0.09	ND		ND		ND	
MO:KANSAS CITY	07/12/90	1.57	0.08	9	5	2	6	7	5
MO:ST. LOUIS	07/11/90	1.58	0.12	8	7	3	8	6	7
MS:JACKSON	07/10/90	1.38	0.07	ND		ND		ND	
MT:HELENA	07/09/90	1.66	0.12	12	7	0	8	8	7
NC:CHARLOTTE	07/09/90	1.58	0.12	12	7	3	8	9	7
ND:MINOT	07/30/90	1.64	0.08	5	5	4	6	7	5
NE:OMAHA	07/03/90	1.43	0.12	4	7	1	8	6	7
NJ:TRENTON	07/03/90	1.61	0.12	1	6	4	8	-3	7
NM:ALBUQUERQUE	07/03/90	1.42	0.09	ND		ND		ND	
NV:LAS VEGAS	07/13/90	1.72	0.23	5	14	-21	19	5	14
NY:BUFFALO	07/30/90	1.65	0.12	6	7	3	8	2	7
NY:NEW YORK CITY	07/02/90	1.54	0.08	ND		ND		ND	
NY:SYRACUSE	07/03/90	1.62	0.08	6	5	-2	6	2	5
OH:CINCINNATI	07/31/90	1.63	0.08	3	5	1	6	4	5

Table 12 (continued)
Radionuclides in Pasteurized Milk
July 1990

Location	Date Collected	K		¹³⁷ Cs		¹⁴⁰ Ba		¹³¹ I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
OH:CLEVELAND	07/17/90	1.60	0.12	11	7	-3	8	5	7
OK:OKLAHOMA CITY	07/02/90	1.30	0.08	ND		ND		ND	
OR:PORTLAND	07/03/90	1.63	0.12	2	7	1	8	5	7
PA:PHILADELPHIA	07/02/90	1.65	0.12	6	7	-1	8	1	7
PA:PITTSBURGH	07/09/90	1.64	0.12	2	6	-3	8	-1	7
PC:CRISTOBAL	07/19/90	1.55	0.08	12	5	-3	6	1	5
PR:SAN JUAN	07/09/90	1.64	0.12	14	7	11	8	8	7
SC:CHARLESTON	07/31/90	1.45	0.09	ND		ND		ND	
SD:RAPID CITY	07/02/90	1.69	0.12	4	7	-4	8	4	7
TN:CHATTANOOGA	07/09/90	1.64	0.12	6	7	2	8	4	7
TN:KNOXVILLE	07/10/90	1.68	0.12	5	7	6	8	7	7
TN:MEMPHIS	07/17/90	1.39	0.08	ND		ND		ND	
TX:AUSTIN	07/23/90	1.60	0.08	5	5	-2	6	5	5
TX:FT. WORTH	07/02/90	1.55	0.12	2	7	3	8	5	7
VA:NORFOLK	07/31/90	1.32	0.07	ND		ND		ND	
WA:SEATTLE	07/03/90	1.62	0.12	7	7	2	8	7	7
WA:SPOKANE	07/10/90	1.61	0.22	5	14	-2	19	0	14
WV:CHARLESTON	07/10/90	1.29	0.22	-4	13	-4	19	8	14

σ = Counting Error.

ND = No Gamma Activity Detectable. Germanium spectrometry used on these samples.

Table 13
Radionuclides in Pasteurized Milk
August 1990

Location	Date Collected	K		¹³⁷ Cs		¹⁴⁰ Ba		¹³¹ I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
AL:MONTGOMERY	08/08/90	1.64	0.12	3	6	-7	8	0	7
AR:LITTLE ROCK	08/21/90	1.56	0.22	4	14	-7	19	-4	14
AZ:PHOENIX	08/09/90	1.64	0.12	6	7	5	8	7	7
CA:LOS ANGELES	08/09/90	1.64	0.16	6	10	3	13	8	10
CA:SACRAMENTO	08/01/90	1.66	0.12	7	7	1	8	4	7
CA:SAN FRANCISCO	08/02/90	1.64	0.22	2	14	-17	19	3	14
CO:DENVER	08/20/90	1.57	0.12	2	6	3	8	4	7
CT:HARTFORD	08/07/90	1.56	0.12	9	7	4	8	5	7
DE:WILMINGTON	08/15/90	1.68	0.12	1	6	-3	8	5	7
FL:TAMPA	08/14/90	1.77	0.13	6	7	-6	8	3	7
GA:ATLANTA	08/13/90	1.56	0.08	7	5	2	6	2	5
HI:HONOLULU	08/07/90	1.40	0.22	-8	13	0	19	-4	14
IA:DES MOINES	08/06/90	1.63	0.08	4	5	-1	6	2	5
IL:CHICAGO	08/09/90	1.62	0.12	4	7	-1	8	2	7
IN:INDIANAPOLIS	08/03/90	1.72	0.12	6	7	3	8	8	7
KS:WICHITA	08/29/90	1.79	0.13	5	7	-4	8	0	7
KY:LOUISVILLE	08/07/90	1.59	0.12	7	7	1	8	6	7
LA:NEW ORLEANS	08/14/90	1.63	0.07	6	4	0	5	4	4
MA:BOSTON	08/13/90	1.55	0.16	-2	10	-7	13	6	10
MD:BALTIMORE	08/10/90	1.69	0.08	3	5	-2	6	-1	5
ME:PORTLAND	08/01/90	1.60	0.12	6	7	2	8	-6	7
MI:DETROIT	08/08/90	1.67	0.09	4	5	-3	6	1	5
MI:GRAND RAPIDS	08/13/90	1.63	0.12	2	6	-3	8	-1	7
MO:KANSAS CITY	08/16/90	1.80	0.13	7	7	0	8	9	7
MO:ST. LOUIS	08/08/90	1.66	0.09	3	5	3	6	-2	5
MS:JACKSON	08/08/90	1.60	0.12	5	7	3	8	4	7
MT:HELENA	08/07/90	1.61	0.12	2	6	0	8	-1	7
NC:CHARLOTTE	08/13/90	1.58	0.12	7	7	3	8	4	7
ND:MINOT	08/28/90	1.65	0.12	3	7	2	8	0	7
NE:OMAHA	08/09/90	1.55	0.12	6	7	1	8	5	7
NJ:TRENTON	08/08/90	1.64	0.08	7	5	4	6	2	5
NM:ALBUQUERQUE	08/28/90	1.58	0.12	6	7	-6	8	2	7
NV:LAS VEGAS	08/08/90	1.35	0.22	-7	13	-9	19	0	14
NY:BUFFALO	08/21/90	1.74	0.13	2	7	4	8	2	7
NY:NEW YORK CITY	08/06/90	1.65	0.12	1	6	0	8	1	7
NY:SYRACUSE	08/06/90	1.66	0.22	7	14	-12	19	1	14
OH:CINCINNATI	08/29/90	1.73	0.13	-4	6	2	8	2	7

Table 13 (continued)
Radionuclides in Pasteurized Milk
August 1990

Location	Date Collected	K		¹³⁷ Cs		¹⁴⁰ Ba		¹³¹ I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
OH:CLEVELAND	08/28/90	1.43	0.22	-4	14	16	19	6	14
OK:OKLAHOMA CITY	08/27/90	1.52	0.08	6	5	1	6	3	5
OR:PORTLAND	08/09/90	1.64	0.22	6	14	-2	19	3	14
PA:PHILADELPHIA	08/06/90	1.77	0.09	ND		ND		ND	
PA:PITTSBURGH	08/08/90	1.59	0.12	1	6	-8	7	3	7
PC:CRISTOBAL	08/30/90	1.42	0.22	19	14	-4	19	6	14
PR:SAN JUAN	08/09/90	1.64	0.12	9	7	9	8	7	7
SC:CHARLESTON	08/20/90	1.72	0.10	3	1	ND		ND	
SD:RAPID CITY	08/08/90	1.58	0.08	3	5	-1	6	3	5
TN:CHATTANOOGA	08/06/90	1.52	0.22	9	14	0	19	8	14
TN:KNOXVILLE	08/06/90	1.68	0.12	0	6	-1	8	0	7
TN:MEMPHIS	08/22/90	1.57	0.12	0	6	-2	8	5	7
TX:AUSTIN	08/14/90	1.52	0.12	7	7	3	8	5	7
TX:FT. WORTH	08/01/90	1.35	0.07	ND		ND		ND	
VA:NORFOLK	08/29/90	1.69	0.22	10	14	-8	19	19	14
VT:MONTPELIER	08/09/90	1.35	0.22	2	14	-8	19	4	14
WA:SEATTLE	08/08/90	1.14	0.06	ND		ND		ND	
WA:SPOKANE	08/06/90	1.52	0.12	9	7	4	8	2	7
WV:CHARLESTON	08/13/90	1.50	0.22	-2	14	3	19	-5	14

σ = Counting Error.

ND = No Gamma Activity Detectable. Germanium spectrometry used on these samples.

Table 14
Radionuclides in Pasteurized Milk
September 1990

Location	Date Collected	K		¹³⁷ Cs		¹⁴⁰ Ba		¹³¹ I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
AR:LITTLE ROCK	09/03/90	1.49	0.22	11	14	-19	18	8	14
AZ:PHOENIX	09/06/90	1.61	0.12	2	7	8	8	5	7
CA:LOS ANGELES	09/14/90	1.61	0.12	4	7	3	8	8	7
CA:SACRAMENTO	09/05/90	1.69	0.08	3	5	-2	6	2	5
CA:SAN FRANCISCO	09/10/90	1.29	0.10	ND		ND		ND	
CO:DENVER	09/24/90	1.56	0.08	6	5	10	6	2	5
DE:WILMINGTON	09/19/90	1.49	0.12	-3	6	4	8	1	7
FL:TAMPA	09/11/90	1.59	0.12	9	7	-2	8	8	7
GA:ATLANTA	09/17/90	1.56	0.16	ND		ND		ND	
HI:HONOLULU	09/09/90	1.15	0.06	ND		ND		ND	
IA:DES MOINES	09/05/90	1.62	0.12	1	6	3	8	3	7
ID:IDAHO FALLS	09/05/90	1.68	0.13	5	8	3	10	7	8
IL:CHICAGO	09/06/90	1.60	0.12	6	7	-1	8	2	7
IN:INDIANAPOLIS	09/04/90	1.63	0.12	4	7	-3	8	3	7
KS:WICHITA	09/18/90	1.62	0.08	3	5	-3	5	1	5
KY:LOUISVILLE	09/04/90	1.48	0.12	7	7	4	8	0	7
MD:BALTIMORE	09/13/90	1.87	0.09	ND		ND		ND	
ME:PORTLAND	09/05/90	1.45	0.22	3	14	-2	19	-6	14
MI:DETROIT	09/13/90	1.71	0.12	3	7	3	8	-1	7
MI:GRAND RAPIDS	09/04/90	1.18	0.07	ND		ND		ND	
MN:ST. PAUL	09/06/90	1.51	0.22	19	14	13	19	10	14
MO:ST. LOUIS	09/04/90	1.64	0.12	8	7	0	8	3	7
MS:JACKSON	09/11/90	1.64	0.12	5	7	3	8	-3	7
MT:HELENA	09/07/90	1.57	0.12	3	7	5	8	7	7
NC:CHARLOTTE	09/13/90	1.48	0.16	3	10	-7	13	3	10
ND:MINOT	09/25/90	1.58	0.12	7	7	7	8	6	7
NJ:TRENTON	09/04/90	1.65	0.12	2	6	-1	8	2	7
NV:LAS VEGAS	09/28/90	0.96	0.08	ND		ND		ND	
NY:BUFFALO	09/24/90	1.74	0.12	13	7	-2	8	6	7
NY:NEW YORK CITY	09/10/90	1.66	0.12	6	7	0	8	9	7
NY:SYRACUSE	09/11/90	1.35	0.22	1	14	20	19	16	15
OH:CINCINNATI	09/27/90	1.55	0.12	7	7	-1	8	0	7
OH:CLEVELAND	09/18/90	1.54	0.12	7	7	4	8	5	7
OR:PORTLAND	09/06/90	1.57	0.22	13	14	-1	19	1	14
PA:PHILADELPHIA	09/04/90	1.57	0.12	-2	6	1	8	6	7
PA:PITTSBURGH	09/04/90	1.51	0.12	12	7	2	8	4	7
PC:CRISTOBAL	09/27/90	1.61	0.12	18	7	7	8	10	7

Table 14 (continued)
Radionuclides in Pasteurized Milk
September 1990

Location	Date Collected	K		¹³⁷ Cs		¹⁴⁰ Ba		¹³¹ I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
PR:SAN JUAN	09/07/90	1.56	0.12	5	7	2	8	2	7
SD:RAPID CITY	09/04/90	1.53	0.14	ND		ND		ND	
TN:CHATTANOOGA	09/04/90	1.62	0.12	3	6	-2	8	1	7
TN:KNOXVILLE	09/10/90	1.58	0.12	5	7	0	8	2	7
TX:AUSTIN	09/13/90	1.69	0.12	7	7	4	8	5	7
TX:FT. WORTH	09/04/90	1.67	0.08	2	5	2	6	4	5
VA:NORFOLK	09/27/90	1.60	0.08	2	4	-1	6	-3	5
VT:BURLINGTON	09/14/90	1.71	0.12	3	7	0	8	3	7
WA:SEATTLE	09/05/90	1.21	0.06	ND		ND		ND	
WA:SPOKANE	09/11/90	1.52	0.12	10	7	3	8	10	7
WV:CHARLESTON	09/18/90	1.65	0.22	0	14	-5	19	-6	14

σ = Counting Error.

ND = No Gamma Activity Detectable. Germanium spectrometry used on these samples.

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 acetylene 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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