United States
Environmental Protection Agency
Office of Radiation and Indoor Air

National Air and
Radiation Environmental Laboratory
540 South Morris Avenue
Montgomery, AL 36115-2601

EPA 402-R-93-093
August 1994

Radiation

EPA

# Environmental Radiation Data Report 74

## April-June 1993

# ENVIRONMENTAL RADIATION DATA

REPORT 74

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# 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 United States Environmental Protection Agency. 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 the *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).

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# Data Reporting Rationale

Frequently, there is little or no radioactivity in environmental media. Thus, the results of laboratory analyses should 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. From July 1975 to March 1991, ERAMS data were reported as calculated, whether the results were negative, zero, or positive. Since April 1991, negative results have been denoted as "not detectable," or "ND." For gamma analyses only, results less than the $2\sigma$ counting error are also denoted as "not detectable."

All data are stored in the NAREL sample database as generated, and these values are available for statistical evaluation. However, caution should be exercised in the use of the data in this report for statistical analysis, since the removal of negative numbers produces a positive bias in the distribution of results.

### Reported Error Terms

Each reported value for specific analyses will be accompanied by a counting error term at the $2\sigma$ (95%) confidence level. 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.

### Significant Figures

No more than three significant figures will be reported. A datum that contains more than three figures will be rounded off to three figures.

### Reporting Levels

The reporting units, smallest increments for reporting, and typical minimum detectable levels (MDL's) for each isotope are shown in Table 1. MDL is defined as the $3\sigma$ error of the background. Reporting increments are sometimes considerably smaller than MDL's to avoid truncation errors in averaging.

### Averages

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

# Table 1

## ERAMS Reporting Increments and Minimum Detectable Levels for Radionuclide Analyses

| Radionuclide | Media | Reporting Units | Reporting Increments | Minimum Detectable Levels |
|---|---|---|---|---|
| Gross Alpha | Water | pCi/L | 1 pCi/L | 2 pCi/L |
| † Gross Beta | Air | $pCi/m^3$ | 0.01 $pCi/m^3$ | 0.01 $pCi/m^3$ |
| | Water | pCi/L | 1 pCi/L | 1 pCi/L |
| | Precipitation | $nCi/m^2$ | 0.01 $nCi/m^2$ | 0.01 $nCi/m^2$ |
| | (specific radiochemical analyses) | | | |
| Tritium | Water | nCi/L | 0.1 nCi/L | 0.2 nCi/L |
| | Milk | nCi/L | 0.1 nCi/L | 0.2 nCi/L |
| Carbon-14 | Milk | pCi/L | 1 pCi/L | 15 pCi/L |
| Krypton-85 | Ambient Air | $pCi/m^3$ | 0.1 $pCi/m^3$ | 2 $pCi/m^3$ |
| †† Plutonium-238,239,240 | Air | $aCi/m^3$ | 0.1 $aCi/m^3$ | 0.015 pCi |
| | Milk | pCi/L | 0.001 pCi/L | 0.015 pCi |
| | Water | pCi/L | 0.001 pCi/L | 0.015 pCi |
| ‡ Uranium-234,235,238 | Air | $aCi/m^3$ | 0.1 $aCi/m^3$ | 0.015 pCi |
| | Milk | pCi/L | 0.001 pCi/L | 0.015 pCi |
| | Water | pCi/L | 0.001 pCi/L | 0.015 pCi |
| Radium-226 | Water | pCi/L | 0.1 pCi/L | 0.1 pCi/L |
| Strontium-90 | Milk | pCi/L | 0.1 pCi/L | 1 pCi/L |
| | Water | pCi/L | 0.1 pCi/L | 1 pCi/L |
| ‡‡ Strontium-89 | Milk | pCi/L | 1 pCi/L | 5 pCi/L |
| ‡‡ Iodine-131 | Milk | pCi/L | 1 pCi/L | 10 pCi/L |
| | Water | pCi/L | 1 pCi/L | 10 pCi/L |
| | Water | pCi/L | 0.1 pCi/L | 0.4 pCi/L |
| Iodine-129 | Milk | fCi/L | 0.1 fCi/L | 0.4 fCi/L |
| Cesium-137 | Milk | pCi/L | 1 pCi/L | 10 pCi/L |
| | Water | pCi/L | 1 pCi/L | 10 pCi/L |
| ‡‡ Barium-140 | Milk | pCi/L | 1 pCi/L | 10 pCi/L |
| | Water | pCi/L | 1 pCi/L | 10 pCi/L |
| Potassium | Milk | g/L | 0.1 g/L | 0.12 g/L |
| | Water | g/L | 0.1 g/L | 0.12 g/L |
| Potassium-40 | Water | pCi/L | 1 pCi/L | 100 pCi/L |

† The value of MDL for precipitation in terms of $nCi/m^2$ would be dependent on precipitation (mm).

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

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

‡‡ Activity as of the day of counting.

# 1. Air Program

## Airborne Particulates and Precipitation

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

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

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

The filters are sent to NAREL for more sensitive analyses in a low background beta counter. Gamma scans are performed on all filters showing gross beta counts greater than $1\,pCi/m^3$. The laboratory obtained values are usually lower than the field estimates due to the decay of naturally occurring radionuclides between the times of the two measurements.

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

A compilation of individual measurements is available from the National Air and Radiation Environmental Laboratory, 540 South Morris Avenue, Montgomery, AL 36115-2601.

Tables 2–4 contain the data from airborne particulate samples for April–June 1993. Tables 5–7 contain the data from precipitation samples for April–June 1993. Table 8 contains the data from tritium in precipitation samples for April–June 1993 at the selected sites.

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

# Table 2

## Gross Beta in Airborne Particulates

### April 1993

| Location | Number of Samples | 5-Hour Field Estimate (pCi/m$^3$) | | | NAREL Lab Measurement (pCi/m$^3$) | | |
|---|---|---|---|---|---|---|---|
| | | Max | Min | Avg | Max | Min | Avg |
| AK:Anchorage | 14 | 0.0 | 0.0 | 0.0 | 0.01 | 0.00 | 0.01 |
| AK:Fairbanks | 17 | 0.0 | 0.0 | 0.0 | 0.02 | 0.00 | 0.01 |
| AK:Juneau | 16 | 0.0 | 0.0 | 0.0 | 0.01 | 0.00 | 0.00 |
| AL:Montgomery | 9 | 0.1 | 0.0 | 0.1 | 0.02 | 0.00 | 0.01 |
| AR:Little Rock | 9 | 0.2 | 0.1 | 0.1 | 0.01 | 0.01 | 0.01 |
| AZ:Phoenix | 8 | 1.3 | 0.1 | 0.8 | 0.01 | 0.01 | 0.01 |
| CA:Berkeley | 9 | 0.1 | 0.0 | 0.0 | 0.01 | 0.00 | 0.00 |
| CA:Los Angeles | 9 | 0.3 | 0.1 | 0.1 | 0.01 | 0.01 | 0.01 |
| CO:Denver | 9 | 0.7 | 0.3 | 0.5 | 0.01 | 0.00 | 0.01 |
| CT:Hartford | 9 | 0.1 | 0.0 | 0.0 | 0.01 | 0.00 | 0.00 |
| DE:Wilmington | 9 | 0.1 | 0.0 | 0.0 | 0.01 | 0.00 | 0.01 |
| FL:Jacksonville | 7 | 0.1 | 0.0 | 0.1 | 0.01 | 0.01 | 0.01 |
| FL:Miami | 9 | 0.1 | 0.0 | 0.0 | 0.01 | 0.01 | 0.01 |
| HI:Honolulu | 8 | 0.2 | 0.1 | 0.1 | 0.01 | 0.00 | 0.00 |
| IA:Iowa City | 9 | 0.1 | 0.1 | 0.1 | 0.01 | 0.01 | 0.01 |
| ID:Boise | 9 | 0.4 | 0.1 | 0.2 | 0.01 | 0.00 | 0.01 |
| ID:Idaho Falls | 9 | 0.0 | 0.0 | 0.0 | 0.01 | 0.00 | 0.01 |
| IL:Chicago | 9 | 0.3 | 0.1 | 0.1 | 0.01 | 0.01 | 0.01 |
| IN:Indianapolis | 7 | 0.2 | 0.1 | 0.1 | 0.01 | 0.01 | 0.01 |
| KS:Topeka | 8 | 1.1 | 0.1 | 0.5 | 0.01 | 0.00 | 0.01 |
| KY:Frankfort | 2 | 0.2 | 0.0 | 0.1 | 0.01 | 0.01 | 0.01 |
| LA:New Orleans | 5 | 0.4 | 0.0 | 0.2 | 0.01 | 0.01 | 0.01 |
| MA:Lawrence | 9 | 0.1 | 0.0 | 0.1 | 0.01 | 0.00 | 0.01 |
| ME:Augusta | 8 | 0.2 | 0.0 | 0.1 | 0.01 | 0.00 | 0.01 |
| MI:Lansing | 9 | 0.1 | 0.0 | 0.1 | 0.01 | 0.01 | 0.01 |
| MN:Minneapolis | 4 | 0.1 | 0.1 | 0.1 | 0.02 | 0.01 | 0.01 |
| MO:Jefferson City | 9 | 0.4 | 0.1 | 0.2 | 0.02 | 0.00 | 0.01 |
| MS:Jackson | 9 | 0.2 | 0.0 | 0.1 | 0.01 | 0.01 | 0.01 |
| NC:Charlotte | 7 | 0.1 | 0.0 | 0.0 | 0.01 | 0.01 | 0.01 |
| NC:Wilmington | 6 | 0.0 | 0.0 | 0.0 | 0.01 | 0.01 | 0.01 |
| ND:Bismarck | 9 | 3.2 | 0.1 | 1.0 | 0.01 | 0.00 | 0.01 |
| NE:Lincoln | 4 | 0.5 | 0.1 | 0.3 | 0.01 | 0.01 | 0.01 |
| NH:Concord | 9 | 0.1 | 0.0 | 0.1 | 0.01 | 0.00 | 0.01 |
| NJ:Trenton | 9 | 0.3 | 0.1 | 0.2 | 0.01 | 0.00 | 0.01 |
| NM:Santa Fe | 9 | 0.5 | 0.1 | 0.3 | 0.01 | 0.01 | 0.01 |
| NV:Las Vegas | 9 | 0.3 | 0.1 | 0.2 | 0.02 | 0.01 | 0.01 |
| NY:Albany | 2 | 0.1 | 0.0 | 0.1 | 0.01 | 0.01 | 0.01 |

## Table 2 (continued)

# Gross Beta in Airborne Particulates

## April 1993

| Location | Number of Samples | 5-Hour Field Estimate (pCi/m$^3$) | | | NAREL Lab Measurement (pCi/m$^3$) | | |
|---|---|---|---|---|---|---|---|
| | | Max | Min | Avg | Max | Min | Avg |
| NY:Niagara Falls | 7 | 0.1 | 0.0 | 0.1 | 0.01 | 0.01 | 0.01 |
| NY:Syracuse | 3 | 0.0 | 0.0 | 0.0 | 0.01 | 0.00 | 0.00 |
| NY:Yaphank | 8 | 0.1 | 0.0 | 0.1 | 0.01 | 0.00 | 0.01 |
| OH:Columbus | 7 | 0.2 | 0.0 | 0.1 | 0.01 | 0.00 | 0.01 |
| OH:Painesville | 9 | 0.2 | 0.0 | 0.1 | 0.01 | 0.01 | 0.01 |
| OH:Ross | 9 | 0.0 | 0.0 | 0.0 | 0.01 | 0.01 | 0.01 |
| OH:Toledo | 9 | 0.3 | 0.1 | 0.2 | 0.02 | 0.01 | 0.01 |
| OR:Portland | 23 | 0.4 | 0.0 | 0.0 | 0.01 | 0.00 | 0.00 |
| PA:Harrisburg | 9 | 0.3 | 0.0 | 0.2 | 0.01 | 0.00 | 0.01 |
| SC:Barnwell | 2 | 0.0 | 0.0 | 0.0 | 0.01 | 0.01 | 0.01 |
| SC:Columbia | 8 | 0.4 | 0.1 | 0.2 | 0.03 | 0.01 | 0.01 |
| SD:Pierre | 8 | 0.5 | 0.1 | 0.3 | 0.01 | 0.01 | 0.01 |
| TN:Knoxville | 9 | 0.9 | 0.1 | 0.4 | 0.02 | 0.01 | 0.01 |
| TN:Nashville | 9 | 0.4 | 0.0 | 0.2 | 0.01 | 0.01 | 0.01 |
| TX:Austin | 9 | 0.2 | 0.0 | 0.1 | 0.01 | 0.00 | 0.01 |
| TX:El Paso | 9 | 0.9 | 0.0 | 0.6 | 0.02 | 0.01 | 0.01 |
| UT:Salt Lake City | 8 | 0.4 | 0.0 | 0.2 | 0.01 | 0.00 | 0.01 |
| VA:Lynchburg | 9 | 0.3 | 0.1 | 0.2 | 0.01 | 0.01 | 0.01 |
| VA:Virginia Beach | 3 | 0.1 | 0.1 | 0.1 | 0.01 | 0.01 | 0.01 |
| WA:Olympia | 15 | 0.2 | 0.0 | 0.1 | 0.01 | 0.00 | 0.00 |
| WA:Spokane | 18 | 0.4 | 0.1 | 0.2 | 0.11 | 0.00 | 0.03 |
| WI:Madison | 9 | 0.2 | 0.0 | 0.1 | 0.01 | 0.01 | 0.01 |

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

# Table 3

## Gross Beta in Airborne Particulates

### May 1993

| Location | Number of Samples | 5-Hour Field Estimate (pCi/m$^3$) | | | NAREL Lab Measurement (pCi/m$^3$) | | |
|---|---|---|---|---|---|---|---|
| | | Max | Min | Avg | Max | Min | Avg |
| AK:Anchorage | 1 | 0.0 | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 |
| AK:Fairbanks | 28 | 0.0 | 0.0 | 0.0 | 0.01 | 0.00 | 0.00 |
| AK:Juneau | 6 | 0.0 | 0.0 | 0.0 | 0.01 | 0.00 | 0.00 |
| AL:Montgomery | 8 | 0.5 | 0.1 | 0.2 | 0.03 | 0.01 | 0.02 |
| AR:Little Rock | 6 | 0.5 | 0.1 | 0.2 | 0.02 | 0.01 | 0.01 |
| AZ:Phoenix | 8 | 1.4 | 0.3 | 0.8 | 0.02 | 0.01 | 0.01 |
| CA:Berkeley | 8 | 0.1 | 0.0 | 0.0 | 0.02 | 0.00 | 0.01 |
| CA:Los Angeles | 8 | 0.4 | 0.0 | 0.1 | 0.02 | 0.01 | 0.01 |
| CO:Denver | 6 | 2.5 | 0.1 | 0.9 | 0.01 | 0.01 | 0.01 |
| CT:Hartford | 8 | 0.1 | 0.0 | 0.1 | 0.01 | 0.00 | 0.01 |
| DE:Wilmington | 8 | 0.4 | 0.1 | 0.2 | 0.01 | 0.01 | 0.01 |
| FL:Jacksonville | 6 | 0.1 | 0.0 | 0.0 | 0.01 | 0.01 | 0.01 |
| FL:Miami | 8 | 0.1 | 0.0 | 0.0 | 0.01 | 0.01 | 0.01 |
| HI:Honolulu | 6 | 0.2 | 0.1 | 0.1 | 0.02 | 0.00 | 0.01 |
| IA:Iowa City | 8 | 0.3 | 0.1 | 0.1 | 0.01 | 0.01 | 0.01 |
| ID:Boise | 8 | 0.4 | 0.2 | 0.3 | 0.02 | 0.00 | 0.01 |
| ID:Idaho Falls | 8 | 0.0 | 0.0 | 0.0 | 0.02 | 0.00 | 0.01 |
| IL:Chicago | 6 | 0.4 | 0.1 | 0.2 | 0.01 | 0.01 | 0.01 |
| IN:Indianapolis | 7 | 0.3 | 0.1 | 0.2 | 0.02 | 0.01 | 0.01 |
| KS:Topeka | 7 | 0.6 | 0.1 | 0.3 | 0.02 | 0.01 | 0.01 |
| KY:Frankfort | 3 | 0.3 | 0.1 | 0.2 | 0.01 | 0.01 | 0.01 |
| LA:New Orleans | 7 | 0.2 | 0.1 | 0.1 | 0.01 | 0.01 | 0.01 |
| MA:Lawrence | 8 | 0.2 | 0.0 | 0.1 | 0.01 | 0.00 | 0.01 |
| ME:Augusta | 7 | 0.2 | 0.0 | 0.1 | 0.01 | 0.00 | 0.00 |
| MI:Lansing | 8 | 0.2 | 0.1 | 0.1 | 0.01 | 0.00 | 0.01 |
| MN:Minneapolis | 4 | 0.1 | 0.0 | 0.1 | 0.01 | 0.01 | 0.01 |
| MO:Jefferson City | 7 | 0.3 | 0.1 | 0.2 | 0.02 | 0.01 | 0.01 |
| MS:Jackson | 8 | 0.4 | 0.1 | 0.2 | 0.01 | 0.00 | 0.01 |
| NC:Charlotte | 7 | 0.2 | 0.0 | 0.1 | 0.02 | 0.01 | 0.01 |
| NC:Wilmington | 6 | 0.0 | 0.0 | 0.0 | 0.02 | 0.00 | 0.01 |
| ND:Bismarck | 7 | 1.7 | 0.2 | 0.9 | 0.01 | 0.01 | 0.01 |
| NE:Lincoln | 1 | 0.0 | 0.0 | 0.0 | 0.01 | 0.01 | 0.01 |
| NH:Concord | 8 | 0.1 | 0.0 | 0.1 | 0.01 | 0.00 | 0.00 |
| NJ:Trenton | 8 | 0.8 | 0.1 | 0.4 | 0.01 | 0.00 | 0.01 |
| NM:Santa Fe | 6 | 0.3 | 0.1 | 0.2 | 0.01 | 0.00 | 0.01 |
| NV:Las Vegas | 8 | 0.2 | 0.1 | 0.2 | 0.04 | 0.01 | 0.01 |
| NY:Albany | 4 | 0.1 | 0.0 | 0.1 | 0.01 | 0.01 | 0.01 |

# Table 3 (continued)

## Gross Beta in Airborne Particulates

### May 1993

| Location | Number of Samples | 5-Hour Field Estimate (pCi/m$^3$) | | | NAREL Lab Measurement (pCi/m$^3$) | | |
|---|---|---|---|---|---|---|---|
| | | Max | Min | Avg | Max | Min | Avg |
| NY:Niagara Falls | 8 | 0.3 | 0.1 | 0.2 | 0.01 | 0.00 | 0.01 |
| NY:Syracuse | 2 | 0.0 | 0.0 | 0.0 | 0.01 | 0.01 | 0.01 |
| NY:Yaphank | 8 | 0.2 | 0.0 | 0.1 | 0.01 | 0.00 | 0.01 |
| OH:Columbus | 4 | 0.1 | 0.1 | 0.1 | 0.01 | 0.00 | 0.01 |
| OH:Painesville | 8 | 0.3 | 0.1 | 0.2 | 0.01 | 0.01 | 0.01 |
| OH:Ross | 8 | 0.0 | 0.0 | 0.0 | 0.02 | 0.01 | 0.01 |
| OH:Toledo | 7 | 0.3 | 0.0 | 0.2 | 0.01 | 0.00 | 0.01 |
| OR:Portland | 7 | 0.0 | 0.0 | 0.0 | 0.02 | 0.00 | 0.01 |
| PA:Harrisburg | 8 | 0.4 | 0.0 | 0.2 | 0.01 | 0.01 | 0.01 |
| SC:Barnwell | 2 | 0.1 | 0.0 | 0.1 | 0.01 | 0.01 | 0.01 |
| SC:Columbia | 8 | 0.5 | 0.1 | 0.2 | 0.01 | 0.01 | 0.01 |
| SD:Pierre | 7 | 0.8 | 0.2 | 0.5 | 0.02 | 0.00 | 0.01 |
| TN:Knoxville | 4 | 0.8 | 0.3 | 0.5 | 0.02 | 0.01 | 0.01 |
| TN:Nashville | 8 | 0.3 | 0.1 | 0.2 | 0.02 | 0.01 | 0.01 |
| TX:Austin | 8 | 0.2 | 0.0 | 0.1 | 0.02 | 0.01 | 0.01 |
| TX:El Paso | 8 | 0.8 | 0.5 | 0.6 | 0.03 | 0.01 | 0.01 |
| UT:Salt Lake City | 8 | 0.4 | 0.0 | 0.2 | 0.03 | 0.00 | 0.01 |
| VA:Lynchburg | 9 | 1.0 | 0.2 | 0.6 | 0.02 | 0.00 | 0.01 |
| WA:Olympia | 8 | 0.1 | 0.0 | 0.1 | 0.01 | 0.00 | 0.00 |
| WA:Spokane | 8 | 0.3 | 0.0 | 0.2 | 0.02 | 0.00 | 0.01 |
| WI:Madison | 8 | 0.4 | 0.1 | 0.2 | 0.01 | 0.01 | 0.01 |

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

# Table 4

## Gross Beta in Airborne Particulates

### June 1993

| Location | Number of Samples | 5-Hour Field Estimate (pCi/m$^3$) | | | NAREL Lab Measurement (pCi/m$^3$) | | |
|---|---|---|---|---|---|---|---|
| | | Max | Min | Avg | Max | Min | Avg |
| AK:Fairbanks | 11 | 0.0 | 0.0 | 0.0 | 0.02 | 0.00 | 0.01 |
| AK:Juneau | 9 | 0.0 | 0.0 | 0.0 | 0.01 | 0.00 | 0.00 |
| AL:Montgomery | 8 | 0.4 | 0.1 | 0.3 | 0.03 | 0.01 | 0.02 |
| AR:Little Rock | 7 | 0.2 | 0.1 | 0.2 | 0.01 | 0.01 | 0.01 |
| AZ:Phoenix | 7 | 0.9 | 0.4 | 0.6 | 0.02 | 0.01 | 0.01 |
| CA:Berkeley | 9 | 0.1 | 0.0 | 0.1 | 0.00 | 0.00 | 0.00 |
| CA:Los Angeles | 9 | 0.1 | 0.0 | 0.1 | 0.01 | 0.00 | 0.01 |
| CO:Denver | 9 | 0.7 | 0.3 | 0.5 | 0.01 | 0.00 | 0.01 |
| CT:Hartford | 9 | 0.1 | 0.0 | 0.1 | 0.01 | 0.00 | 0.01 |
| DE:Wilmington | 10 | 0.4 | 0.0 | 0.2 | 0.01 | 0.01 | 0.01 |
| FL:Jacksonville | 8 | 0.1 | 0.0 | 0.1 | 0.02 | 0.00 | 0.01 |
| FL:Miami | 9 | 0.0 | 0.0 | 0.0 | 0.01 | 0.00 | 0.01 |
| HI:Honolulu | 6 | 0.2 | 0.1 | 0.2 | 0.00 | 0.00 | 0.00 |
| IA:Iowa City | 9 | 0.2 | 0.0 | 0.1 | 0.01 | 0.00 | 0.01 |
| ID:Boise | 9 | 0.4 | 0.2 | 0.3 | 0.01 | 0.00 | 0.01 |
| ID:Idaho Falls | 9 | 0.0 | 0.0 | 0.0 | 0.01 | 0.00 | 0.01 |
| IL:Chicago | 8 | 0.6 | 0.1 | 0.3 | 0.01 | 0.01 | 0.01 |
| IN:Indianapolis | 8 | 0.2 | 0.1 | 0.2 | 0.01 | 0.01 | 0.01 |
| KS:Topeka | 7 | 1.0 | 0.3 | 0.6 | 0.01 | 0.01 | 0.01 |
| KY:Frankfort | 5 | 0.2 | 0.1 | 0.2 | 0.01 | 0.01 | 0.01 |
| LA:New Orleans | 7 | 0.2 | 0.1 | 0.1 | 0.01 | 0.01 | 0.01 |
| MA:Lawrence | 8 | 0.2 | 0.0 | 0.1 | 0.01 | 0.00 | 0.01 |
| ME:Augusta | 8 | 0.2 | 0.0 | 0.1 | 0.01 | 0.00 | 0.01 |
| MI:Lansing | 9 | 0.4 | 0.0 | 0.1 | 0.01 | 0.00 | 0.01 |
| MN:Minneapolis | 5 | 0.1 | 0.0 | 0.1 | 0.01 | 0.01 | 0.01 |
| MO:Jefferson City | 9 | 0.8 | 0.2 | 0.4 | 0.01 | 0.01 | 0.01 |
| MS:Jackson | 9 | 0.3 | 0.1 | 0.2 | 0.02 | 0.01 | 0.01 |
| NC:Charlotte | 9 | 0.2 | 0.1 | 0.1 | 0.02 | 0.01 | 0.01 |
| NC:Wilmington | 4 | 0.0 | 0.0 | 0.0 | 0.01 | 0.01 | 0.01 |
| ND:Bismarck | 6 | 0.0 | 0.0 | 0.0 | 0.01 | 0.00 | 0.01 |
| NE:Lincoln | 4 | 0.5 | 0.1 | 0.3 | 0.01 | 0.01 | 0.01 |
| NH:Concord | 9 | 0.2 | 0.0 | 0.1 | 0.01 | 0.00 | 0.01 |
| NJ:Trenton | 9 | 0.7 | 0.2 | 0.5 | 0.01 | 0.00 | 0.01 |
| NM:Santa Fe | 6 | 0.7 | 0.1 | 0.4 | 0.01 | 0.00 | 0.01 |
| NV:Las Vegas | 9 | 0.2 | 0.0 | 0.1 | 0.03 | 0.01 | 0.01 |
| NY:Albany | 5 | 0.1 | 0.0 | 0.0 | 0.01 | 0.00 | 0.01 |
| NY:Niagara Falls | 9 | 0.4 | 0.1 | 0.1 | 0.01 | 0.00 | 0.01 |

## Table 4 (continued)

# Gross Beta in Airborne Particulates

## June 1993

| Location | Number of Samples | 5-Hour Field Estimate (pCi/m$^3$) | | | NAREL Lab Measurement (pCi/m$^3$) | | |
|---|---|---|---|---|---|---|---|
| | | Max | Min | Avg | Max | Min | Avg |
| NY:Syracuse | 3 | 0.1 | 0.0 | 0.0 | 0.01 | 0.00 | 0.01 |
| NY:Yaphank | 9 | 0.2 | 0.1 | 0.1 | 0.01 | 0.00 | 0.01 |
| OH:Columbus | 1 | 0.0 | 0.0 | 0.0 | 0.01 | 0.01 | 0.01 |
| OH:Painesville | 9 | 0.3 | 0.1 | 0.2 | 0.01 | 0.00 | 0.01 |
| OH:Ross | 9 | 0.0 | 0.0 | 0.0 | 0.02 | 0.01 | 0.01 |
| OH:Toledo | 7 | 0.5 | 0.1 | 0.3 | 0.01 | 0.00 | 0.01 |
| OR:Portland | 8 | 0.0 | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 |
| PA:Harrisburg | 9 | 0.4 | 0.0 | 0.2 | 0.01 | 0.01 | 0.01 |
| SC:Barnwell | 2 | 0.0 | 0.0 | 0.0 | 0.01 | 0.01 | 0.01 |
| SC:Columbia | 9 | 0.3 | 0.1 | 0.2 | 0.02 | 0.01 | 0.01 |
| SD:Pierre | 8 | 0.4 | 0.2 | 0.3 | 0.01 | 0.00 | 0.01 |
| TN:Knoxville | 5 | 0.6 | 0.1 | 0.4 | 0.02 | 0.01 | 0.02 |
| TN:Nashville | 9 | 0.4 | 0.1 | 0.2 | 0.02 | 0.01 | 0.01 |
| TX:Austin | 9 | 0.1 | 0.0 | 0.1 | 0.01 | 0.00 | 0.01 |
| TX:El Paso | 9 | 1.1 | 0.4 | 0.6 | 0.02 | 0.01 | 0.01 |
| UT:Salt Lake City | 8 | 0.4 | 0.1 | 0.2 | 0.01 | 0.01 | 0.01 |
| VA:Lynchburg | 8 | 0.9 | 0.2 | 0.6 | 0.01 | 0.01 | 0.01 |
| VA:Virginia Beach | 2 | 0.0 | 0.0 | 0.0 | 0.01 | 0.01 | 0.01 |
| WA:Olympia | 9 | 0.1 | 0.0 | 0.0 | 0.01 | 0.00 | 0.00 |
| WA:Spokane | 9 | 0.4 | 0.1 | 0.2 | 0.01 | 0.00 | 0.01 |
| WI:Madison | 9 | 0.3 | 0.1 | 0.2 | 0.01 | 0.00 | 0.01 |

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

# Table 5

## Gross Beta and Specific Gamma in Precipitation*

### April 1993

| Location | Depth (mm) | Gross Beta Activity nCi/m$^2$ | $\pm 2\sigma$ | Specific Gamma Activity pCi/L $\pm 2\sigma$ |
|---|---|---|---|---|
| AK:Anchorage | 2.4 | 0.01 | 0.00 | ND |
| AK:Fairbanks | 4.0 | 0.00 | 0.00 | ND |
| AK:Juneau | 8.0 | 0.02 | 0.00 | $^{7}$Be: 64.0±15.0 |
| AK:Juneau | 35.0 | 0.04 | 0.01 | ND |
| AL:Montgomery | 51.0 | 0.18 | 0.02 | $^{7}$Be: 69.4±54.9 |
| AR:Little Rock | 149.0 | 0.16 | 0.05 | $^{7}$Be: 79.7±50.8 |
| CA:Berkeley | 10.4 | 0.01 | 0.00 | ND |
| | | | | ND |
| CO:Denver | 26.0 | 0.09 | 0.01 | $^{7}$Be: 55.7±41.4 |
| CT:Hartford | 85.0 | 0.21 | 0.03 | ND |
| DE:Wilmington | 136.0 | 0.41 | 0.06 | ND |
| FL:Jacksonville | 46.4 | 0.02 | 0.01 | ND |
| FL:Miami | 62.4 | 0.03 | 0.02 | ND |
| ID:Boise | 32.0 | 0.03 | 0.01 | ND |
| ID:Idaho Falls | 38.2 | 0.08 | 0.01 | ND |
| IL:Chicago | 146.8 | 0.21 | 0.05 | ND |
| LA:New Orleans | 124.0 | 0.13 | 0.04 | ND |
| ME:Augusta | 43.0 | 0.11 | 0.02 | $^{7}$Be: 43.6±41.2 |
| MI:Lansing | 103.4 | 0.40 | 0.05 | $^{7}$Be: 77.3±43.3 |
| MN:Minneapolis | 80.0 | 0.10 | 0.03 | ND |
| MO:Jefferson City | 111.0 | 0.65 | 0.06 | $^{7}$Be: 93.2±50.8 |
| NC:Charlotte | 109.0 | 0.19 | 0.04 | ND |
| NC:Wilmington | 71.0 | 0.17 | 0.03 | ND |
| ND:Bismarck | 21.6 | 0.06 | 0.01 | ND |
| NH:Concord | 46.6 | 0.11 | 0.02 | $^{7}$Be: 51.5±38.7 |
| | | | | $^{7}$Be: 51.5±38.7 |
| NJ:Trenton | 85.8 | 0.37 | 0.04 | $^{7}$Be: 64.7±32.5 |
| NM:Santa Fe | 14.0 | 0.01 | 0.00 | ND |
| NY:Albany | 53.6 | 0.08 | 0.02 | ND |
| NY:Niagara Falls | 79.0 | 0.04 | 0.02 | ND |
| NY:Yaphank | 136.0 | 0.28 | 0.05 | ND |
| OH:Painesville | 75.4 | 0.20 | 0.03 | $^{7}$Be: 58.5±50.6 |
| OH:Toledo | 86.0 | 0.16 | 0.03 | $^{212}$Pb: 7.0±5.3 |
| OR:Portland | 4.8 | 0.02 | 0.00 | $^{7}$Be: 44.7±14.5 |
| OR:Portland | 2.6 | 0.00 | 0.00 | $^{214}$Pb: 8.3±6.0 |
| OR:Portland | 5.0 | 0.02 | 0.00 | $^{7}$Be: 107±34 |
| OR:Portland | 2.0 | 0.00 | 0.00 | ND |
| OR:Portland | 10.0 | 0.01 | 0.00 | $^{7}$Be: 20.3±15.1 |
| | | | | $^{7}$Be: 34.8±13.8 |
| OR:Portland | 92.2 | 0.10 | 0.03 | ND |

## Table 5 (continued)

# Gross Beta and Specific Gamma in Precipitation*

## April 1993

| Location | Depth (mm) | Gross Beta Activity nCi/m$^2$ | ±2σ | Specific Gamma Activity pCi/L ±2σ |
|---|---|---|---|---|
| OR:Portland | 12.0 | 0.01 | 0.00 | $^{7}$Be: 30.4±25.2 |
| PA:Harrisburg | 176.4 | 0.43 | 0.07 | ND |
| SC:Barnwell | 88.8 | 0.06 | 0.03 | $^{214}$Pb: 8.7±6.2<br>$^{214}$Bi: 19.4±6.8 |
| SC:Columbia | 74.0 | 0.11 | 0.02 | $^{7}$Be: 56.6±40.0 |
| TN:Knoxville | 98.0 | 0.08 | 0.03 | $^{7}$Be: 69.0±53.7 |
| TN:Nashville | 81.4 | 0.08 | 0.02 | $^{7}$Be: 50.8±36.2 |
| TX:Austin | 96.0 | 0.15 | 0.03 | ND |
| UT:Salt Lake City | 25.8 | 0.05 | 0.01 | ND |
| VA:Lynchburg | 124.0 | 0.05 | 0.03 | ND |
| WA:Olympia | 19.0 | 0.01 | 0.00 | $^{7}$Be: 13.9±13.5 |
| WA:Olympia | 25.0 | 0.02 | 0.01 | $^{7}$Be: 30.9±12.8 |
| WA:Olympia | 2.0 | 0.00 | 0.00 | $^{7}$Be: 0.1±0.0 |
| WA:Olympia | 8.0 | 0.02 | 0.00 | $^{7}$Be: 46.7±15.8 |
| WA:Olympia | 10.0 | 0.02 | 0.00 | ND |
| WA:Olympia | 60.0 | 0.04 | 0.02 | $^{7}$Be: 23.6±15.7 |
| WA:Olympia | 187.0 | 0.25 | 0.06 | ND |
| WA:Olympia | 5.0 | 0.00 | 0.00 | $^{7}$Be: 18.1±12.9 |
| WI:Madison | 157.6 | 0.20 | 0.06 | ND |

Note: $\sigma$ = Counting Error. ND = Not Detectable.

* The multiple results shown for stations in Portland, Oregon, and Olympia, Washington, are due to increased sampling to monitor possible depositions resulting from the explosion of a tank containing uranium on April 6, 1994, at the Tomsk reprocessing facility in the former Soviet Union. For four weeks following the Tomsk incident, ERAMS air stations took daily samples and precipitation stations took samples as precipitation events occurred.

# Table 6

## Gross Beta and Specific Gamma in Precipitation

### May 1993

| Location | Depth (mm) | Gross Beta Activity $nCi/m^2$ | $\pm 2\sigma$ | Specific Gamma Activity $pCi/L$ | $\pm 2\sigma$ |
|---|---|---|---|---|---|
| AK:Anchorage | 14.4 | 0.02 | 0.00 | ND | |
| AK:Juneau | 24.0 | 0.09 | 0.01 | ND | |
| AL:Montgomery | 64.0 | 0.13 | 0.02 | $^{7}$Be: | 88.6±44.8 |
| AR:Little Rock | 89.0 | 0.13 | 0.03 | $^{7}$Be: | 52.8±45.5 |
| AZ:Phoenix | 2.0 | 0.01 | 0.00 | ND | |
| CA:Berkeley | 12.6 | 0.01 | 0.00 | ND | |
| CO:Denver | 8.4 | 0.02 | 0.00 | $^{7}$Be: | 52.3±44.0 |
| CT:Hartford | 2.0 | 0.00 | 0.00 | $^{7}$Be: | 91.8±54.6 |
| DE:Wilmington | 34.0 | 0.09 | 0.01 | $^{7}$Be: | 61.0±42.0 |
| | | | | $^{7}$Be: | 51.9±39.6 |
| FL:Jacksonville | 4.2 | 0.03 | 0.00 | ND | |
| FL:Miami | 4.2 | 0.02 | 0.00 | ND | |
| HI:Honolulu | 49.0 | 0.10 | 0.02 | ND | |
| ID:Boise | 24.0 | 0.02 | 0.01 | ND | |
| ID:Idaho Falls | 37.0 | 0.03 | 0.01 | ND | |
| IL:Chicago | 36.2 | 0.04 | 0.01 | ND | |
| LA:New Orleans | 119.0 | 0.13 | 0.04 | ND | |
| ME:Augusta | 25.0 | 0.12 | 0.01 | $^{7}$Be: | 155±47 |
| MI:Lansing | 36.6 | 0.07 | 0.01 | ND | |
| MN:Minneapolis | 85.0 | 0.07 | 0.02 | $^{7}$Be: | 49.1±37.9 |
| MO:Jefferson City | 37.0 | 0.08 | 0.01 | ND | |
| NC:Charlotte | 58.0 | 0.13 | 0.02 | ND | |
| NC:Wilmington | 41.0 | 0.09 | 0.02 | ND | |
| ND:Bismarck | 58.8 | 0.23 | 0.03 | ND | |
| NH:Concord | 6.8 | 0.02 | 0.00 | $^{7}$Be: | 78.1±45.7 |
| NJ:Trenton | 21.0 | 0.12 | 0.01 | $^{7}$Be: | 84.0±50.1 |
| NM:Santa Fe | 23.0 | 0.03 | 0.01 | ND | |
| NY:Albany | 8.4 | 0.02 | 0.00 | $^{7}$Be: | 372±65 |
| NY:Niagara Falls | 20.0 | 0.03 | 0.01 | ND | |
| NY:Yaphank | 8.0 | 0.02 | 0.00 | $^{7}$Be: | 66.0±35.7 |
| OH:Painesville | 13.4 | 0.02 | 0.00 | ND | |
| OH:Toledo | 20.0 | 0.03 | 0.01 | ND | |
| OR:Portland | 66.8 | 0.07 | 0.02 | ND | |
| PA:Harrisburg | 44.0 | 0.09 | 0.02 | ND | |
| SC:Barnwell | 51.8 | 0.30 | 0.03 | ND | |
| SC:Columbia | 27.2 | 0.06 | 0.01 | ND | |
| TN:Knoxville | 69.0 | 0.09 | 0.02 | ND | |
| TN:Nashville | 71.0 | 0.14 | 0.03 | $^{7}$Be: | 112±50 |
| TX:Austin | 90.0 | 0.10 | 0.03 | ND | |
| UT:Salt Lake City | 80.2 | 0.12 | 0.03 | ND | |

## Table 6 (continued)

# Gross Beta and Specific Gamma in Precipitation

## May 1993

| Location | Depth (mm) | Gross Beta Activity $nCi/m^2$ | $\pm 2\sigma$ | Specific Gamma Activity $pCi/L$ | $\pm 2\sigma$ |
|---|---|---|---|---|---|
| VA:Lynchburg | 47.6 | 0.13 | 0.02 | ND | |
| WA:Olympia | 65.0 | 0.04 | 0.02 | ND | |
| WI:Madison | 65.0 | 0.08 | 0.02 | ND | |

Note: $\sigma$ = Counting Error. ND = Not Detectable.

# Table 7

## Gross Beta and Specific Gamma in Precipitation

### June 1993

| Location | Depth (mm) | Gross Beta Activity $nCi/m^2$ | $\pm 2\sigma$ | Specific Gamma Activity pCi/L | $\pm 2\sigma$ |
|---|---|---|---|---|---|
| AK:Fairbanks | 23.0 | 0.04 | 0.01 | $^{7}$Be: 79.2 | 50.1 |
| AK:Juneau | 136.0 | 0.09 | 0.04 | ND | |
| AL:Montgomery | 72.0 | 0.07 | 0.02 | ND | |
| AR:Little Rock | 66.0 | 0.07 | 0.02 | ND | |
| CA:Berkeley | 10.0 | 0.01 | 0.00 | ND | |
| CO:Denver | 31.0 | 0.07 | 0.01 | $^{7}$Be: 36.1 | 33.1 |
| CT:Hartford | 48.0 | 0.12 | 0.02 | $^{7}$Be: 71.4 | 28.9 |
| DE:Wilmington | 106.0 | 0.22 | 0.04 | $^{7}$Be: 51.6 | 31.5 |
| FL:Jacksonville | 139.8 | 0.06 | 0.04 | ND | |
| FL:Miami | 98.0 | 0.03 | 0.03 | ND | |
| ID:Boise | 42.0 | 0.03 | 0.01 | ND | |
| ID:Idaho Falls | 57.6 | 0.06 | 0.02 | ND | |
| IL:Chicago | 84.8 | 0.05 | 0.02 | $^{7}$Be: 29.3 | 27.8 |
| LA:New Orleans | 185.0 | 0.37 | 0.07 | $^{7}$Be: 59.5 | 33.4 |
| ME:Augusta | 98.0 | 0.38 | 0.05 | $^{7}$Be: 71.9 | 29.6 |
| MI:Lansing | 146.6 | 0.15 | 0.04 | $^{7}$Be: 47.4 | 39.1 |
| MN:Minneapolis | 156.0 | 0.14 | 0.05 | ND | |
| MO:Jefferson City | 119.0 | 0.21 | 0.04 | ND | |
| NC:Charlotte | 21.0 | 0.10 | 0.01 | $^{7}$Be: 130 | 64 |
| NC:Wilmington | 51.0 | 0.11 | 0.02 | $^{7}$Be: 31.0 | 24.9 |
| ND:Bismarck | 119.0 | 0.11 | 0.03 | ND | |
| NH:Concord | 41.4 | 0.16 | 0.02 | $^{7}$Be: 67.9 | 36.6 |
| NJ:Trenton | 72.6 | 0.20 | 0.03 | $^{7}$Be: 94.1 | 54.5 |
| NY:Albany | 56.4 | 0.28 | 0.03 | $^{7}$Be: 90.5 | 33.0 |
| NY:Niagara Falls | 120.0 | 0.20 | 0.04 | ND | |
| NY:Syracuse | 40.0 | 0.05 | 0.01 | ND | |
| NY:Yaphank | 24.0 | 0.11 | 0.01 | ND | |
| OH:Painesville | 137.8 | 0.18 | 0.05 | $^{7}$Be: 35.9 | 35.5 |
| OH:Toledo | 90.0 | 0.22 | 0.04 | ND | |
| OR:Portland | 38.4 | 0.02 | 0.01 | ND | |
| PA:Harrisburg | 84.8 | 0.28 | 0.04 | $^{7}$Be: 50.3 | 36.5 |
| SC:Barnwell | 54.4 | 0.08 | 0.02 | ND | |
| SC:Columbia | 12.4 | 0.05 | 0.01 | $^{7}$Be: 135 | 50 |
| TN:Knoxville | 80.0 | 0.30 | 0.04 | $^{7}$Be: 115 | 38 |
| TN:Nashville | 157.4 | 0.28 | 0.06 | ND | |
| TX:Austin | 90.0 | 0.04 | 0.02 | ND | |
| TX:El Paso | 23.0 | 0.03 | 0.01 | ND | |
| UT:Salt Lake City | 15.8 | 0.04 | 0.01 | ND | |
| VA:Lynchburg | 28.6 | 0.60 | 0.03 | ND | |
| WA:Olympia | 106.0 | 0.07 | 0.03 | ND | |
| WI:Madison | 154.8 | 0.14 | 0.05 | ND | |

# Table 8

## Tritium in Precipitation

### April–June 1993

| Location | April 1993 nCi/L | ±2σ | May 1993 nCi/L | ±2σ | June 1993 nCi/L | ±2σ |
|---|---|---|---|---|---|---|
| AK:Anchorage | 0.3 | 0.2 | 0.1 | 0.1 | NS | |
| AK:Fairbanks | NA | | NS | | 0.3 | 0.2 |
| AK:Juneau | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 |
| AL:Montgomery | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.1 |
| AR:Little Rock | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 |
| AZ:Phoenix | NS | | 0.1 | 0.1 | NS | |
| CA:Berkeley | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 |
| CO:Denver | 0.3 | 0.2 | 0.1 | 0.1 | 0.1 | 0.2 |
| CT:Hartford | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.2 |
| DE:Wilmington | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| FL:Jacksonville | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 0.2 |
| FL:Miami | 0.2 | 0.1 | 0.1 | 0.2 | 0.1 | 0.2 |
| HI:Honolulu | NS | | 0.1 | 0.1 | NS | |
| ID:Boise | 0.1 | 0.2 | 0.1 | 0.2 | 0.1 | 0.2 |
| ID:Idaho Falls | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 |
| IL:Chicago | 0.1 | 0.2 | 0.1 | 0.2 | 0.1 | 0.2 |
| LA:New Orleans | 0.1 | 0.2 | 0.1 | 0.2 | 0.3 | 0.2 |
| ME:Augusta | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 |
| MI:Lansing | 0.1 | 0.2 | 0.1 | 0.2 | 0.3 | 0.2 |
| MN:Minneapolis | 0.3 | 0.2 | 0.1 | 0.2 | 0.2 | 0.1 |
| MO:Jefferson City | 0.2 | 0.2 | 0.1 | 0.2 | 0.2 | 0.1 |
| NC:Charlotte | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 |
| NC:Wilmington | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 |
| ND:Bismarck | 0.1 | 0.2 | 0.1 | 0.2 | 0.2 | 0.1 |
| NH:Concord | 0.1 | 0.2 | 0.1 | 0.1 | 0.2 | 0.3 |
| NJ:Trenton | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 |
| NM:Santa Fe | 0.2 | 0.2 | 0.1 | 0.2 | NS | |
| NY:Albany | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.2 |
| NY:Niagara Falls | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 |
| NY:Syracuse | NS | | NS | | 0.1 | 0.2 |
| NY:Yaphank | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 |
| OH:Painesville | 0.1 | 0.2 | 0.1 | 0.1 | 0.2 | 0.1 |
| OH:Toledo | 0.1 | 0.2 | 0.1 | 0.2 | 0.2 | 0.1 |
| OR:Portland | 0.1 | 0.2 | 0.1 | 0.1 | 0.3 | 0.2 |
| PA:Harrisburg | 0.1 | 0.1 | 0.2 | 0.2 | 0.1 | 0.1 |
| SC:Barnwell | 0.6 | 0.2 | 0.3 | 0.2 | 0.1 | 0.2 |
| SC:Columbia | 0.2 | 0.1 | 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 | 0.1 | 0.1 | 0.2 | 0.1 | 0.2 |
| TX:Austin | 0.2 | 0.2 | 0.1 | 0.2 | 0.2 | 0.1 |
| TX:El Paso | NS | | NS | | 0.2 | 0.1 |

## Table 8 (continued)

# Tritium in Precipitation

## April–June 1993

| Location | April 1993 nCi/L | ±2σ | May 1993 nCi/L | ±2σ | June 1993 nCi/L | ±2σ |
|---|---|---|---|---|---|---|
| UT:Salt Lake City | 0.2 | 0.2 | 0.1 | 0.2 | 0.3 | 0.2 |
| VA:Lynchburg | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| WA:Olympia | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| WI:Madison | 0.1 | 0.2 | 0.1 | 0.1 | 0.3 | 0.1 |

Note: $\sigma$ = Counting Error. NS = No Sample. NA = No Analysis.

## Plutonium and Uranium in Airborne Particulates and Precipitation

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

Concentrations 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 60,000 to 250,000 cubic meters.

Plutonium and uranium results are published when they become available.

Table 9 contains the plutonium and uranium results for the period January–June 1993. Table 10 contains the plutonium and uranium in precipitation data for January–June 1993. Values are based upon composites of the March, April, and May samples. Samples from these three months only are analyzed annually because, due to the spring rains, they usually contain the year's highest concentrations of plutonium and uranium.

# Table 9

## Plutonium and Uranium In Airborne Particulates

### January–June 1993 Composites

| Location | $^{238}Pu$ | | $^{239-240}Pu$ | | $^{234}U$ | | $^{235}U$ | | $^{238}U$ | |
|---|---|---|---|---|---|---|---|---|---|---|
| | aCi/m$^3$ | $\pm 2\sigma$ | aCi/m$^3$ | $\pm 2\sigma$ | aCi/m$^3$ | $\pm 2\sigma$ | aCi/m$^3$ | $\pm 2\sigma$ | aCi/m$^3$ | $\pm 2\sigma$ |
| AK:Anchorage | 0.6 | 0.7 | ND | | 11.9 | 2.2 | 0.7 | 0.5 | 9.1 | 1.9 |
| AK:Fairbanks | 0.9 | 1.3 | 1.9 | 1.4 | 21.4 | 4.7 | 2.2 | 1.4 | 15.3 | 3.9 |
| AK:Juneau | 0.5 | 0.5 | 0.4 | 0.3 | 12.7 | 1.8 | 0.7 | 0.4 | 10.9 | 1.7 |
| AL:Montgomery | ND | | 0.7 | 0.5 | 24.6 | 3.3 | 0.4 | 0.4 | 19.3 | 2.9 |
| AR:Little Rock | 0.4 | 0.5 | 0.2 | 0.4 | 34.2 | 4.6 | 2.0 | 1.0 | 26.7 | 4.0 |
| AZ:Phoenix | 1.3 | 1.5 | 0.2 | 1.0 | 51.4 | 7.7 | 1.8 | 1.3 | 41.4 | 6.9 |
| CA:Berkeley | 0.1 | 0.2 | 0.1 | 0.1 | 9.2 | 1.3 | 1.1 | 0.4 | 6.9 | 1.1 |
| CA:Los Angeles | 0.3 | 0.5 | ND | | 29.8 | 3.6 | 1.8 | 0.8 | 20.4 | 2.9 |
| CO:Denver | 0.4 | 0.9 | ND | | 43.2 | 4.7 | 2.0 | 0.9 | 40.1 | 4.4 |
| CT:Hartford | 0.4 | 0.5 | 0.1 | 0.3 | 17.8 | 2.7 | 0.7 | 0.5 | 15.6 | 2.5 |
| DE:Wilmington | 0.7 | 0.6 | 0.2 | 0.5 | 17.8 | 2.4 | 1.5 | 0.7 | 15.2 | 2.2 |
| FL:Jacksonville | 0.3 | 0.3 | ND | | 18.8 | 2.2 | 0.6 | 0.4 | 13.8 | 1.8 |
| FL:Miami | 0.2 | 0.4 | 2.4 | 0.9 | 29.3 | 3.7 | 2.5 | 1.0 | 22.1 | 3.1 |
| HI:Honolulu | 0.1 | 0.3 | 0.3 | 0.3 | 6.9 | 1.3 | 0.3 | 0.3 | 5.6 | 1.2 |
| IA:Iowa City | 0.2 | 0.5 | 0.3 | 0.5 | 17.7 | 2.6 | 0.8 | 0.5 | 13.3 | 2.2 |
| ID:Boise | 0.2 | 0.6 | 0.4 | 0.5 | 24.2 | 3.2 | 1.8 | 0.8 | 21.9 | 3.0 |
| ID:Idaho Falls | 0.1 | 0.6 | 0.9 | 0.6 | 13.8 | 2.6 | 1.2 | 0.7 | 12.9 | 2.5 |
| IL:Chicago | 0.8 | 0.6 | 0.2 | 0.4 | 25.1 | 4.1 | 2.2 | 1.2 | 22.6 | 3.9 |
| IN:Indianapolis | 0.7 | 0.6 | 0.3 | 0.4 | 33.5 | 4.4 | 2.0 | 1.0 | 35.4 | 4.5 |
| KS:Topeka | 0.4 | 0.3 | 0.1 | 0.2 | 31.6 | 2.9 | 1.4 | 0.5 | 29.6 | 2.8 |
| KY:Frankfort | ND | | 0.3 | 0.2 | 14.8 | 1.6 | 0.8 | 0.3 | 14.1 | 1.5 |
| LA:New Orleans | 0.1 | 0.2 | 0.1 | 0.2 | 17.2 | 2.6 | 1.1 | 0.6 | 17.7 | 2.6 |
| MA:Lawrence | 0.1 | 0.5 | 0.2 | 0.3 | 22.4 | 3.4 | 1.2 | 0.8 | 20.2 | 3.2 |
| ME:Augusta | 0.8 | 0.9 | 0.7 | 0.7 | 40.4 | 6.8 | 1.3 | 1.2 | 40.1 | 6.7 |
| MI:Lansing | 0.7 | 0.3 | 0.1 | 0.1 | 9.7 | 1.2 | 0.4 | 0.2 | 9.6 | 1.2 |
| MN:Minneapolis | 0.1 | 0.3 | ND | | 20.4 | 2.8 | 1.4 | 0.7 | 17.1 | 2.5 |
| MO:Jefferson City | 0.1 | 0.3 | 0.3 | 0.2 | 13.7 | 1.7 | 0.9 | 0.4 | 12.3 | 1.6 |
| MS:Jackson | 0.3 | 0.5 | 0.6 | 0.4 | 17.0 | 2.4 | 0.5 | 0.4 | 13.6 | 2.2 |
| NC:Charlotte | 0.6 | 0.6 | 0.3 | 0.4 | 31.7 | 4.0 | 1.4 | 0.8 | 25.1 | 3.5 |
| NC:Wilmington | 0.2 | 0.3 | 0.2 | 0.2 | 14.5 | 1.9 | 0.6 | 0.4 | 13.6 | 1.8 |
| ND:Bismarck | 0.4 | 0.5 | 0.1 | 0.2 | 21.6 | 3.0 | 0.9 | 0.6 | 18.5 | 2.7 |
| NE:Lincoln | 0.3 | 0.4 | ND | | 19.1 | 2.6 | 0.9 | 0.7 | 16.6 | 2.4 |
| NH:Concord | 0.1 | 0.2 | 0.1 | 0.1 | 15.5 | 1.8 | 0.7 | 0.4 | 14.6 | 1.7 |
| NJ:Trenton | 0.6 | 0.4 | 0.1 | 0.2 | 9.3 | 1.3 | 0.5 | 0.3 | 9.4 | 1.3 |
| NM:Santa Fe | 0.1 | 0.7 | 0.9 | 0.7 | 28.5 | 3.8 | 1.2 | 0.7 | 24.1 | 3.5 |
| NV:Las Vegas | 0.8 | 1.4 | 1.5 | 1.1 | 161 | 17 | 5.7 | 2.6 | 98.1 | 12.4 |
| NY:Albany | 1.0 | 0.9 | 0.5 | 0.6 | 27.3 | 3.6 | 1.5 | 0.8 | 26.1 | 3.5 |

## Table 9 (continued)

# Plutonium and Uranium In Airborne Particulates

### January–June 1993 Composites

| Location | $^{238}Pu$ aCi/m$^3$ | $\pm 2\sigma$ | $^{239-240}Pu$ aCi/m$^3$ | $\pm 2\sigma$ | $^{234}U$ aCi/m$^3$ | $\pm 2\sigma$ | $^{235}U$ aCi/m$^3$ | $\pm 2\sigma$ | $^{238}U$ aCi/m$^3$ | $\pm 2\sigma$ |
|---|---|---|---|---|---|---|---|---|---|---|
| NY:Niagara Falls | 1.8 | 1.0 | 0.2 | 0.4 | 42.5 | 4.3 | 4.5 | 1.3 | 40.2 | 4.2 |
| NY:Syracuse | 0.6 | 0.4 | 0.1 | 0.1 | 13.0 | 1.9 | 0.7 | 0.4 | 10.8 | 1.7 |
| NY:Yaphank | ND | | 0.2 | 0.3 | 16.8 | 2.6 | 0.9 | 0.6 | 13.3 | 2.3 |
| OH:Columbus | 0.1 | 0.2 | ND | | 17.1 | 1.9 | 0.5 | 0.3 | 15.3 | 1.8 |
| OH:Painesville | 0.5 | 0.7 | 0.5 | 0.5 | 18.2 | 2.5 | 0.7 | 0.5 | 16.6 | 2.4 |
| OH:Ross | 0.9 | 1.0 | 0.6 | 0.7 | 56.5 | 8.4 | 3.5 | 1.9 | 55.7 | 8.3 |
| OH:Toledo | 0.4 | 0.4 | 0.3 | 0.3 | 25.1 | 3.0 | 0.8 | 0.5 | 24.4 | 2.9 |
| OR:Portland | ND | | 0.3 | 0.3 | 16.2 | 2.8 | 0.8 | 0.6 | 14.0 | 2.6 |
| PA:Harrisburg | 0.1 | 0.3 | 0.1 | 0.2 | 11.8 | 1.4 | 0.7 | 0.3 | 11.4 | 1.4 |
| RI:Providence | 0.8 | 0.6 | 0.2 | 0.4 | 25.3 | 4.0 | 2.0 | 1.1 | 21.1 | 3.6 |
| SC:Barnwell | 0.2 | 0.3 | 0.6 | 0.3 | 16.8 | 1.8 | 1.1 | 0.4 | 20.4 | 2.1 |
| SC:Columbia | 0.5 | 0.7 | 2.4 | 1.0 | 41.2 | 4.8 | 1.7 | 0.9 | 37.4 | 4.6 |
| SD:Pierre | 0.3 | 0.3 | 0.2 | 0.2 | 13.7 | 1.7 | 0.9 | 0.4 | 12.1 | 1.6 |
| TN:Knoxville | 0.3 | 0.4 | 0.1 | 0.2 | 19.9 | 2.5 | 1.2 | 0.6 | 17.3 | 2.3 |
| TN:Nashville | 0.4 | 0.7 | 0.3 | 0.4 | 26.2 | 3.5 | 2.4 | 1.0 | 24.1 | 3.3 |
| TX:Austin | 0.4 | 0.4 | 0.1 | 0.2 | 11.6 | 1.9 | 0.4 | 0.4 | 9.8 | 1.7 |
| TX:El Paso | 0.2 | 1.1 | ND | | 77.2 | 11.2 | 1.7 | 1.5 | 65.4 | 10.1 |
| UT:Salt Lake City | ND | | 0.4 | 0.4 | 24.6 | 3.4 | 0.9 | 0.6 | 20.2 | 3.1 |
| VA:Lynchburg | 0.3 | 0.3 | 0.2 | 0.2 | 89.3 | 5.9 | 2.8 | 0.7 | 12.1 | 1.5 |
| VA:Virginia Beach | 0.2 | 0.2 | 0.1 | 0.1 | 13.5 | 1.6 | 0.7 | 0.3 | 10.8 | 1.4 |
| WA:Olympia | 0.2 | 0.3 | 0.3 | 0.2 | 6.6 | 1.2 | 0.4 | 0.3 | 5.1 | 1.0 |
| WA:Spokane | 0.2 | 0.6 | 0.6 | 0.5 | 25.3 | 3.0 | 1.4 | 0.6 | 21.0 | 2.7 |
| WI:Madison | 0.3 | 0.5 | 0.2 | 0.4 | 20.8 | 3.2 | 0.9 | 0.6 | 20.1 | 3.1 |

Note: $\sigma$ = Counting Error. ND = Not Detectable.

# Table 10

## Plutonium and Uranium Analyses
## Selected Precipitation Composite Samples

### January–June 1993

| Location | $^{238}Pu$ | | $^{239-240}Pu$ | | $^{234}U$ | | $^{235}U$ | | $^{238}U$ | |
|---|---|---|---|---|---|---|---|---|---|---|
| | pCi/L | $\pm 2\sigma$ | pCi/L | $\pm 2\sigma$ | pCi/L | $\pm 2\sigma$ | pCi/L | $\pm 2\sigma$ | pCi/L | $\pm 2\sigma$ |
| AK:Anchorage | 0.003 | 0.006 | 0.002 | 0.005 | 0.073 | 0.024 | ND | | 0.047 | 0.020 |
| AK:Juneau | 0.010 | 0.009 | 0.028 | 0.013 | 0.086 | 0.024 | 0.008 | 0.012 | 0.026 | 0.020 |
| AL:Montgomery | ND | | ND | | 0.061 | 0.018 | 0.005 | 0.005 | 0.028 | 0.012 |
| AR:Little Rock | 0.009 | 0.009 | ND | | 0.083 | 0.021 | 0.001 | 0.004 | 0.032 | 0.013 |
| AZ:Phoenix | 0.004 | 0.006 | 0.018 | 0.010 | 0.007 | 0.006 | 0.004 | 0.004 | 0.009 | 0.007 |
| CA:Berkeley | 0.003 | 0.004 | 0.003 | 0.004 | 0.097 | 0.023 | 0.002 | 0.004 | 0.043 | 0.015 |
| CO:Denver | 0.003 | 0.006 | 0.002 | 0.004 | 0.085 | 0.022 | 0.008 | 0.007 | 0.028 | 0.014 |
| CT:Hartford | 0.013 | 0.013 | ND | | 0.022 | 0.010 | 0.005 | 0.005 | 0.007 | 0.006 |
| DE:Wilmington | 0.013 | 0.010 | 0.004 | 0.005 | 0.080 | 0.027 | 0.004 | 0.006 | 0.047 | 0.021 |
| FL:Jacksonville | 0.001 | 0.007 | 0.002 | 0.006 | 0.098 | 0.026 | 0.007 | 0.007 | 0.023 | 0.013 |
| FL:Miami | 0.010 | 0.007 | ND | | 0.063 | 0.023 | 0.010 | 0.009 | 0.032 | 0.015 |
| HI:Honolulu | 0.002 | 0.008 | ND | | 0.047 | 0.016 | 0.006 | 0.006 | 0.033 | 0.014 |
| ID:Boise | 0.011 | 0.008 | 0.013 | 0.008 | 0.054 | 0.018 | 0.004 | 0.005 | 0.038 | 0.015 |
| ID:Idaho Falls | 0.021 | 0.016 | ND | | 0.079 | 0.022 | 0.005 | 0.009 | 0.014 | 0.013 |
| IL:Chicago | 0.005 | 0.008 | 0.018 | 0.009 | 0.056 | 0.018 | 0.007 | 0.007 | 0.043 | 0.016 |
| LA:New Orleans | 0.009 | 0.009 | 0.005 | 0.006 | 0.053 | 0.016 | 0.004 | 0.004 | 0.036 | 0.014 |
| ME:Augusta | 0.006 | 0.008 | 0.000 | 0.002 | 0.071 | 0.021 | 0.003 | 0.004 | 0.034 | 0.015 |
| MI:Lansing | 0.008 | 0.010 | 0.006 | 0.007 | 0.076 | 0.022 | 0.002 | 0.005 | 0.037 | 0.015 |
| MN:Minneapolis | 0.005 | 0.007 | 0.002 | 0.003 | 0.057 | 0.018 | 0.002 | 0.004 | 0.046 | 0.016 |
| MO:Jefferson City | 0.007 | 0.007 | 0.001 | 0.002 | 0.063 | 0.017 | 0.002 | 0.003 | 0.032 | 0.012 |
| MS:Jackson | 0.007 | 0.006 | ND | | 0.064 | 0.020 | 0.006 | 0.006 | 0.030 | 0.014 |
| NC:Charlotte | 0.004 | 0.008 | 0.001 | 0.003 | 0.071 | 0.023 | 0.001 | 0.004 | 0.029 | 0.014 |
| NC:Wilmington | 0.009 | 0.009 | 0.018 | 0.009 | 0.049 | 0.022 | 0.001 | 0.004 | 0.032 | 0.016 |
| ND:Bismarck | 0.003 | 0.008 | ND | | 0.065 | 0.019 | 0.003 | 0.005 | 0.033 | 0.014 |
| NH:Concord | 0.012 | 0.010 | ND | | 0.058 | 0.018 | 0.004 | 0.005 | 0.014 | 0.010 |
| NJ:Trenton | 0.007 | 0.009 | ND | | 0.063 | 0.020 | 0.003 | 0.004 | 0.016 | 0.010 |
| NM:Santa Fe | 0.007 | 0.007 | 0.007 | 0.007 | 0.086 | 0.021 | 0.003 | 0.004 | 0.042 | 0.014 |
| NV:Las Vegas | 0.013 | 0.010 | 0.003 | 0.004 | 0.079 | 0.030 | 0.015 | 0.013 | 0.029 | 0.018 |
| NY:Albany | 0.013 | 0.008 | 0.004 | 0.004 | 0.068 | 0.020 | 0.007 | 0.006 | 0.033 | 0.014 |
| NY:Niagara Falls | 0.013 | 0.009 | 0.001 | 0.003 | 0.083 | 0.024 | 0.011 | 0.009 | 0.038 | 0.016 |
| NY:Yaphank | 0.030 | 0.015 | 0.008 | 0.008 | 0.010 | 0.007 | 0.002 | 0.003 | 0.006 | 0.006 |
| OH:Painesville | 0.004 | 0.006 | 0.000 | 0.004 | 0.066 | 0.019 | 0.005 | 0.006 | 0.027 | 0.012 |
| OH:Toledo | 0.002 | 0.008 | 0.000 | 0.006 | 0.092 | 0.023 | 0.003 | 0.005 | 0.023 | 0.012 |
| OR:Portland | 0.007 | 0.009 | 0.003 | 0.006 | 0.038 | 0.014 | ND | | 0.022 | 0.011 |
| PA:Harrisburg | 0.012 | 0.011 | 0.003 | 0.005 | 0.070 | 0.023 | 0.002 | 0.010 | 0.056 | 0.024 |
| SC:Barnwell | 0.005 | 0.007 | 0.002 | 0.003 | 0.042 | 0.016 | 0.003 | 0.004 | 0.029 | 0.014 |
| SC:Columbia | 0.011 | 0.014 | ND | | 0.061 | 0.019 | 0.004 | 0.005 | 0.036 | 0.015 |

## Table 10 (continued)

# Plutonium and Uranium Analyses
# Selected Precipitation Composite Samples

## January–June 1993

| Location | $^{238}Pu$ | | $^{239-240}Pu$ | | $^{234}U$ | | $^{235}U$ | | $^{238}U$ | |
|---|---|---|---|---|---|---|---|---|---|---|
| | pCi/L | $\pm 2\sigma$ | pCi/L | $\pm 2\sigma$ | pCi/L | $\pm 2\sigma$ | pCi/L | $\pm 2\sigma$ | pCi/L | $\pm 2\sigma$ |
| TN:Knoxville | 0.002 | 0.006 | 0.002 | 0.003 | 0.063 | 0.019 | 0.003 | 0.004 | 0.034 | 0.014 |
| TN:Nashville | 0.009 | 0.008 | 0.001 | 0.002 | 0.055 | 0.019 | 0.009 | 0.007 | 0.027 | 0.013 |
| TX:Austin | 0.017 | 0.012 | 0.030 | 0.013 | 0.067 | 0.018 | 0.002 | 0.003 | 0.024 | 0.011 |
| UT:Salt Lake City | 0.002 | 0.004 | 0.006 | 0.006 | 0.085 | 0.026 | 0.006 | 0.006 | 0.037 | 0.017 |
| VA:Lynchburg | 0.009 | 0.009 | 0.014 | 0.008 | 0.068 | 0.024 | 0.007 | 0.009 | 0.042 | 0.019 |
| WA:Olympia | 0.003 | 0.006 | 0.000 | 0.001 | 0.077 | 0.024 | ND | | 0.031 | 0.015 |
| WI:Madison | 0.009 | 0.011 | 0.030 | 0.014 | 0.008 | 0.006 | ND | | 0.006 | 0.007 |

Note: $\sigma$ = Counting Error. ND = Not Detectable.

## 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.*

# 2. 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 11 contains the tritium concentration data for April–June 1993.

# Table 11

## Tritium in Surface Water

### April–June 1993

| Location | Source | Date Collected | $^3H$ nCi/L | $\pm 2\sigma$ |
|---|---|---|---|---|
| AL:Decatur | Tennessee River | 04/01/93 | 0.1 | 0.2 |
| AL:Dothan | Chattahoochee River | 04/06/93 | 0.1 | 0.2 |
| AL:Scottsboro | Tennessee River | 04/01/93 | 0.1 | 0.2 |
| AR:Little Rock | Arkansas River | 04/12/93 | 0.1 | 0.2 |
| CA:Clay Station | Folsom S. Canal | 04/07/93 | 0.1 | 0.2 |
| CA:Diablo Canyon | Pacific Ocean | 06/28/93 | 0.2 | 0.2 |
| CA:Eureka | Humboldt Bay | 04/01/93 | 0.1 | 0.2 |
| CA:San Onofre | Pacific Ocean | 06/22/93 | 0.1 | 0.1 |
| CO:Platteville | South Platte River | 04/08/93 | 0.1 | 0.2 |
| FL:Crystal River | Gulf Of Mexico | 04/07/93 | 0.1 | 0.2 |
| FL:Ft. Pierce | Atlantic Ocean | 04/22/93 | 0.1 | 0.2 |
| FL:Homestead | Biscayne Bay | 04/19/93 | 0.1 | 0.2 |
| IA:Cedar Rapids | Cedar River | 04/27/93 | 0.1 | 0.2 |
| ID:Buhl | Snake River | 04/22/93 | 0.1 | 0.2 |
| IL:E. Moline | Mississippi River | 04/06/93 | 0.1 | 0.2 |
| IL:Morris | Illinois River | 05/20/93 | 0.2 | 0.1 |
| IL:Zion | Lake Michigan | 06/30/93 | 0.1 | 0.1 |
| KS:Leroy | Neosho River | 06/29/93 | 0.1 | 0.1 |
| LA:New Orleans | Mississippi River | 05/31/93 | 0.2 | 0.2 |
| MA:Plymouth | Cape Cod Bay | 04/15/93 | 0.1 | 0.2 |
| MD:Conowingo | Susquehanna River | 04/05/93 | 0.2 | 0.2 |
| ME:Wiscasset | Montseway Bay | 05/13/93 | 0.1 | 0.1 |
| MN:Monticello | Mississippi River | 05/13/93 | 0.1 | 0.2 |
| MN:Red Wing | Mississippi River | 04/21/93 | 0.1 | 0.2 |
| MS:Port Gibson | Mississippi River | 04/06/93 | 0.1 | 0.2 |
| NC:Charlotte | Catawba River | 04/15/93 | 0.3 | 0.2 |
| NC:Southport | Atlantic Ocean | 04/01/93 | 0.1 | 0.2 |
| NE:Rulo | Missouri River | 04/22/93 | 0.1 | 0.2 |
| NJ:Bayside | Delaware River | 04/13/93 | 0.1 | 0.2 |
| NJ:Oyster Creek | Oyster Creek | 04/22/93 | 0.1 | 0.2 |
| NY:Chelsea | Hudson River | 04/02/93 | 0.1 | 0.2 |
| NY:Ossining | Hudson River | 04/29/93 | 0.2 | 0.2 |
| NY:Oswego | Lake Ontario | 06/24/93 | 0.3 | 0.2 |
| OH:Toledo | Lake Erie | 04/06/93 | 0.1 | 0.2 |
| OR:Bradwood | Columbia River | 04/28/93 | 0.1 | 0.2 |
| PA:Danville | Susquehanna River | 04/07/93 | 0.2 | 0.2 |
| PA:Philadelphia | Delaware River | 04/15/93 | 0.1 | 0.2 |

## Table 11 (continued)

# Tritium in Surface Water

## April–June 1993

| Location | Source | Date Collected | $^3H$ nCi/L | $\pm 2\sigma$ |
|---|---|---|---|---|
| PA:Philadelphia | Schuylkill R.-Belmont | 04/14/93 | 0.1 | 0.2 |
| PA:Philadelphia | Schuylkill R.-Queen | 04/14/93 | 0.2 | 0.2 |
| SC:Allendale | Savannah River | 04/30/93 | 0.8 | 0.2 |
| SC:Broad River | Broad River | 04/23/93 | 0.1 | 0.2 |
| SC:Hartsville | Lake Robinson | 04/19/93 | 0.1 | 0.2 |
| TN:Kingston | Clinch River | 04/28/93 | 2.0 | 0.2 |
| TN:Oak Ridge | Clinch River | 05/03/93 | 0.1 | 0.2 |
| TX:El Paso | Rio Grande | 04/02/93 | 0.1 | 0.2 |
| TX:Matagorda | Colorado River | 04/08/93 | 0.2 | 0.2 |
| VA:Doswell | North Anna River | 04/07/93 | 2.4 | 0.2 |
| VA:Newport News | James River | 04/15/93 | 0.2 | 0.2 |
| VT:Vernon | Connecticut River | 04/09/93 | 0.1 | 0.2 |
| WI:Victory | Mississippi River | 04/06/93 | 0.2 | 0.2 |
| WV:Wheeling | Ohio River | 04/01/93 | 0.1 | 0.2 |

Note: $\sigma$ = Counting Error.

## Drinking Water

This program monitors ambient radiation levels in drinking water at 78 sites. These data serve to assess trends and anomalies in concentrations, and to compare with standards set forth in the EPA "National Interim Primary Drinking Water Regulations." These regulations provide for approval of supplies when the combined radium-226 and radium-228 levels do not exceed 5 pCi/L, when the gross alpha (excluding radon and uranium) levels do not exceed 15 pCi/L, when tritium levels do not exceed 20,000 pCi/L, when the strontium-90 levels do not exceed 8 pCi/L, and when the gross beta levels do not exceed 50 pCi/L.

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

The analyses include (a) tritium on a quarterly basis; (b) gross alpha, gross beta, strontium-90, and gamma on annual composites; (c) radium-226 if the gross alpha exceeds 2 pCi/L and radium-228 if the radium-226 falls between 3 and 5 pCi/L; (d) specific iodine-131 on one quarterly sample per year for each station; and (e) an annual composite for plutonium-238, -239, and -240 and uranium-234, -235, and -238 for stations that demonstrate gross alpha levels greater than 2 pCi/L.

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

Table 12 contains the data from drinking water samples for April–June 1993.

# Table 12

## Tritium in Drinking Water

### April–June 1993

| Location | Date Collected | $^3H$ nCi/L | $\pm 2\sigma$ |
|---|---|---|---|
| AK:Fairbanks | 04/06/93 | 0.1 | 0.2 |
| AL:Dothan | 04/01/93 | 0.1 | 0.2 |
| AL:Muscle Shoals | 04/01/93 | 0.1 | 0.2 |
| AL:Scottsboro | 04/01/93 | 0.2 | 0.2 |
| AR:Little Rock | 04/12/93 | 0.2 | 0.2 |
| CA:Berkeley | 06/24/93 | 0.1 | 0.2 |
| CA:Los Angeles | 04/01/93 | 0.1 | 0.2 |
| CO:Denver | 04/06/93 | 0.1 | 0.2 |
| CO:Platteville | 04/08/93 | 0.1 | 0.2 |
| DC:Washington | 04/08/93 | 0.1 | 0.2 |
| DE:Dover | 04/05/93 | 0.1 | 0.2 |
| FL:Miami | 04/02/93 | 0.2 | 0.2 |
| FL:Tampa | 04/26/93 | 0.2 | 0.2 |
| GA:Savannah | 06/11/93 | 0.2 | 0.2 |
| HI:Honolulu | 04/02/93 | 0.1 | 0.2 |
| IA:Cedar Rapids | 04/27/93 | 0.1 | 0.2 |
| ID:Idaho Falls | 04/12/93 | 0.2 | 0.2 |
| IL:W. Chicago | 04/02/93 | 0.1 | 0.2 |
| KS:Topeka | 04/01/93 | 0.1 | 0.2 |
| MA:Lawrence | 04/01/93 | 0.1 | 0.2 |
| MD:Baltimore | 04/01/93 | 0.1 | 0.2 |
| MD:Conowingo | 04/05/93 | 0.2 | 0.2 |
| ME:Augusta | 04/15/93 | 0.3 | 0.2 |
| MI:Grand Rapids | 04/02/93 | 0.1 | 0.2 |
| MN:Minneapolis | 05/18/93 | 0.2 | 0.2 |
| MN:Red Wing | 04/21/93 | 0.1 | 0.2 |
| MO:Jefferson City | 06/30/93 | 0.1 | 0.2 |
| MS:Jackson | 04/06/93 | 0.2 | 0.2 |
| MS:Port Gibson | 04/06/93 | 0.1 | 0.2 |
| NC:Charlotte | 04/15/93 | 0.0 | 3.0 |
| NC:Wilmington | 04/01/93 | 0.1 | 0.2 |
| ND:Bismarck | 04/01/93 | 0.1 | 0.2 |
| NH:Concord | 06/30/93 | 0.1 | 0.2 |
| NJ:Trenton | 04/02/93 | 0.3 | 0.2 |
| NJ:Waretown | 04/22/93 | 0.1 | 0.2 |
| NV:Las Vegas | 04/02/93 | 0.2 | 0.2 |
| NY:New York City | 04/07/93 | 0.1 | 0.2 |
| NY:Niagara Falls | 05/10/93 | 0.3 | 0.2 |
| NY:Syracuse | 06/29/93 | 0.2 | 0.1 |
| OH:Cincinnati | 04/22/93 | 0.1 | 0.2 |
| OH:Columbus | 04/05/93 | 0.2 | 0.2 |

## Table 12 (continued)

# Tritium in Drinking Water

## April–June 1993

| Location | Date Collected | $^3$H nCi/L | $\pm 2\sigma$ |
|---|---|---|---|
| OH:East Liverpool | 04/27/93 | 0.1 | 0.2 |
| OH:Toledo | 04/06/93 | 0.1 | 0.2 |
| OK:Oklahoma City | 05/19/93 | 0.2 | 0.2 |
| OR:Portland | 04/02/93 | 0.1 | 0.2 |
| PA:Columbia | 04/08/93 | 0.2 | 0.2 |
| PA:Harrisburg | 04/08/93 | 0.1 | 0.2 |
| PA:Philadelphia-Baxter | 04/14/93 | 0.1 | 0.2 |
| PA:Philadelphia-Queen | 04/15/93 | 0.1 | 0.2 |
| PA:Philadelphia | 04/15/93 | 0.1 | 0.2 |
| PA:Pittsburgh | 04/27/93 | 0.2 | 0.2 |
| RI:Providence | 06/30/93 | 0.1 | 0.2 |
| SC:Barnwell | 04/06/93 | 0.1 | 0.2 |
| SC:Columbia | 04/06/93 | 0.1 | 0.2 |
| SC:Hartsville | 04/19/93 | 0.1 | 0.2 |
| SC:Jenkinsville | 04/16/93 | 0.1 | 0.2 |
| SC:Seneca | 04/20/93 | ND | |
| TN:Chattanooga | 04/19/93 | 0.3 | 0.2 |
| TX:Austin | 04/07/93 | 0.1 | 0.2 |
| VA:Doswell | 04/07/93 | 0.2 | 0.2 |
| VA:Lynchburg | 04/02/93 | 0.1 | 0.2 |
| VA:Virginia Beach | 04/06/93 | 0.1 | 0.2 |
| WI:Genoa City | 04/06/93 | 0.1 | 0.2 |
| WI:Madison | 04/08/93 | 0.1 | 0.2 |

Note: $\sigma$ = Counting Error.

# 3. External Gamma Ambient Monitoring Program

The External Gamma Monitoring Program (EGAMP), 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 EGAMP program utilizes $CaF_2$:Mn thermoluminescent dosimeters (TLD's). These dosimeters are commercially available glass-bulb type dosimeters with energy compensating shields. A group of three TLD's is located at each station or site. Dosimeters are annealed by the station operator prior to positioning in the field. The dosimeters are returned to NAREL for readout approximately every three months. Several dosimeters are annealed by the station operator as controls and returned with the exposed field dosimeters to correct for any exposures accumulated during shipment.

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

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† Since some of these sites may not return dosimeters each period, the number of sites listed may vary slightly.

# 4. 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 at least one 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, including 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 13–15 contain the concentrations of radionuclides in pasteurized milk for April–June 1993. Table 16 contains the concentrations of strontium-90 in pasteurized milk EPA Regional Composites for April 1993.

# Table 13

## Radionuclides in Pasteurized Milk

### April 1993

| Location | Date Collected | K g/L | K $\pm 2\sigma$ | $^{137}$Cs pCi/L | $^{137}$Cs $\pm 2\sigma$ | $^{140}$Ba pCi/L | $^{140}$Ba $\pm 2\sigma$ | $^{131}$I pCi/L | $^{131}$I $\pm 2\sigma$ |
|---|---|---|---|---|---|---|---|---|---|
| AL:Montgomery | 04/08/93 | 1.63 | 0.06 | ND | | ND | | ND | |
| AR:Little Rock | 04/06/93 | 1.56 | 0.06 | ND | | ND | | ND | |
| AZ:Phoenix | 04/14/93 | 1.60 | 0.06 | ND | | ND | | ND | |
| CA:Los Angeles | 04/14/93 | 1.61 | 0.06 | ND | | ND | | ND | |
| CA:Sacramento | 04/05/93 | 1.61 | 0.07 | ND | | ND | | ND | |
| CA:San Francisco | 04/06/93 | 1.68 | 0.07 | ND | | ND | | ND | |
| CO:Denver | 04/02/93 | 1.42 | 0.08 | ND | | ND | | ND | |
| DE:Wilmington | 04/21/93 | 1.61 | 0.08 | ND | | ND | | ND | |
| FL:Tampa | 04/05/93 | 1.63 | 0.05 | 7 | 1 | ND | | ND | |
| GA:Atlanta | 04/27/93 | 1.49 | 0.06 | ND | | ND | | ND | |
| HI:Honolulu | 04/26/93 | 1.63 | 0.07 | ND | | ND | | ND | |
| IA:Des Moines | 04/12/93 | 1.64 | 0.07 | ND | | ND | | ND | |
| IL:Chicago | 04/01/93 | 1.51 | 0.11 | ND | | ND | | ND | |
| IN:Indianapolis | 04/05/93 | 1.60 | 0.06 | ND | | ND | | ND | |
| KS:Wichita | 04/29/93 | 1.57 | 0.14 | ND | | ND | | ND | |
| KY:Louisville | 04/06/93 | 1.53 | 0.06 | ND | | ND | | ND | |
| LA:New Orleans | 04/27/93 | 1.63 | 0.07 | ND | | ND | | ND | |
| MA:Boston | 04/09/93 | 1.55 | 0.06 | ND | | ND | | ND | |
| MD:Baltimore | 04/02/93 | 1.58 | 0.11 | ND | | ND | | ND | |
| ME:Portland | 04/07/93 | 1.66 | 0.06 | ND | | ND | | ND | |
| MI:Detroit | 04/08/93 | 1.63 | 0.07 | ND | | ND | | ND | |
| MI:Grand Rapids | 04/05/93 | 1.70 | 0.07 | ND | | ND | | ND | |
| MN:St. Paul | 04/07/93 | 1.67 | 0.07 | ND | | ND | | ND | |
| MO:Kansas City | 04/14/93 | 1.58 | 0.07 | ND | | ND | | ND | |
| MS:Jackson | 04/06/93 | 1.51 | 0.06 | ND | | ND | | ND | |
| MT:Helena | 04/12/93 | 1.60 | 0.08 | ND | | ND | | ND | |
| NC:Charlotte | 04/29/93 | 1.38 | 0.13 | ND | | ND | | ND | |
| ND:Minot | 04/27/93 | 1.66 | 0.07 | ND | | ND | | ND | |
| NJ:Trenton | 04/07/93 | 1.58 | 0.08 | ND | | ND | | ND | |
| NM:Albuquerque | 04/13/93 | 1.61 | 0.06 | ND | | ND | | ND | |
| NV:Las Vegas | 04/13/93 | 1.67 | 0.07 | ND | | ND | | ND | |
| NY:Buffalo | 04/19/93 | 1.67 | 0.08 | ND | | ND | | ND | |
| NY:Syracuse | 04/05/93 | 1.51 | 0.07 | ND | | ND | | ND | |
| OH:Cincinnati | 04/28/93 | 1.62 | 0.06 | ND | | ND | | ND | |
| OH:Cleveland | 04/15/93 | 1.63 | 0.06 | ND | | ND | | ND | |
| OR:Portland | 04/05/93 | 1.68 | 0.07 | ND | | ND | | ND | |
| PA:Philadelphia | 04/05/93 | 1.62 | 0.06 | ND | | ND | | ND | |

## Table 13 (continued)

# Radionuclides in Pasteurized Milk

## April 1993

| Location | Date Collected | K g/L | K ±2σ | $^{137}$Cs pCi/L | $^{137}$Cs ±2σ | $^{140}$Ba pCi/L | $^{140}$Ba ±2σ | $^{131}$I pCi/L | $^{131}$I ±2σ |
|---|---|---|---|---|---|---|---|---|---|
| PA:Pittsburgh | 04/05/93 | 1.54 | 0.06 | ND | | ND | | ND | |
| PC:Cristobal | 04/02/93 | 1.55 | 0.06 | 7 | 2 | ND | | ND | |
| PR:San Juan | 04/08/93 | 1.61 | 0.09 | ND | | ND | | ND | |
| SC:Charleston | 04/21/93 | 1.51 | 0.06 | ND | | ND | | ND | |
| SD:Rapid City | 04/05/93 | 1.60 | 0.05 | ND | | ND | | ND | |
| TN:Chattanooga | 04/12/93 | 1.63 | 0.07 | ND | | ND | | ND | |
| TN:Knoxville | 04/05/93 | 1.61 | 0.06 | ND | | ND | | ND | |
| TN:Memphis | 04/19/93 | 1.56 | 0.07 | ND | | ND | | ND | |
| TX:Austin | 04/28/93 | 1.63 | 0.06 | ND | | ND | | ND | |
| TX:Ft. Worth | 04/08/93 | 1.55 | 0.06 | ND | | ND | | ND | |
| VA:Norfolk | 04/01/93 | 1.55 | 0.07 | ND | | ND | | ND | |
| VT:Burlington | 04/13/93 | 1.57 | 0.06 | ND | | ND | | ND | |
| WA:Seattle | 04/01/93 | 1.58 | 0.07 | ND | | ND | | ND | |
| WA:Spokane | 04/06/93 | 1.58 | 0.06 | ND | | ND | | ND | |
| WV:Charleston | 04/20/93 | 1.63 | 0.05 | ND | | ND | | ND | |

Note: $\sigma$ = Counting Error. ND = Not Detectable.

# Table 14

## Radionuclides in Pasteurized Milk

### May 1993

| Location | Date Collected | K g/L | K $\pm 2\sigma$ | $^{137}$Cs pCi/L | $^{137}$Cs $\pm 2\sigma$ | $^{140}$Ba pCi/L | $^{140}$Ba $\pm 2\sigma$ | $^{131}$I pCi/L | $^{131}$I $\pm 2\sigma$ |
|---|---|---|---|---|---|---|---|---|---|
| AL:Montgomery | 05/07/93 | 1.57 | 0.09 | ND | | ND | | ND | |
| AR:Little Rock | 05/10/93 | 1.58 | 0.08 | ND | | ND | | ND | |
| AZ:Phoenix | 05/27/93 | 1.54 | 0.11 | ND | | ND | | ND | |
| CA:Los Angeles | 05/20/93 | 1.53 | 0.08 | ND | | ND | | ND | |
| CA:Sacramento | 05/03/93 | 1.63 | 0.14 | ND | | ND | | ND | |
| CO:Denver | 05/10/93 | 1.57 | 0.06 | ND | | ND | | ND | |
| CT:Hartford | 05/03/93 | 1.57 | 0.10 | ND | | ND | | ND | |
| DE:Wilmington | 05/18/93 | 1.56 | 0.08 | ND | | ND | | ND | |
| FL:Tampa | 05/03/93 | 1.57 | 0.08 | 2 | 2 | ND | | ND | |
| GA:Atlanta | 05/11/93 | 1.49 | 0.08 | ND | | ND | | ND | |
| HI:Honolulu | 05/18/93 | 1.57 | 0.08 | ND | | ND | | ND | |
| IA:Des Moines | 05/12/93 | 1.63 | 0.06 | ND | | ND | | ND | |
| IL:Chicago | 05/06/93 | 1.66 | 0.06 | ND | | ND | | ND | |
| IN:Indianapolis | 05/03/93 | 1.53 | 0.09 | ND | | ND | | ND | |
| KS:Wichita | 05/26/93 | 1.58 | 0.05 | ND | | ND | | ND | |
| KY:Louisville | 05/04/93 | 1.58 | 0.05 | ND | | ND | | ND | |
| MA:Boston | 05/20/93 | 1.54 | 0.08 | ND | | ND | | ND | |
| MA:Lawrence | 05/18/93 | 1.63 | 0.06 | ND | | ND | | ND | |
| MD:Baltimore | 05/14/93 | 1.72 | 0.06 | ND | | ND | | ND | |
| MI:Detroit | 05/07/93 | 1.58 | 0.14 | ND | | ND | | ND | |
| MI:Grand Rapids | 05/05/93 | 1.57 | 0.08 | ND | | ND | | ND | |
| MN:St. Paul | 05/05/93 | 1.61 | 0.06 | ND | | ND | | ND | |
| MO:Kansas City | 05/10/93 | 1.61 | 0.06 | ND | | ND | | ND | |
| MO:St. Louis | 05/04/93 | 1.60 | 0.10 | ND | | ND | | ND | |
| MS:Jackson | 05/05/93 | 1.57 | 0.09 | ND | | ND | | ND | |
| MT:Helena | 05/10/93 | 1.63 | 0.06 | ND | | ND | | ND | |
| NC:Charlotte | 05/27/93 | 1.35 | 0.08 | ND | | ND | | ND | |
| ND:Minot | 05/26/93 | 1.63 | 0.05 | ND | | ND | | ND | |
| NJ:Trenton | 05/04/93 | 1.57 | 0.06 | ND | | ND | | ND | |
| NM:Albuquerque | 05/07/93 | 1.61 | 0.06 | ND | | ND | | ND | |
| NV:Las Vegas | 05/03/93 | 1.58 | 0.09 | ND | | ND | | ND | |
| NY:Buffalo | 05/05/93 | 1.62 | 0.14 | ND | | ND | | ND | |
| NY:Syracuse | 05/05/93 | 1.64 | 0.06 | ND | | ND | | ND | |
| OH:Cincinnati | 05/26/93 | 1.60 | 0.08 | ND | | ND | | ND | |
| OH:Cleveland | 05/19/93 | 1.55 | 0.10 | ND | | ND | | ND | |
| OR:Portland | 05/04/93 | 1.64 | 0.05 | ND | | ND | | ND | |
| PA:Philadelphia | 05/05/93 | 1.58 | 0.06 | ND | | ND | | ND | |

## Table 14 (continued)

# Radionuclides in Pasteurized Milk

## May 1993

| Location | Date Collected | K g/L | K ±2σ | $^{137}$Cs pCi/L | $^{137}$Cs ±2σ | $^{140}$Ba pCi/L | $^{140}$Ba ±2σ | $^{131}$I pCi/L | $^{131}$I ±2σ |
|---|---|---|---|---|---|---|---|---|---|
| PA:Pittsburgh | 05/03/93 | 1.58 | 0.08 | ND | | ND | | ND | |
| PC:Cristobal | 05/13/93 | 1.49 | 0.06 | 8 | 2 | ND | | ND | |
| PR:San Juan | 05/07/93 | 1.47 | 0.10 | ND | | ND | | ND | |
| SD:Rapid City | 05/03/93 | 1.62 | 0.06 | ND | | ND | | ND | |
| TN:Knoxville | 05/03/93 | 1.58 | 0.09 | ND | | ND | | ND | |
| TX:Ft. Worth | 05/11/93 | 1.53 | 0.04 | ND | | ND | | ND | |
| VA:Norfolk | 05/27/93 | 1.52 | 0.06 | ND | | ND | | ND | |
| VT:Burlington | 05/14/93 | 1.56 | 0.09 | ND | | ND | | ND | |
| WA:Seattle | 05/11/93 | 1.67 | 0.06 | ND | | ND | | ND | |
| WA:Spokane | 05/04/93 | 1.56 | 0.04 | ND | | ND | | ND | |
| WV:Charleston | 05/18/93 | 1.57 | 0.09 | ND | | ND | | ND | |

Note: $\sigma$ = Counting Error. ND = Not Detectable.

# Table 15

## Radionuclides in Pasteurized Milk

### June 1993

| Location | Date Collected | K g/L | K ±2σ | $^{137}$Cs pCi/L | $^{137}$Cs ±2σ | $^{140}$Ba pCi/L | $^{140}$Ba ±2σ | $^{131}$I pCi/L | $^{131}$I ±2σ |
|---|---|---|---|---|---|---|---|---|---|
| AL:Montgomery | 06/11/93 | 1.62 | 0.06 | ND | | ND | | ND | |
| AR:Little Rock | 06/15/93 | 1.58 | 0.08 | ND | | ND | | ND | |
| AZ:Phoenix | 06/22/93 | 1.61 | 0.06 | ND | | ND | | ND | |
| CA:Los Angeles | 06/02/93 | 1.66 | 0.06 | ND | | ND | | ND | |
| CA:Sacramento | 06/01/93 | 1.64 | 0.09 | ND | | ND | | ND | |
| CO:Denver | 06/22/93 | 1.65 | 0.06 | ND | | ND | | ND | |
| CT:Hartford | 06/07/93 | 1.63 | 0.06 | ND | | ND | | ND | |
| DE:Wilmington | 06/23/93 | 1.55 | 0.06 | ND | | ND | | ND | |
| FL:Tampa | 06/01/93 | 1.70 | 0.06 | ND | | ND | | ND | |
| GA:Atlanta | 06/07/93 | 1.42 | 0.08 | ND | | ND | | ND | |
| HI:Honolulu | 06/24/93 | 1.66 | 0.06 | ND | | ND | | ND | |
| IA:Des Moines | 06/14/93 | 1.58 | 0.05 | ND | | ND | | ND | |
| IL:Chicago | 06/04/93 | 1.62 | 0.09 | ND | | ND | | ND | |
| IN:Indianapolis | 06/07/93 | 1.49 | 0.08 | ND | | ND | | ND | |
| KS:Wichita | 06/16/93 | 1.51 | 0.08 | ND | | ND | | ND | |
| KY:Louisville | 06/07/93 | 1.63 | 0.06 | ND | | ND | | ND | |
| LA:New Orleans | 06/24/93 | 1.64 | 0.08 | ND | | ND | | ND | |
| MA:Boston | 06/07/93 | 1.60 | 0.09 | ND | | ND | | ND | |
| MD:Baltimore | 06/04/93 | 1.69 | 0.07 | ND | | ND | | ND | |
| ME:Portland | 06/01/93 | 1.62 | 0.09 | ND | | ND | | ND | |
| MI:Grand Rapids | 06/07/93 | 1.58 | 0.14 | ND | | ND | | ND | |
| MN:St. Paul | 06/02/93 | 1.57 | 0.06 | ND | | ND | | ND | |
| MO:Kansas City | 06/24/93 | 1.51 | 0.14 | ND | | ND | | ND | |
| MO:St. Louis | 06/03/93 | 1.62 | 0.06 | ND | | ND | | ND | |
| MS:Jackson | 06/07/93 | 1.58 | 0.05 | ND | | ND | | ND | |
| MT:Helena | 06/28/93 | 1.45 | 0.10 | ND | | ND | | ND | |
| NC:Charlotte | 06/23/93 | 1.53 | 0.09 | ND | | ND | | ND | |
| ND:Minot | 06/28/93 | 1.56 | 0.08 | ND | | ND | | ND | |
| NJ:Trenton | 06/09/93 | 1.57 | 0.06 | ND | | ND | | ND | |
| NM:Albuquerque | 06/21/93 | 1.55 | 0.08 | ND | | ND | | ND | |
| NV:Las Vegas | 06/15/93 | 1.45 | 0.10 | ND | | ND | | ND | |
| NY:Buffalo | 06/09/93 | 1.62 | 0.09 | ND | | ND | | ND | |
| NY:Syracuse | 06/01/93 | 1.60 | 0.10 | ND | | ND | | ND | |
| OH:Cincinnati | 06/30/93 | 1.56 | 0.09 | ND | | ND | | ND | |
| OH:Cleveland | 06/15/93 | 1.56 | 0.08 | ND | | ND | | ND | |
| OR:Portland | 06/01/93 | 1.63 | 0.05 | ND | | ND | | ND | |
| PA:Philadelphia | 06/07/93 | 1.60 | 0.05 | ND | | ND | | ND | |

## Table 15 (continued)

# Radionuclides in Pasteurized Milk

## June 1993

| Location | Date Collected | K g/L | K $\pm 2\sigma$ | $^{137}$Cs pCi/L | $^{137}$Cs $\pm 2\sigma$ | $^{140}$Ba pCi/L | $^{140}$Ba $\pm 2\sigma$ | $^{131}$I pCi/L | $^{131}$I $\pm 2\sigma$ |
|---|---|---|---|---|---|---|---|---|---|
| PA:Pittsburgh | 06/08/93 | 1.47 | 0.10 | ND | | ND | | ND | |
| PC:Cristobal | 06/02/93 | 1.41 | 0.10 | 5 | 3 | ND | | ND | |
| PR:San Juan | 06/11/93 | 1.48 | 0.14 | ND | | ND | | ND | |
| SC:Charleston | 06/16/93 | 1.67 | 0.06 | ND | | ND | | ND | |
| SD:Rapid City | 06/02/93 | 1.50 | 0.08 | ND | | ND | | ND | |
| TN:Chattanooga | 06/23/93 | 1.62 | 0.05 | ND | | ND | | ND | |
| TN:Knoxville | 06/09/93 | 1.56 | 0.08 | ND | | ND | | ND | |
| TX:Austin | 06/07/93 | 1.57 | 0.06 | ND | | ND | | ND | |
| TX:Ft. Worth | 06/14/93 | 1.63 | 0.06 | ND | | ND | | ND | |
| VT:Burlington | 06/16/93 | 1.62 | 0.07 | ND | | ND | | ND | |
| WA:Seattle | 06/02/93 | 1.62 | 0.08 | ND | | ND | | ND | |
| WA:Spokane | 06/07/93 | 1.63 | 0.08 | ND | | ND | | ND | |
| WV:Charleston | 06/23/93 | 1.62 | 0.07 | ND | | ND | | ND | |

Note: $\sigma$ = Counting Error. ND = Not Detectable.

# Table 16

## Strontium-90 in Pasteurized Milk
## EPA Regional Composites

### April 1993

| EPA Region | Collection Date | $^{90}Sr$ pCi/L | $\pm 2\sigma$ |
|---|---|---|---|
| I | 04/10/93 | 1.4 | 0.5 |
| II | 04/10/93 | 1.6 | 0.1 |
| III | 04/14/93 | 1.0 | 0.4 |
| IV | 04/13/93 | 1.5 | 0.3 |
| V | 04/10/93 | 1.4 | 0.4 |
| VI | 04/16/93 | 1.7 | 0.4 |
| VII | 04/18/93 | 1.4 | 0.4 |
| VIII | 04/12/93 | 1.3 | 0.4 |
| IX | 04/13/93 | 0.4 | 0.7 |
| X | 04/04/93 | 0.6 | 0.4 |

Note: $\sigma$ = Counting Error.

## 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, which is then assayed for carbon-14 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 April–May 1982, 1983–1986, and March–May 1987. They were published in *Environmental Radiation Data: Report 54* and *Environmental Radiation Data: Report 59.*

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

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