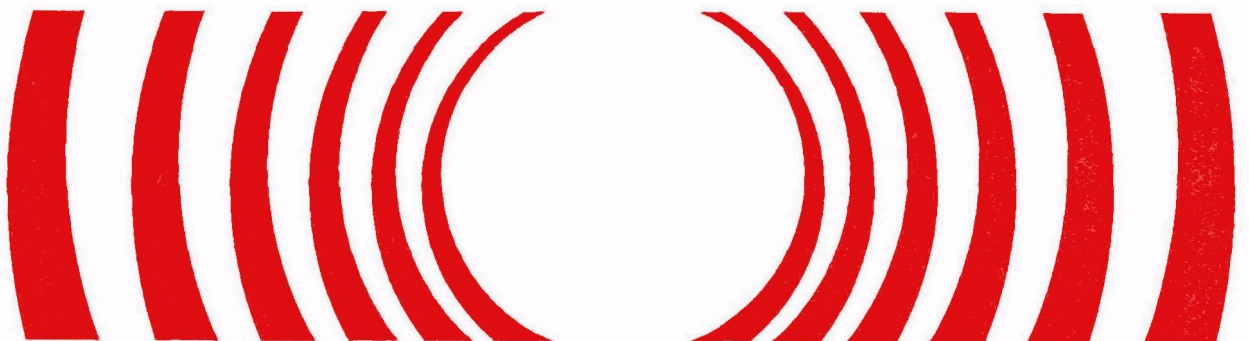

Radiation

 **Environmental Radiation Data
Report 66**

April–June 1991



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ENVIRONMENTAL

RADIATION

DATA

REPORT 66

April - June 1991

United States Environmental Protection Agency

Office of Radiation and Indoor Air

Preface

Environmental Radiation Data (ERD) is compiled and distributed quarterly by the Office of Radiation and Indoor Air's 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 and Indoor Air (ORIA). It is comprised of a nationwide network of 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 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 and Indoor Air 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 April - June 1991. Tables 5-7 contain the data in precipitation samples for April - June 1991. Table 8 contains the data for tritium in precipitation samples for April - June 1991 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
April 1991

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	5	0.0	0.0	0.0	0.01	0.00	0.01
AR:LITTLE ROCK	9	0.2	0.1	0.2	0.01	0.01	0.01
AZ:PHOENIX	8	1.7	0.3	0.9	0.02	0.01	0.01
CA:BERKELEY	9	0.1	0.0	0.1	0.01	0.00	0.00
CA:LOS ANGELES	9	0.4	0.0	0.2	0.01	0.01	0.01
CO:DENVER	9	1.8	0.3	0.7	0.01	0.01	0.01
CT:HARTFORD	9	0.2	0.0	0.1	0.01	0.01	0.01
DC:WASHINGTON	1	0.1	0.1	0.1	0.01	0.01	0.01
DE:WILMINGTON	9	0.5	0.0	0.2	0.01	0.00	0.01
FL:JACKSONVILLE	6	0.1	0.0	0.1	0.01	0.01	0.01
FL:MIAMI	9	0.2	0.0	0.0	0.02	0.01	0.02
HI:HONOLULU	8	0.2	0.1	0.1	0.00	0.00	0.00
IA:IOWA CITY	9	0.3	0.1	0.2	0.01	0.01	0.01
ID:BOISE	9	0.4	0.2	0.3	0.02	0.00	0.01
ID:IDAHO FALLS	9	0.0	0.0	0.0	0.01	0.00	0.01
IL:CHICAGO	9	0.5	0.1	0.2	0.01	0.01	0.01
IN:INDIANAPOLIS	8	0.5	0.1	0.2	0.01	0.01	0.01
KS:TOPEKA	8	1.3	0.4	0.7	0.01	0.01	0.01
KY:FRANKFORT	2	0.3	0.0	0.2	0.01	0.01	0.01
LA:NEW ORLEANS	7	0.6	0.0	0.1	0.02	0.00	0.01
MA:LAWRENCE	7	0.1	0.0	0.0	0.01	0.00	0.01
ME:AUGUSTA	9	0.2	0.0	0.1	0.01	0.00	0.01
MI:LANSING	8	0.2	0.0	0.1	0.02	0.00	0.01
MN:MINNEAPOLIS	7	0.7	0.0	0.2	0.02	0.01	0.01
MO:JEFFERSON CITY	9	1.4	0.1	0.5	0.04	0.01	0.02
MS:JACKSON	9	0.2	0.0	0.1	0.02	0.01	0.01
NC:CHARLOTTE	9	0.1	0.0	0.1	0.02	0.01	0.01
NC:WILMINGTON	9	0.0	0.0	0.0	0.01	0.00	0.01
ND:BISMARCK	9	2.3	0.2	0.8	0.03	0.00	0.01
NE:LINCOLN	1	0.5	0.5	0.5	0.01	0.01	0.01
NH:CONCORD	9	0.2	0.0	0.1	0.01	0.00	0.01
NJ:TRENTON	9	0.5	0.0	0.2	0.01	0.00	0.01
NM:SANTA FE	9	0.5	0.2	0.3	0.01	0.00	0.01
NV:LAS VEGAS	9	0.3	0.1	0.2	0.02	0.01	0.01
NY:ALBANY	4	0.1	0.0	0.0	0.01	0.01	0.01
NY:NIAGARA FALLS	9	0.2	0.1	0.1	0.01	0.01	0.01
NY:SYRACUSE	4	0.2	0.0	0.1	0.02	0.01	0.01

Table 2 (continued)
Gross Beta in Airborne Particulates
April 1991

Location	Number of Samples	5-Hour Field Estimate			NAREL Lab Measurement		
		Max	Min	Avg	Max	Min	Avg
NY:YAPHANK	9	0.3	0.1	0.1	0.01	0.00	0.01
OH:COLUMBUS	7	0.3	0.1	0.2	0.02	0.01	0.01
OH:PAINESVILLE	8	0.2	0.0	0.1	0.01	0.01	0.01
OH:ROSS	9	0.0	0.0	0.0	0.10	0.01	0.03
OH:TOLEDO	9	0.0	0.0	0.0	0.02	0.00	0.01
OK:OKLAHOMA CITY	8	1.6	0.0	0.4	0.01	0.01	0.01
OR:PORTLAND	9	0.0	0.0	0.0	0.01	0.00	0.00
PA:HARRISBURG	9	0.5	0.1	0.2	0.01	0.01	0.01
PA:PITTSBURGH	9	0.1	0.1	0.1	0.01	0.00	0.01
RI:PROVIDENCE	9	0.0	0.0	0.0	0.01	0.00	0.01
SC:BARNWELL	2	0.0	0.0	0.0	0.02	0.01	0.01
SC:COLUMBIA	9	0.6	0.0	0.2	0.03	0.01	0.02
SD:PIERRE	8	0.5	0.1	0.3	0.02	0.01	0.01
TN:KNOXVILLE	8	1.1	0.4	0.7	0.03	0.01	0.02
TN:NASHVILLE	9	1.2	0.2	0.4	0.03	0.01	0.02
TX:AUSTIN	7	0.6	0.1	0.2	0.01	0.00	0.01
TX:EL PASO	9	0.7	0.0	0.3	0.02	0.01	0.01
UT:SALT LAKE CITY	9	0.3	0.1	0.2	0.01	0.00	0.01
VA:LYNCHBURG	8	0.6	0.1	0.3	0.01	0.00	0.01
VA:VIRGINIA BEACH	4	0.1	0.1	0.1	0.01	0.00	0.01
WA:OLYMPIA	9	0.2	0.0	0.1	0.02	0.00	0.00
WA:SPOKANE	9	0.4	0.1	0.2	0.01	0.00	0.01
WI:MADISON	9	1.3	0.2	0.6	0.02	0.01	0.02
WV:CHARLESTON	3	0.0	0.0	0.0	0.01	0.00	0.01

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
May 1991

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

Table 3 (continued)
Gross Beta in Airborne Particulates
May 1991

Location	Number of Samples	5-Hour Field Estimate			NAREL Lab Measurement		
		Max	Min	Avg	Max	Min	Avg
OH:COLUMBUS	5	0.7	0.1	0.3	0.02	0.01	0.01
OH:PAINESVILLE	8	0.4	0.1	0.3	0.01	0.00	0.01
OH:ROSS	9	0.0	0.0	0.0	0.03	0.01	0.02
OH:TOLEDO	9	0.0	0.0	0.0	0.01	0.00	0.01
OK:OKLAHOMA CITY	5	0.6	0.0	0.2	0.01	0.00	0.01
OR:PORTLAND	9	0.0	0.0	0.0	0.01	0.00	0.00
PA:HARRISBURG	9	0.5	0.2	0.3	0.01	0.00	0.01
PA:PITTSBURGH	9	0.4	0.1	0.3	0.02	0.01	0.01
RI:PROVIDENCE	8	0.0	0.0	0.0	0.01	0.00	0.01
SC:BARNWELL	1	0.1	0.1	0.1	0.01	0.01	0.01
SC:COLUMBIA	9	0.8	0.1	0.3	0.02	0.01	0.01
SD:PIERRE	5	0.3	0.1	0.2	0.01	0.01	0.01
TN:KNOXVILLE	8	1.0	0.1	0.4	0.02	0.00	0.02
TN:NASHVILLE	9	2.4	0.1	0.6	0.02	0.01	0.02
TX:AUSTIN	9	0.2	0.1	0.1	0.01	0.00	0.01
TX:EL PASO	8	0.8	0.1	0.5	0.02	0.01	0.01
UT:SALT LAKE CITY	9	0.3	0.1	0.2	0.01	0.01	0.01
VA:LYNCHBURG	9	1.0	0.1	0.3	0.01	0.01	0.01
VA:VIRGINIA BEACH	3	0.1	0.1	0.1	0.01	0.01	0.01
WA:OLYMPIA	9	0.1	0.0	0.1	0.01	0.00	0.00
WA:SPOKANE	9	0.6	0.1	0.2	0.01	0.00	0.01
WI:MADISON	9	0.9	0.1	0.5	0.02	0.00	0.01
WV:CHARLESTON	6	0.1	0.1	0.1	0.01	0.00	0.01

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
June 1991

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	8	0.0	0.0	0.0	0.01	0.01	0.01
AR:LITTLE ROCK	8	0.5	0.2	0.3	0.01	0.01	0.01
AZ:PHOENIX	6	2.5	0.5	1.1	0.02	0.01	0.01
CA:BERKELEY	8	0.3	0.0	0.1	0.00	0.00	0.00
CA:LOS ANGELES	8	0.1	0.0	0.1	0.01	0.00	0.01
CO:DENVER	7	0.7	0.2	0.5	0.01	0.01	0.01
CT:HARTFORD	8	0.1	0.0	0.1	0.01	0.00	0.01
DE:WILMINGTON	8	0.5	0.1	0.2	0.02	0.00	0.01
FL:JACKSONVILLE	8	0.1	0.0	0.1	0.01	0.00	0.01
FL:MIAMI	4	0.1	0.1	0.1	0.01	0.01	0.01
HI:HONOLULU	8	0.2	0.1	0.1	0.00	0.00	0.00
IA:IOWA CITY	8	0.4	0.1	0.2	0.01	0.01	0.01
ID:BOISE	8	0.7	0.1	0.4	0.02	0.00	0.01
ID:IDAHO FALLS	8	0.0	0.0	0.0	0.01	0.00	0.01
IL:CHICAGO	9	1.5	0.1	0.5	0.01	0.00	0.01
IN:INDIANAPOLIS	7	1.2	0.0	0.4	0.02	0.00	0.01
KS:TOPEKA	8	2.0	0.7	1.1	0.02	0.01	0.01
KY:FRANKFORT	4	0.6	0.2	0.4	0.01	0.01	0.01
LA:NEW ORLEANS	8	0.2	0.0	0.1	0.02	0.00	0.01
MA:LAWRENCE	8	0.1	0.0	0.1	0.01	0.00	0.01
ME:AUGUSTA	8	0.5	0.0	0.2	0.01	0.00	0.00
MI:LANSING	8	0.5	0.1	0.3	0.01	0.00	0.01
MN:MINNEAPOLIS	8	0.7	0.1	0.4	0.02	0.00	0.01
MO:JEFFERSON CITY	8	1.9	0.4	0.9	0.05	0.01	0.02
MS:JACKSON	8	0.3	0.1	0.2	0.03	0.01	0.01
NC:CHARLOTTE	8	0.6	0.1	0.2	0.01	0.01	0.01
NC:WILMINGTON	8	0.0	0.0	0.0	0.01	0.00	0.01
ND:BISMARCK	8	0.8	0.2	0.5	0.01	0.00	0.01
NE:LINCOLN	8	1.7	0.1	0.8	0.02	0.01	0.01
NH:CONCORD	8	0.2	0.1	0.1	0.01	0.00	0.00
NJ:TRENTON	8	0.9	0.3	0.6	0.01	0.00	0.01
NM:SANTA FE	8	0.5	0.1	0.3	0.01	0.01	0.01
NV:LAS VEGAS	8	0.3	0.1	0.2	0.02	0.01	0.01
NY:ALBANY	4	0.1	0.1	0.1	0.01	0.00	0.00
NY:NIAGARA FALLS	8	0.5	0.1	0.3	0.02	0.00	0.01
NY:SYRACUSE	3	0.1	0.0	0.1	0.01	0.00	0.01
NY:YAPHANK	8	0.2	0.1	0.1	0.01	0.00	0.01

Table 4 (continued)
Gross Beta in Airborne Particulates
June 1991

Location	Number of Samples	5-Hour Field Estimate			NAREL Lab Measurement		
		Max	Min	Avg	Max	Min	Avg
OH:COLUMBUS	4	0.2	0.0	0.1	0.01	0.00	0.01
OH:PAINESVILLE	7	0.7	0.1	0.4	0.03	0.00	0.01
OH:ROSS	8	0.0	0.0	0.0	0.07	0.01	0.03
OH:TOLEDO	8	0.0	0.0	0.0	0.02	0.00	0.01
OK:OKLAHOMA CITY	6	1.0	0.0	0.3	0.02	0.01	0.01
OR:PORTLAND	8	0.0	0.0	0.0	0.01	0.00	0.00
PA:HARRISBURG	8	1.0	0.2	0.5	0.01	0.00	0.01
PA:PITTSBURGH	8	0.5	0.3	0.4	0.02	0.01	0.01
RI:PROVIDENCE	8	0.0	0.0	0.0	0.01	0.00	0.01
SC:BARNWELL	1	0.0	0.0	0.0	0.00	0.00	0.00
SC:COLUMBIA	8	0.5	0.1	0.3	0.02	0.00	0.01
SD:PIERRE	6	0.2	0.1	0.2	0.01	0.00	0.01
TN:KNOXVILLE	7	1.3	0.1	0.6	0.02	0.01	0.01
TN:NASHVILLE	8	1.0	0.2	0.6	0.08	0.01	0.03
TX:AUSTIN	8	0.2	0.1	0.1	0.02	0.00	0.01
TX:EL PASO	8	1.1	0.3	0.7	0.02	0.01	0.02
UT:SALT LAKE CITY	7	0.3	0.1	0.2	0.01	0.01	0.01
VA:LYNCHBURG	8	0.8	0.2	0.6	0.01	0.00	0.01
VA:VIRGINIA BEACH	2	0.1	0.1	0.1	0.01	0.01	0.01
WA:OLYMPIA	8	0.1	0.0	0.0	0.00	0.00	0.00
WA:SPOKANE	8	0.4	0.1	0.2	0.01	0.00	0.00
WI:MADISON	8	1.0	0.1	0.5	0.01	0.00	0.01
WV:CHARLESTON	3	0.3	0.2	0.3	0.02	0.01	0.01

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

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

Table 5
Gross Beta and Specific Gamma in Precipitation
April 1991

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m ²)	Specific Gamma Activity (pCi/l)
AL:MONTGOMERY	128.0	0.18 0.05	ND
AR:LITTLE ROCK	101.0	0.14 0.04	ND
CA:BERKELEY	5.0	0.01 0.00	ND
CO:DENVER	15.6	0.08 0.01	ND
CT:HARTFORD	40.0	0.03 0.01	ND
DE:WILMINGTON	72.2	0.21 0.04	ND
FL:JACKSONVILLE	109.8	0.15 0.04	ND
FL:MIAMI	133.0	0.13 0.05	ND
ID:BOISE	55.0	0.07 0.02	ND
ID:IDAHO FALLS	30.6	0.17 0.02	ND
IL:CHICAGO	105.2	0.07 0.03	ND
LA:NEW ORLEANS	172.0	0.13 0.06	ND
MI:LANSING	124.8	0.18 0.05	ND
MN:MINNEAPOLIS	38.0	0.02 0.01	ND
MO:JEFFERSON CITY	87.0	0.15 0.03	ND
MS:JACKSON	92.0	0.06 0.03	ND
NC:CHARLOTTE	162.0	0.21 0.06	ND
NC:WILMINGTON	81.0	0.19 0.04	ND
ND:BISMARCK	38.6	0.37 0.03	ND
NH:CONCORD	76.6	0.24 0.04	ND
NJ:TRENTON	71.0	0.18 0.03	ND
NY:ALBANY	53.6	0.11 0.02	ND
NY:NEW YORK CITY	38.0	0.07 0.02	ND
NY:NIAGARA FALLS	91.0	0.11 0.04	ND
NY:YAPHANK	100.0	0.16 0.04	ND
OH:PAINESVILLE	63.6	0.26 0.03	ND
OH:TOLEDO	94.0	0.19 0.04	ND
OR:PORTLAND	95.4	0.05 0.03	ND
PA:HARRISBURG	8.0	0.01 0.00	ND
SC:BARNWELL	67.8	0.10 0.03	ND
SC:COLUMBIA	207.2	0.24 0.08	ND
TN:KNOXVILLE	105.0	0.09 0.03	ND
TN:NASHVILLE	84.8	0.09 0.03	ND
TX:AUSTIN	90.0	0.10 0.03	ND
UT:SALT LAKE CITY	29.4	0.10 0.01	ND
VA:LYNCHBURG	97.8	0.12 0.04	ND
WA:OLYMPIA	87.8	0.09 0.03	ND
WI:MADISON	87.8	0.10 0.03	ND

σ = Counting Error.
 ND = No Gamma Activity Detectable.

Table 6
Gross Beta and Specific Gamma in Precipitation
May 1991

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m ²)	Specific Gamma Activity (pCi/l)
AL:MONTGOMERY	155.0	0.24 0.06	ND
AR:LITTLE ROCK	59.0	0.04 0.02	ND
CO:DENVER	60.8	0.06 0.02	ND
CT:HARTFORD	84.0	0.13 0.03	ND
DE:WILMINGTON	96.0	0.17 0.04	ND
FL:JACKSONVILLE	67.6	0.08 0.02	ND
FL:MIAMI	47.2	0.10 0.02	ND
ID:BOISE	14.4	0.03 0.01	ND
ID:IDAHO FALLS	84.4	0.12 0.03	ND
IL:CHICAGO	102.2	0.02 0.04	ND
LA:NEW ORLEANS	270.6	0.29 0.10	ND
ME:AUGUSTA	76.0	0.21 0.03	ND
MI:LANSING	38.8	0.08 0.02	ND
MN:MINNEAPOLIS	162.0	0.19 0.06	ND
MO:JEFFERSON CITY	70.0	0.06 0.03	ND
MS:JACKSON	84.0	0.06 0.03	ND
NC:CHARLOTTE	96.0	0.24 0.04	ND
NC:WILMINGTON	81.0	0.42 0.05	ND
ND:BISMARCK	100.4	0.06 0.04	ND
NH:CONCORD	84.4	0.20 0.04	ND
NJ:TRENTON	40.8	0.06 0.02	ND
NM:SANTA FE	34.0	0.04 0.01	ND
NV:LAS VEGAS	8.0	0.07 0.01	ND
NY:ALBANY	62.6	0.14 0.03	ND
NY:NEW YORK CITY	33.6	0.04 0.01	ND
NY:NIAGARA FALLS	73.0	0.08 0.03	ND
NY:SYRACUSE	32.0	0.04 0.01	ND
NY:YAPHANK	53.0	0.17 0.03	ND
OH:PAINESVILLE	39.8	0.10 0.02	ND
OH:TOLEDO	26.0	0.02 0.01	ND
OR:PORTLAND	82.8	0.13 0.03	ND
PA:HARRISBURG	87.0	0.18 0.04	ND
RI:PROVIDENCE	42.0	0.24 0.02	ND
SC:BARNWELL	39.6	0.03 0.02	ND
SC:COLUMBIA	138.2	0.25 0.05	ND
TN:KNOXVILLE	98.0	0.09 0.03	ND
TN:NASHVILLE	36.0	0.05 0.01	ND
TX:AUSTIN	68.0	0.09 0.03	ND
UT:SALT LAKE CITY	68.4	0.07 0.02	ND
VA:LYNCHBURG	52.4	0.34 0.03	ND
WA:OLYMPIA	48.8	0.07 0.02	ND
WI:MADISON	50.0	0.04 0.02	ND
WV:CHARLESTON	42.0	0.08 0.02	ND

σ = Counting Error.
 ND = No Gamma Activity Detectable.

Table 7
Gross Beta and Specific Gamma in Precipitation
June 1991

Location	Depth (mm)	Act. $\pm 2\sigma$ (nCi/m ²)	Specific Gamma Activity (pCi/l)
AL:MONTGOMERY	140.0	0.29 0.06	ND
AR:LITTLE ROCK	82.0	0.08 0.03	ND
CO:DENVER	75.2	0.13 0.03	ND
CT:HARTFORD	40.0	0.03 0.01	ND
DE:WILMINGTON	47.0	0.38 0.03	ND
FL:JACKSONVILLE	160.2	0.19 0.06	ND
FL:MIAMI	161.4	0.18 0.06	ND
ID:BOISE	5.0	0.06 0.00	ND
ID:IDAHO FALLS	8.0	0.02 0.00	ND
IL:CHICAGO	54.2	0.03 0.02	ND
LA:NEW ORLEANS	90.0	0.10 0.03	ND
ME:AUGUSTA	104.0	0.32 0.06	ND
MI:LANSING	79.2	0.12 0.03	ND
MN:MINNEAPOLIS	36.0	0.02 0.01	ND
MO:JEFFERSON CITY	20.0	0.01 0.01	ND
MS:JACKSON	56.0	0.05 0.02	ND
NC:CHARLOTTE	29.0	0.09 0.01	ND
NC:WILMINGTON	33.0	0.05 0.01	ND
ND:BISMARCK	38.8	0.07 0.02	ND
NH:CONCORD	38.0	0.12 0.02	ND
NJ:TRENTON	49.2	0.11 0.02	ND
NM:SANTA FE	9.0	0.03 0.00	ND
NV:LAS VEGAS	4.0	0.02 0.00	ND
NY:ALBANY	58.0	0.21 0.03	ND
NY:NEW YORK CITY	28.2	0.06 0.01	ND
NY:NIAGARA FALLS	25.0	0.02 0.01	ND
NY:SYRACUSE	20.0	0.00 0.01	ND
NY:YAPHANK	79.0	0.33 0.04	ND
OH:PAINESVILLE	27.0	0.04 0.01	ND
OH:TOLEDO	51.0	0.06 0.02	ND
OR:PORTLAND	32.0	0.03 0.01	ND
PA:HARRISBURG	17.0	0.11 0.01	ND
SC:BARNWELL	69.2	0.12 0.03	ND
SC:COLUMBIA	87.6	0.08 0.03	ND
TN:KNOXVILLE	129.0	0.16 0.05	ND
TN:NASHVILLE	93.2	0.33 0.04	ND
TX:AUSTIN	90.0	0.06 0.03	ND
UT:SALT LAKE CITY	30.0	0.10 0.02	ND
VA:LYNCHBURG	31.0	0.17 0.02	ND
WA:OLYMPIA	36.4	0.03 0.01	ND
WI:MADISON	73.0	0.06 0.02	ND
WV:CHARLESTON	42.0	0.08 0.02	ND

σ = Counting Error.
 ND = No Gamma Activity Detectable.

Table 8
Tritium in Precipitation
April - June 1991

Location	April 1991		May 1991		June 1991	
	nCi/l	$\pm 2\sigma$	nCi/l	$\pm 2\sigma$	nCi/l	$\pm 2\sigma$
AL:MONTGOMERY	0.2	0.2	0.2	0.2	0.2	0.2
AR:LITTLE ROCK	0.1	0.2	0.1	0.2	0.2	0.2
CA:BERKELEY	0.1	0.2	NS		NS	
CO:DENVER	0.2	0.2	0.1	0.2	0.2	0.2
CT:HARTFORD	0.2	0.2	0.1	0.2	0.2	0.2
DE:WILMINGTON	0.1	0.2	0.2	0.2	0.2	0.2
FL:JACKSONVILLE	0.1	0.2	0.3	0.2	0.1	0.2
FL:MIAMI	0.2	0.2	0.2	0.2	0.1	0.2
ID:BOISE	0.2	0.2	0.2	0.2	0.2	0.2
ID:IDAHO FALLS	0.2	0.2	0.2	0.2	0.2	0.2
IL:CHICAGO	0.3	0.2	0.1	0.2	0.1	0.2
LA:NEW ORLEANS	0.2	0.2	0.2	0.2	0.1	0.2
ME:AUGUSTA	NS		0.1	0.2	0.2	0.2
MI:LANSING	0.2	0.2	0.1	0.2	0.2	0.2
MN:MINNEAPOLIS	0.2	0.2	0.2	0.2	0.2	0.2
MO:JEFFERSON CITY	0.3	0.2	0.2	0.2	0.2	0.2
MS:JACKSON	0.2	0.2	0.2	0.2	0.1	0.2
NC:CHARLOTTE	0.2	0.2	0.2	0.2	0.1	0.2
NC:WILMINGTON	0.1	0.2	0.2	0.2	0.2	0.2
ND:BISMARCK	0.3	0.2	0.1	0.2	0.1	0.2
NH:CONCORD	0.2	0.2	0.3	0.2	0.2	0.2
NJ:TRENTON	0.3	0.2	0.2	0.2	0.2	0.2
NM:SANTA FE	NS		0.1	0.2	0.1	0.2
NV:LAS VEGAS	NS		0.2	0.2	0.2	0.2
NY:ALBANY	0.2	0.2	0.2	0.2	0.1	0.2
NY:NEW YORK CITY	0.3	0.2	0.2	0.2	0.1	0.2
NY:NIAGARA FALLS	0.2	0.2	0.3	0.2	0.1	0.2
NY:SYRACUSE	NS		0.2	0.2	0.1	0.2
NY:YAPHANK	0.1	0.2	0.1	0.2	0.2	0.2
OH:PAINESVILLE	0.3	0.2	0.1	0.2	0.1	0.2
OH:TOLEDO	0.3	0.2	0.1	0.2	0.2	0.2
OR:PORTLAND	0.1	0.2	0.2	0.2	0.2	0.2
PA:HARRISBURG	0.3	0.2	0.2	0.2	0.2	0.2
RI:PROVIDENCE	NS		0.2	0.2	NS	
SC:BARNWELL	0.4	0.2	0.3	0.2	0.5	0.2
SC:COLUMBIA	0.2	0.2	0.3	0.2	0.2	0.2
TN:KNOXVILLE	0.2	0.2	0.2	0.2	0.2	0.2
TN:NASHVILLE	0.2	0.2	0.2	0.2	0.1	0.2
TX:AUSTIN	0.2	0.2	0.1	0.2	0.1	0.2
UT:SALT LAKE CITY	0.1	0.2	0.1	0.2	0.2	0.2
VA:LYNCHBURG	0.2	0.2	0.1	0.2	0.1	0.2
WA:OLYMPIA	0.1	0.2	0.1	0.2	0.1	0.2
WI:MADISON	0.2	0.2	0.1	0.2	0.3	0.2
WV:CHARLESTON	NS		0.2	0.2	0.2	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 April - June 1991.

Table 9
Tritium in Surface Water
April - June 1991

Location	Source	Date Collected	nCi/l	$\pm 2\sigma$
AL:DECATUR	TENNESSEE RIVER	04/04/91	0.3	0.2
AL:GORDON	CHATTAHOOCHEE RIVER	04/11/91	1.1	0.2
AL:SCOTTSBORO	TENNESSEE RIVER	04/05/91	0.2	0.2
AR:LITTLE ROCK	ARKANSAS RIVER	04/18/91	0.1	0.2
CA:CLAY STATION	FOLSOM S. CANAL	02/18/91	0.2	0.2
CA:DIABLO CANYON	PACIFIC OCEAN	05/15/91	0.1	0.2
CA:EUREKA	HUMBOLDT BAY	04/11/91	0.1	0.2
CA:SAN ONOFRE	PACIFIC OCEAN	06/19/91	0.1	0.2
CO:PLATTEVILLE	SOUTH PLATTE RIVER	04/05/91	0.1	0.2
CT:EAST HADDAM	CONNECTICUT RIVER	04/08/91	0.1	0.2
CT:WATERFORD	LONG ISLAND SOUND	04/08/91	0.3	0.2
FL:CRYSTAL RIVER	GULF OF MEXICO	04/15/91	0.2	0.2
FL:FT. PIERCE	ATLANTIC OCEAN	04/09/91	0.1	0.2
FL:HOMESTEAD	BISCAYNE BAY	04/04/91	0.1	0.2
IA:CEDAR RAPIDS	CEDAR RIVER	04/18/91	0.1	0.2
IL:E. MOLINE	MISSISSIPPI RIVER	04/23/91	0.3	0.2
IL:MORRIS	ILLINOIS RIVER	04/02/91	0.2	0.2
IL:ZION	LAKE MICHIGAN	06/26/91	0.2	0.2
KS:LEROY	NEOSHO RIVER	04/03/91	0.1	0.2
LA:NEW ORLEANS	MISSISSIPPI RIVER	04/04/91	0.1	0.2
MA:PLYMOUTH	CAPE COD BAY	04/17/91	0.2	0.2
MD:CONOWINGO	SUSQUEHANNA RIVER	04/16/91	0.1	0.2
MD:LUSBY	CHESAPEAKE BAY	04/08/91	0.2	0.2
ME:WISCASSET	MONTSEWAY BAY	04/09/91	0.1	0.2
MI:BRIDGMAN	LAKE MICHIGAN	04/05/91	0.2	0.2
MI:CHARLEVOIX	LAKE MICHIGAN	04/08/91	0.2	0.2
MI:MONROE	LAKE ERIE	04/08/91	0.2	0.2
MI:SOUTH HAVEN	LAKE MICHIGAN	04/07/91	0.2	0.2
MN:MONTICELLO	MISSISSIPPI RIVER	04/23/91	0.2	0.2
MN:RED WING	MISSISSIPPI RIVER	05/13/91	0.2	0.2
MS:PORT GIBSON	MISSISSIPPI RIVER	04/09/91	0.2	0.2
NC:CHARLOTTE	CATAWBA RIVER	04/01/91	0.3	0.2
NC:SOUTHPORT	ATLANTIC OCEAN	04/10/91	0.2	0.2
NE:RULO	MISSOURI RIVER	04/02/91	0.1	0.2
NJ:BAYSIDE	DELAWARE RIVER	04/16/91	0.2	0.2
NJ:BAYSIDE	DELAWARE RIVER	04/17/91	0.5	0.2
NJ:OYSTER CREEK	OYSTER CREEK	04/17/91	0.2	0.2

Table 9 (continued)
Tritium in Surface Water
April - June 1991

Location	Source	Date	
		Collected	nCi/l $\pm 2\sigma$
NV:BOULDER CITY	COLORADO RIVER	05/03/91	0.2 0.2
NY:CHELSEA	HUDSON RIVER	04/08/91	0.2 0.2
NY:OSSINING	HUDSON RIVER	04/29/91	0.3 0.2
NY:OSWEGO	LAKE ONTARIO	06/19/91	0.2 0.2
OH:TOLEDO	LAKE ERIE	04/04/91	0.1 0.2
OR:BRADWOOD	COLUMBIA RIVER	05/30/91	0.1 0.2
PA:DANVILLE	SUSQUEHANNA RIVER	04/17/91	0.3 0.2
PA:PHILADELPHIA	SCHUYLKILL-BELMONT	04/23/91	0.2 0.2
PA:PHILADELPHIA	DELAWARE-BAXTER	04/23/91	0.3 0.2
PA:PHILADELPHIA	SCHUYLKILL-QUEEN	04/23/91	0.3 0.2
SC:ALLENDALE	SAVANNAH RIVER	04/30/91	0.2 0.2
SC:BROAD RIVER	BROAD RIVER	04/25/91	0.3 0.2
SC:HARTSVILLE	LAKE ROBINSON	04/15/91	0.3 0.2
TN:DAISY	TENNESSEE RIVER	04/16/91	0.2 0.2
TN:KINGSTON	CLINCH RIVER	04/08/91	0.3 0.2
TX:EL PASO	RIO GRANDE	06/04/91	0.2 0.2
TX:MATAGORDA	COLORADO RIVER	04/16/91	0.2 0.2
VA:DOSWELL	NORTH ANNA RIVER	04/04/91	3.5 0.2
VA:NEWPORT NEWS	JAMES RIVER	04/18/91	0.2 0.2
WA:NORTHPORT	COLUMBIA RIVER	05/22/91	0.1 0.2
WA:RICHLAND	COLUMBIA RIVER	04/23/91	0.1 0.2
WI:TWO CREEKS	LAKE MICHIGAN	04/16/91	0.2 0.2
WI:VICTORY	MISSISSIPPI RIVER	04/05/91	0.2 0.2
WV:WHEELING	OHIO RIVER	04/03/91	0.1 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 April - June 1991.

Table 10
Tritium in Drinking Water
 April - June 1991

Location	Date Collected	nCi/l	$\pm 2\sigma$
AK:FAIRBANKS	05/20/91	0.1	0.2
AL:DOTHAN	04/11/91	0.2	0.2
AL:MONTGOMERY	04/08/91	0.2	0.2
AL:MUSCLE SHOALS	04/04/91	0.3	0.2
AL:SCOTTSBORO	04/05/91	0.2	0.2
AR:LITTLE ROCK	04/18/91	0.1	0.2
CA:BERKELEY	04/05/91	0.1	0.2
CA:LOS ANGELES	04/08/91	0.2	0.2
CO:DENVER	04/08/91	0.1	0.2
CO:PLATTEVILLE	04/08/91	0.2	0.2
CT:HARTFORD	04/08/91	0.1	0.2
DC:WASHINGTON	06/15/91	0.2	0.2
DE:DOVER	04/05/91	0.1	0.2
FL:MIAMI	04/02/91	0.2	0.2
FL:TAMPA	04/08/91	0.1	0.2
HI:HONOLULU	04/25/91	0.3	0.2
IA:CEDAR RAPIDS	04/18/91	0.2	0.2
ID:BOISE	04/08/91	0.1	0.2
ID:IDAHO FALLS	04/05/91	0.2	0.2
IL:CHICAGO	04/12/91	0.1	0.2
IL:MORRIS	05/06/91	0.1	0.2
KS:TOPEKA	04/01/91	0.2	0.2
LA:NEW ORLEANS	04/09/91	0.1	0.2
MA:LAWRENCE	04/04/91	0.1	0.2
MD:BALTIMORE	04/03/91	0.2	0.2
MD:CONOWINGO	04/16/91	0.1	0.2
ME:AUGUSTA	04/09/91	0.1	0.2
MI:DETROIT	04/04/91	0.2	0.2
MI:GRAND RAPIDS	04/12/91	0.2	0.2
MN:MINNEAPOLIS	04/04/91	0.1	0.2
MN:RED WING	04/17/91	0.1	0.2
MO:JEFFERSON CITY	04/02/91	0.1	0.2
MS:JACKSON	04/09/91	0.1	0.2
MS:PORT GIBSON	04/09/91	0.2	0.2
MT:HELENA	04/04/91	0.2	0.2
NC:CHARLOTTE	04/01/91	0.3	0.2
ND:BISMARCK	04/02/91	0.2	0.2
NE:LINCOLN	04/08/91	0.1	0.2
NH:CONCORD	04/09/91	0.1	0.2
NJ:TRENTON	04/16/91	0.1	0.2
NJ:WARETOWN	04/17/91	0.1	0.2

Table 10 (continued)
Tritium in Drinking Water
April - June 1991

Location	Date Collected	nCi/l	$\pm 2\sigma$
NM:SANTA FE	04/08/91	0.1	0.2
NV:LAS VEGAS	04/04/91	0.2	0.2
NY:ALBANY	04/29/91	0.2	0.2
NY:NEW YORK CITY	04/03/91	0.2	0.2
NY:NIAGARA FALLS	04/04/91	0.2	0.2
NY:SYRACUSE	06/12/91	0.1	0.2
OH:CINCINNATI	05/28/91	0.1	0.2
OH:COLUMBUS	04/23/91	0.1	0.2
OH:EAST LIVERPOOL	05/08/91	0.2	0.2
OH:PAINESVILLE	04/08/91	0.2	0.2
OH:TOLEDO	04/04/91	0.2	0.2
OK:OKLAHOMA CITY	04/10/91	0.2	0.2
OR:PORTLAND	04/03/91	0.2	0.2
PA:COLUMBIA	04/17/91	0.2	0.2
PA:HARRISBURG	04/17/91	0.2	0.2
PA:PHILADELPHIA	04/23/91	0.1	0.2
PA:PHILADELPHIA	04/23/91	0.2	0.2
PA:PHILADELPHIA	04/23/91	0.2	0.2
PA:PITTSBURGH	05/08/91	0.1	0.2
PC:ANCON	04/10/91	0.1	0.2
RI:PROVIDENCE	04/05/91	0.2	0.2
SC:BARNWELL	04/11/91	0.0	0.0
SC:COLUMBIA	04/02/91	0.2	0.2
SC:HARTSVILLE	04/03/91	0.1	0.2
SC:JENKINSVILLE	04/12/91	0.3	0.2
SC:SENECA	04/16/91	0.2	0.2
TN:KNOXVILLE	04/03/91	0.2	0.2
TX:AUSTIN	04/05/91	0.1	0.2
VA:DOSWELL	05/03/91	0.2	0.2
VA:LYNCHBURG	04/04/91	0.2	0.2
VA:VIRGINIA BEACH	04/11/91	0.2	0.2
WA:RICHLAND	04/23/91	0.2	0.2
WA:SEATTLE	04/02/91	0.1	0.2
WI:GENOA CITY	04/09/91	0.2	0.2
WI:MADISON	04/03/91	0.1	0.2

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-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-90.

Iodine-131, barium-140, cesium-137, and potassium are determined by gamma spectral analysis. Strontium-90 is 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 April - June 1991. Table 14 contains the concentrations of strontium-90 in pasteurized milk EPA Regional Composites for April - June 1991.

Table 11
Radionuclides in Pasteurized Milk
April 1991

Location	Date Collected	K		¹³⁷ Cs		¹⁴⁰ Ba		¹³¹ I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
AL:MONTGOMERY	04/08/91	1.84	0.08	ND		ND		ND	
AR:LITTLE ROCK	04/01/91	1.61	0.10	ND		ND		ND	
AZ:PHOENIX	04/11/91	1.61	0.14	ND		ND		ND	
CA:LOS ANGELES	04/04/91	1.44	0.16	ND		ND		ND	
CA:SACRAMENTO	04/01/91	1.69	0.09	ND		ND		ND	
CA:SAN FRANCISCO	04/03/91	1.61	0.08	ND		ND		ND	
CT:HARTFORD	04/08/91	1.55	0.07	ND		ND		ND	
DE:DOVER	04/17/91	1.45	0.15	ND		ND		ND	
FL:TAMPA	04/24/91	1.55	0.12	ND		ND		ND	
GA:ATLANTA	04/03/91	1.42	0.11	ND		ND		ND	
HI:HONOLULU	04/11/91	1.78	0.24	ND		ND		ND	
IA:DES MOINES	04/09/91	1.63	0.14	ND		ND		ND	
ID:IDAHO FALLS	04/16/91	1.69	0.12	ND		ND		ND	
IL:CHICAGO	04/03/91	1.66	0.09	ND		ND		ND	
IN:INDIANAPOLIS	04/01/91	1.56	0.12	ND		ND		ND	
KY:LOUISVILLE	04/01/91	1.61	0.13	ND		ND		ND	
MA:BOSTON	04/10/91	1.57	0.18	ND		ND		ND	
MD:BALTIMORE	04/11/91	1.67	0.13	ND		ND		ND	
ME:PORTLAND	04/02/91	1.57	0.16	ND		ND		ND	
MI:DETROIT	04/11/91	1.56	0.14	ND		ND		ND	
MI:GRAND RAPIDS	04/08/91	1.76	0.12	ND		ND		ND	
MN:ST. PAUL	04/03/91	1.85	0.09	ND		ND		ND	
MO:KANSAS CITY	04/15/91	1.74	0.14	ND		ND		ND	
MO:ST. LOUIS	04/03/91	1.61	0.09	ND		ND		ND	
MS:JACKSON	04/03/91	1.63	0.12	ND		ND		ND	
MT:HELENA	04/29/91	1.50	0.10	ND		ND		ND	
NC:CHARLOTTE	04/30/91	1.88	0.14	ND		ND		ND	
ND:MINOT	04/01/91	1.62	0.16	ND		ND		ND	
NE:OMAHA	04/29/91	1.54	0.08	ND		ND		ND	
NH:MANCHESTER	04/08/91	1.32	0.10	ND		ND		ND	
NJ:TRENTON	04/03/91	1.55	0.08	ND		ND		ND	
NM:ALBUQUERQUE	04/09/91	1.60	0.08	ND		ND		ND	
NV:LAS VEGAS	04/30/91	1.69	0.12	ND		ND		ND	
NY:BUFFALO	04/01/91	1.61	0.12	ND		ND		ND	
NY:NEW YORK CITY	04/01/91	1.55	0.12	ND		ND		ND	
NY:SYRACUSE	04/02/91	1.58	0.17	ND		ND		ND	
OH:CINCINNATI	04/25/91	1.61	0.08	ND		ND		ND	

Table 11 (continued)
Radionuclides in Pasteurized Milk
April 1991

Location	Date Collected	K		¹³⁷ Cs		¹⁴⁰ Ba		¹³¹ I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
OH:CLEVELAND	04/23/91	1.63	0.08	ND		ND		ND	
OK:OKLAHOMA CITY	04/29/91	1.69	0.10	ND		ND		ND	
OR:PORTLAND	04/01/91	1.63	0.09	ND		ND		ND	
PA:PHILADELPHIA	04/08/91	1.72	0.14	ND		ND		ND	
PA:PITTSBURGH	04/10/91	1.61	0.12	ND		ND		ND	
PR:SAN JUAN	04/09/91	1.66	0.14	ND		ND		ND	
SC:CHARLESTON	04/18/91	1.68	0.09	ND		ND		ND	
SD:RAPID CITY	04/01/91	1.63	0.13	ND		ND		ND	
TN:KNOXVILLE	04/09/91	1.58	0.13	ND		ND		ND	
TN:MEMPHIS	04/29/91	1.73	0.09	ND		ND		ND	
TX:AUSTIN	04/18/91	1.39	0.14	ND		ND		ND	
TX:FT. WORTH	04/02/91	1.86	0.14	ND		ND		ND	
VA:NORFOLK	04/25/91	1.56	0.13	ND		ND		ND	
VT:BURLINGTON	04/15/91	1.48	0.18	ND		ND		ND	
WA:SEATTLE	04/01/91	1.64	0.14	ND		ND		ND	
WA:SPOKANE	04/05/91	1.60	0.08	ND		ND		ND	
WV:CHARLESTON	04/17/91	1.63	0.08	ND		ND		ND	

σ = Counting Error.

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

Table 12
Radionuclides in Pasteurized Milk
May 1991

Location	Date Collected	K		¹³⁷ Cs	¹⁴⁰ Ba	¹³¹ I
		g/l	±2σ	pCi/l ±2σ	pCi/l ±2σ	pCi/l ±2σ
AL:MONTGOMERY	05/09/91	1.42	0.10	ND	ND	ND
AR:LITTLE ROCK	05/06/91	1.51	0.08	ND	ND	ND
AZ:PHOENIX	05/09/91	1.56	0.11	ND	ND	ND
CA:LOS ANGELES	05/03/91	1.85	0.08	ND	ND	ND
CA:SACRAMENTO	05/01/91	1.60	0.14	ND	ND	ND
CA:SAN FRANCISCO	05/02/91	1.55	0.08	ND	ND	ND
CO:DENVER	05/20/91	1.61	0.08	ND	ND	ND
FL:TAMPA	05/28/91	1.66	0.09	ND	ND	ND
GA:ATLANTA	05/13/91	1.51	0.08	ND	ND	ND
HI:HONOLULU	05/21/91	1.71	0.08	ND	ND	ND
IA:DES MOINES	05/06/91	1.60	0.09	ND	ND	ND
ID:IDAHO FALLS	05/30/91	1.60	0.12	ND	ND	ND
IL:CHICAGO	05/01/91	1.66	0.14	ND	ND	ND
IN:INDIANAPOLIS	05/06/91	1.53	0.08	ND	ND	ND
KS:WICHITA	05/03/91	1.57	0.08	ND	ND	ND
KY:LOUISVILLE	05/06/91	1.54	0.08	ND	ND	ND
LA:NEW ORLEANS	05/21/91	1.57	0.08	ND	ND	ND
MA:BOSTON	05/08/91	1.55	0.16	ND	ND	ND
MD:BALTIMORE	05/09/91	1.66	0.08	ND	ND	ND
ME:PORTLAND	05/03/91	1.74	0.08	ND	ND	ND
MI:DETROIT	05/10/91	1.85	0.06	ND	ND	ND
MI:GRAND RAPIDS	05/06/91	1.64	0.08	ND	ND	ND
MN:ST. PAUL	05/01/91	1.54	0.14	ND	ND	ND
MO:KANSAS CITY	05/23/91	1.79	0.09	ND	ND	ND
MO:ST. LOUIS	05/08/91	1.58	0.12	ND	ND	ND
MT:HELENA	05/10/91	1.69	0.06	ND	ND	ND
NC:CHARLOTTE	05/23/91	1.62	0.07	ND	ND	ND
ND:MINOT	05/29/91	1.63	0.08	ND	ND	ND
NE:OMAHA	05/30/91	1.57	0.15	ND	ND	ND
NH:MANCHESTER	05/07/91	1.38	0.07	ND	ND	ND
NJ:TRENTON	05/08/91	1.69	0.14	ND	ND	ND
NM:ALBUQUERQUE	05/14/91	1.56	0.10	ND	ND	ND
NV:LAS VEGAS	05/16/91	1.66	0.11	ND	ND	ND
NY:BUFFALO	05/20/91	1.76	0.12	ND	ND	ND
NY:NEW YORK CITY	05/08/91	1.66	0.08	ND	ND	ND
NY:SYRACUSE	05/07/91	1.64	0.07	ND	ND	ND
OK:OKLAHOMA CITY	05/20/91	1.55	0.08	ND	ND	ND

Table 12 (continued)
Radionuclides in Pasteurized Milk
May 1991

Location	Date Collected	K		¹³⁷ Cs		¹⁴⁰ Ba		¹³¹ I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
OR:PORTLAND	05/06/91	1.64	0.08	ND		ND		ND	
PA:PHILADELPHIA	05/06/91	1.61	0.08	ND		ND		ND	
PA:PITTSBURGH	05/08/91	1.47	0.23	ND		ND		ND	
PC:CRISTOBAL	05/02/91	1.60	0.09	6	3	ND		ND	
PR:SAN JUAN	05/08/91	1.63	0.08	ND		ND		ND	
SC:CHARLESTON	05/23/91	1.68	0.14	ND		ND		ND	
TN:CHATTANOOGA	05/20/91	1.56	0.13	ND		ND		ND	
TN:KNOXVILLE	05/08/91	1.64	0.13	ND		ND		ND	
TN:MEMPHIS	05/13/91	1.54	0.10	ND		ND		ND	
TX:FT. WORTH	05/02/91	1.61	0.08	ND		ND		ND	
VA:NORFOLK	05/30/91	1.57	0.14	ND		ND		ND	
VT:BURLINGTON	05/21/91	1.57	0.08	ND		ND		ND	
WA:SEATTLE	05/04/91	1.92	0.13	ND		ND		ND	
WA:SPOKANE	05/06/91	1.61	0.08	ND		ND		ND	
WV:CHARLESTON	05/20/91	1.55	0.10	ND		ND		ND	

σ = Counting Error.

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

Table 13
Radionuclides in Pasteurized Milk
June 1991

Location	Date Collected	K		¹³⁷ Cs		¹⁴⁰ Ba		¹³¹ I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
AL:MONTGOMERY	06/07/91	1.53	0.18	ND		ND		ND	
AR:LITTLE ROCK	06/04/91	1.56	0.13	ND		ND		ND	
AZ:PHOENIX	06/06/91	1.41	0.14	ND		ND		ND	
CA:LOS ANGELES	06/03/91	1.60	0.15	ND		ND		ND	
CA:SACRAMENTO	06/03/91	1.76	0.19	ND		ND		ND	
CA:SAN FRANCISCO	06/06/91	1.86	0.12	ND		ND		ND	
CO:DENVER	06/20/91	1.69	0.12	ND		ND		ND	
DE:WILMINGTON	06/19/91	1.75	0.23	ND		ND		ND	
FL:TAMPA	06/18/91	1.78	0.14	ND		ND		ND	
GA:ATLANTA	06/10/91	1.55	0.12	ND		ND		ND	
HI:HONOLULU	06/17/91	1.62	0.14	ND		ND		ND	
IA:DES MOINES	06/04/91	1.64	0.12	ND		ND		ND	
ID:IDAHO FALLS	06/17/91	1.57	0.12	ND		ND		ND	
IL:CHICAGO	06/06/91	1.72	0.14	ND		ND		ND	
IN:INDIANAPOLIS	06/04/91	1.64	0.08	ND		ND		ND	
KS:WICHITA	06/18/91	1.80	0.13	ND		ND		ND	
KY:LOUISVILLE	06/04/91	1.76	0.24	ND		ND		ND	
LA:NEW ORLEANS	06/07/91	1.62	0.12	ND		ND		ND	
MA:BOSTON	06/05/91	1.63	0.14	ND		ND		ND	
MD:BALTIMORE	06/07/91	1.81	0.14	ND		ND		ND	
ME:PORTLAND	06/07/91	1.77	0.11	4	2	ND		ND	
MI:DETROIT	06/05/91	1.68	0.10	ND		ND		ND	
MI:GRAND RAPIDS	06/03/91	1.63	0.08	ND		ND		ND	
MN:ST. PAUL	06/05/91	1.80	0.13	ND		ND		ND	
MO:KANSAS CITY	06/17/91	1.49	0.12	ND		ND		ND	
MO:ST. LOUIS	06/10/91	1.63	0.12	ND		ND		ND	
MS:JACKSON	06/06/91	1.57	0.08	ND		ND		ND	
MT:HELENA	06/20/91	1.58	0.12	ND		ND		ND	
ND:MINOT	06/26/91	1.73	0.19	ND		ND		ND	
NE:OMAHA	06/26/91	1.78	0.14	ND		ND		ND	
NJ:TRENTON	06/04/91	1.50	0.13	ND		ND		ND	
NM:ALBUQUERQUE	06/24/91	1.57	0.08	ND		ND		ND	
NV:LAS VEGAS	06/28/91	1.70	0.10	ND		ND		ND	
NY:BUFFALO	06/26/91	1.63	0.09	ND		ND		ND	
NY:NEW YORK CITY	06/03/91	1.62	0.09	ND		ND		ND	
NY:SYRACUSE	06/02/91	1.55	0.22	ND		ND		ND	
OH:CINCINNATI	06/27/91	1.60	0.13	ND		ND		ND	

Table 13 (continued)
Radionuclides in Pasteurized Milk
June 1991

Location	Date Collected	K		¹³⁷ Cs		¹⁴⁰ Ba		¹³¹ I	
		g/l	±2σ	pCi/l	±2σ	pCi/l	±2σ	pCi/l	±2σ
OH:CLEVELAND	06/14/91	1.55	0.16	ND		ND		ND	
OR:PORTLAND	06/04/91	1.67	0.13	ND		ND		ND	
PA:PHILADELPHIA	06/03/91	1.59	0.10	ND		ND		ND	
PA:PITTSBURGH	06/03/91	1.62	0.14	ND		ND		ND	
PR:SAN JUAN	06/17/91	1.58	0.16	ND		ND		ND	
SC:CHARLESTON	06/19/91	1.49	0.16	ND		ND		ND	
SD:RAPID CITY	06/07/91	1.60	0.17	ND		ND		ND	
TN:CHATTANOOGA	06/10/91	1.62	0.10	ND		ND		ND	
TN:KNOXVILLE	06/05/91	1.53	0.13	ND		ND		ND	
TN:MEMPHIS	06/12/91	1.60	0.14	ND		ND		ND	
TX:AUSTIN	06/28/91	1.73	0.14	ND		ND		ND	
VA:NORFOLK	06/27/91	1.63	0.13	ND		ND		ND	
VT:BURLINGTON	06/07/91	1.59	0.13	ND		ND		ND	
WA:SPOKANE	06/07/91	1.61	0.09	ND		ND		ND	
WV:CHARLESTON	06/18/91	1.69	0.13	ND		ND		ND	
WY:RIVERTON	06/05/91	1.37	0.15	ND		ND		ND	

σ = Counting Error.

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

Table 14
Strontium-90 in Pasteurized Milk
EPA Regional Composites
April - June 1991

EPA Region	Collection Date	⁹⁰ Sr	
		pCi/l	±2σ
I	04/12/91	1.5	0.4
II	04/13/91	1.4	0.4
III	04/18/91	1.4	0.4
IV	04/18/91	0.8	0.3
V	04/15/91	1.4	0.4
VI	04/15/91	1.2	0.8
VII	04/15/91	1.2	0.3
VIII	04/25/91	1.4	1.0
IX	04/15/91	0.4	0.5
X	04/15/91	1.1	0.5

σ = Counting Error.

NA = Not Analyzed.

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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