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ENVIRONMENTAL RADIATION DATA

REPORT 98

April - June 1999

United States Environmental Protection Agency

Office of Radiation and Indoor Air

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Preface

Environmental Radiation Data (ERD) is compiled and published 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). ERD is published in both hard-copy and electronic formats. Electronic reports are available online at www.epa.gov/narel.

The United States Environmental Protection Agency established ERAMS in 1973 with an emphasis on identifying trends in the accumulation of long-lived radionuclides in the environment. ERAMS is comprised of a nationwide network of sampling stations that provide air, precipitation, surface water, drinking water, and milk samples.

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 analyses, gamma analyses, and radionuclide-specific analyses for uranium, plutonium, strontium, iodine, radium, 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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Acknowledgments

All sampling for the Environmental Radiation Ambient Monitoring System (ERAMS) is performed by volunteer collectors who are frequently members of the health departments or related environmental agencies of their respective states. The National Air and Radiation Environmental Laboratory (NAREL) on behalf of the U.S. Environmental Protection Agency would like to acknowledge the time and effort of these volunteer collectors, who are so essential to the successful operation of ERAMS. The efforts of the sample collectors are especially appreciated during times of emergency operation when sampling frequencies are increased and schedules are sometimes demanding.

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Data Reporting Conventions

Every laboratory measurement involves uncertainty. When there is little or no radioactivity in a sample, one consequence of measurement uncertainty is the possibility of obtaining a measured value that is less than zero. Such a negative result occurs when random effects in the measurement process cause the measured value for the sample to be less than that of the blank or background, which is subtracted from it. From April 1991 to December 1995, negative results were reported as "not detected" or "ND," and gamma analysis results that were less than their estimated measurement uncertainties were also reported as "ND." In January 1996 both of these practices were discontinued. Although negative activities are physically impossible, the inclusion of negative results in the report allows better statistical analysis of the data.

Results of gamma analyses are still reported as "ND" when gamma-emitting radionuclides are not detected.

Measurement Uncertainty

Each measured value y is reported with an expanded uncertainty $U = k\,u_c(y)$, which is determined from the combined standard uncertainty $u_c(y)$ and the coverage factor $k = 2$. The interval from $y - U$ to $y + U$ is estimated to have a level of confidence of approximately 95%.

Significant Figures

Expanded uncertainties are reported to two significant figures. Measurement results are rounded to the corresponding number of decimal places.

Detection Capability

The minimum detectable concentrations (MDCs) for each radionuclide are shown in Table 1. The MDC is defined as the minimum concentration that gives a 95% probability of detection when the detection criteria are chosen to give only a 5% probability of false detection in a blank sample.

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Table 1

Reporting Units and Minimum Detectable Concentrations for Radionuclide Analyses

Radionuclide	Media	Reporting Unit	Minimum Detectable Concentration
Gross Alpha	Water	pCi/L	2
Gross Beta	Air	pCi/m³	0.0015
	Water	pCi/L	2
	Precipitation	pCi/L	2
Tritium	Water	pCi/L	150
	Milk	pCi/L	150
* Plutonium-238,239/240	Air	aCi/m³	0.75
	Water	pCi/L	0.1
† Uranium-234,235,238	Air	aCi/m³	0.75
	Water	pCi/L	0.1
Radium-226	Water	pCi/L	0.02
Strontium-90	Milk	pCi/L	2
	Water	pCi/L	1
‡ Iodine-131	Milk (gamma)	pCi/L	4
	Water (gamma)	pCi/L	4
	Water	pCi/L	0.3
Cesium-137	Milk	pCi/L	5
	Water	pCi/L	5
‡ Barium-140	Milk	pCi/L	15
	Water	pCi/L	15
Potassium	Milk	g/L	0.06
	Water	g/L	0.06
Potassium-40	Water	pCi/L	50

* The MDC for air is based on an assumed total sample volume of 120,000 m³. Measurement by alpha spectrometry includes combined activities of ^{239}Pu and ^{240}Pu, since the relative contributions of these two isotopes cannot be determined.

† The MDC for air is based on an assumed total sample volume of 120,000 m³.

‡ Activity as of the day of counting.

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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 after collection to allow for decay of natural radon isotopes and their progeny. 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 most 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 compilation of individual measurements is available from the National Air and Radiation Environmental Laboratory, 540 South Morris Avenue, Montgomery, AL 36115-2601.

Table 2

Gross Beta in Airborne Particulates
April 1999

Location	Number of Samples	5-hour Field Estimate (pCi/m³)			NAREL Lab Measurement (pCi/m³)		
		Max	Min	Avg	Max	Min	Avg
AK: Fairbanks	2	0.0	0.0	0.0	0.016	0.009	0.012
AL: Montgomery	9	0.1	0.1	0.1	0.034	0.012	0.023
AR: Little Rock	8	0.1	0.0	0.1	0.018	0.010	0.012
AZ: Phoenix	4	0.6	0.2	0.4	0.022	0.007	0.013
CA: Berkeley	9	0.2	0.0	0.1	0.010	0.003	0.005
CA: Los Angeles	9	0.3	0.0	0.1	0.022	0.004	0.008
CO: Denver	7	0.6	0.2	0.4	0.018	0.005	0.011
CT: Hartford	9	0.2	0.0	0.1	0.010	0.004	0.007
DE: Wilmington	8	0.1	0.0	0.1	0.012	0.005	0.008
FL: Jacksonville	9	0.1	0.1	0.1	0.014	0.007	0.011
FL: Miami	4	0.0	0.0	0.0	0.013	0.007	0.010
HI: Honolulu	8	0.1	0.1	0.1	0.007	0.003	0.005
IA: Iowa City	9	0.9	0.1	0.3	0.015	0.010	0.012
ID: Boise	9	0.7	0.2	0.4	0.012	0.005	0.007
ID: Idaho Falls	9				0.011	0.006	0.008
IN: Indianapolis	9	0.6	0.0	0.2	0.012	0.007	0.009
KS: Topeka	9	1.3	0.1	0.5	0.015	0.007	0.010
ME: Augusta	8	0.2	0.0	0.1	0.010	0.004	0.006
MI: Lansing	9	0.2	0.0	0.1	0.012	0.005	0.008
MN: Minneapolis	2	0.1	0.1	0.1	0.011	0.011	0.011
MN: Welch	5	0.4	0.1	0.2	0.015	0.005	0.009
MS: Jackson	9	0.2	0.0	0.1	0.017	0.008	0.012
NC: Charlotte	6	0.1	0.0	0.1	0.016	0.013	0.014
NC: Wilmington	1				0.011	0.011	0.011
ND: Bismarck	3	0.7	0.1	0.3	0.012	0.008	0.009
NH: Concord	9	0.2	0.0	0.1	0.010	0.003	0.006
NV: Las Vegas	9	0.1	0.1	0.1	0.020	0.005	0.011
NY: Albany	4	0.1	0.0	0.1	0.013	0.006	0.010
NY: New York City	9	0.1	0.0	0.1	0.010	0.006	0.008
NY: Yaphank	9	0.1	0.0	0.1	0.010	0.005	0.007
OH: Painesville	9	0.2	0.0	0.1	0.012	0.003	0.009
OH: Ross	9				0.016	0.007	0.011
OR: Portland	9	0.1	0.0	0.1	0.009	0.003	0.005
PA: Harrisburg	9	0.4	0.1	0.2	0.012	0.007	0.010
PA: Pittsburgh	9	0.2	0.1	0.1	0.013	0.006	0.009
SC: Barnwell	1	0.0	0.0	0.0	0.005	0.005	0.005
SC: Columbia	8	0.2	0.0	0.1	0.018	0.005	0.013
SD: Pierre	5	0.2	0.1	0.1	0.010	0.007	0.008

Table 2 (continued)

Gross Beta in Airborne Particulates
April 1999

Location	Number of Samples	5-hour Field Estimate (pCi/m³)			NAREL Lab Measurement (pCi/m³)		
		Max	Min	Avg	Max	Min	Avg
TN: Knoxville	8	1.0	0.0	0.5	0.037	0.009	0.018
TN: Nashville	9	0.2	0.0	0.1	0.016	0.008	0.011
TN: Oak Ridge/Bethel	9	0.3	0.1	0.2	0.016	0.007	0.012
TN: Oak Ridge/K25	9	0.5	0.1	0.2	0.016	0.006	0.011
TN: Oak Ridge/Melton	9	0.5	0.1	0.2	0.015	0.007	0.010
TN: Oak Ridge/Y12 E	9	0.5	0.1	0.2	0.016	0.007	0.011
TN: Oak Ridge/Y12 W	9	0.3	0.0	0.1	0.016	0.007	0.012
TX: Austin	7	0.3	0.1	0.1	0.013	0.006	0.009
TX: El Paso	9	0.6	0.0	0.4	0.024	0.008	0.016
UT: Salt Lake City	5	0.1	0.0	0.1	0.014	0.006	0.009
VA: Lynchburg	9	0.8	0.1	0.3	0.015	0.007	0.009
WA: Olympia	4	0.2	0.0	0.1	0.008	0.003	0.005
WA: Spokane	3	0.2	0.1	0.1	0.005	0.003	0.004
WI: Madison	9	0.4	0.1	0.3	0.014	0.007	0.011

Table 3

Gross Beta in Airborne Particulates
May 1999

Location	Number of Samples	5-hour Field Estimate (pCi/m³)			NAREL Lab Measurement (pCi/m³)		
		Max	Min	Avg	Max	Min	Avg
AL: Montgomery	8	0.2	0.1	0.1	0.033	0.012	0.021
AR: Little Rock	6	0.1	0.0	0.1	0.010	0.007	0.009
AZ: Phoenix	3	0.5	0.2	0.3	0.017	0.011	0.013
CA: Berkeley	6	0.1	0.0	0.1	0.006	0.003	0.004
CA: Los Angeles	7	0.2	0.0	0.1	0.012	0.007	0.009
CO: Denver	6	0.7	0.1	0.4	0.013	0.003	0.008
CT: Hartford	7	0.1	0.0	0.1	0.006	0.003	0.005
DE: Wilmington	8	0.3	0.1	0.1	0.009	0.006	0.008
FL: Jacksonville	8	0.1	0.0	0.1	0.015	0.005	0.008
FL: Miami	4	0.0	0.0	0.0	0.009	0.003	0.006
HI: Honolulu	7	0.1	0.1	0.1	0.005	0.002	0.004
IA: Iowa City	7	0.6	0.0	0.3	0.014	0.006	0.009
ID: Boise	6	0.8	0.1	0.5	0.010	0.004	0.007
ID: Idaho Falls	7				0.014	0.005	0.008
IN: Indianapolis	8	0.5	0.0	0.2	0.014	0.007	0.008
KS: Topeka	8	1.4	0.2	0.4	0.009	0.005	0.007
ME: Augusta	8	0.1	0.0	0.1	0.008	0.002	0.005
MI: Lansing	8	0.4	0.1	0.2	0.014	0.005	0.008
MN: Minneapolis	4	0.2	0.1	0.2	0.014	0.006	0.010
MS: Jackson	8	0.4	0.1	0.2	0.014	0.008	0.011
NC: Charlotte	3	0.1	0.0	0.1	0.012	0.009	0.011
ND: Bismarck	4	0.1	0.1	0.1	0.009	0.004	0.006
NH: Concord	9	0.2	0.1	0.1	0.009	0.002	0.006
NV: Las Vegas	7	0.1	0.1	0.1	0.013	0.006	0.010
NY: Albany	3	0.1	0.0	0.0	0.011	0.005	0.007
NY: New York City	8	0.1	0.0	0.1	0.012	0.004	0.007
NY: Yaphank	8	0.1	0.1	0.1	0.009	0.003	0.006
OH: Painesville	7	0.2	0.1	0.2	0.011	0.006	0.008
OH: Ross	8				0.014	0.007	0.009
OR: Portland	6	0.1	0.0	0.0	0.005	0.002	0.004
PA: Harrisburg	8	0.5	0.1	0.2	0.010	0.006	0.008
PA: Pittsburgh	8	0.1	0.1	0.1	0.013	0.007	0.009
SC: Barnwell	1	0.0	0.0	0.0	0.004	0.004	0.004
SC: Columbia	7	0.4	0.0	0.1	0.015	0.005	0.010
SD: Pierre	4	0.2	0.0	0.1	0.008	0.004	0.006
TN: Knoxville	7	0.6	0.2	0.4	0.033	0.010	0.017
TN: Nashville	8	0.2	0.0	0.1	0.012	0.009	0.011
TN: Oak Ridge/Bethel	8	0.4	0.1	0.3	0.011	0.007	0.008

Table 3 (continued)

Gross Beta in Airborne Particulates
May 1999

Location	Number of Samples	5-hour Field Estimate			NAREL Lab Measurement		
		Max	Min	Avg	Max	Min	Avg
		(pCi/m³)			(pCi/m³)		
TN: Oak Ridge/K25	8	0.5	0.0	0.3	0.012	0.007	0.009
TN: Oak Ridge/Melton	8	0.5	0.1	0.3	0.011	0.005	0.008
TN: Oak Ridge/Y12 E	8	0.5	0.1	0.3	0.014	0.007	0.009
TN: Oak Ridge/Y12 W	8	0.4	0.1	0.2	0.012	0.007	0.009
TX: Austin	6	0.1	0.0	0.1	0.017	0.008	0.011
TX: El Paso	7	0.6	0.3	0.5	0.021	0.008	0.013
UT: Salt Lake City	4	0.4	0.0	0.1	0.013	0.006	0.009
VA: Lynchburg	8	1.0	0.2	0.5	0.010	0.006	0.008
WA: Olympia	3	0.0	0.0	0.0	0.003	0.002	0.003
WA: Spokane	7	0.2	0.1	0.1	0.009	0.004	0.006
WI: Madison	5	0.4	0.1	0.3	0.012	0.006	0.009

Table 4

Gross Beta in Airborne Particulates
June 1999

Location	Number of Samples	5-hour Field Estimate (pCi/m³)			NAREL Lab Measurement (pCi/m³)		
		Max	Min	Avg	Max	Min	Avg
AK: Fairbanks	2	0.0	0.0	0.0	0.005	0.005	0.005
AL: Montgomery	9	0.2	0.0	0.1	0.026	0.008	0.017
AR: Little Rock	8	0.2	0.0	0.1	0.015	0.007	0.010
AZ: Phoenix	5	0.4	0.1	0.3	0.015	0.009	0.013
CA: Berkeley	9	0.1	0.0	0.0	0.004	0.001	0.002
CA: Los Angeles	9	0.2	0.0	0.1	0.007	0.005	0.006
CO: Denver	8	0.8	0.3	0.4	0.013	0.007	0.009
CT: Hartford	9	0.2	0.0	0.1	0.010	0.005	0.008
DE: Wilmington	9	0.3	0.1	0.2	0.016	0.007	0.010
FL: Jacksonville	9	0.1	0.0	0.1	0.009	0.004	0.006
FL: Miami	4	0.0	0.0	0.0	0.009	0.004	0.006
HI: Honolulu	8	0.1	0.0	0.1	0.004	0.002	0.003
IA: Iowa City	9	0.8	0.1	0.4	0.017	0.006	0.010
ID: Boise	9	0.3	0.2	0.2	0.009	0.003	0.006
ID: Idaho Falls	8				0.011	0.005	0.007
IN: Indianapolis	9	0.7	0.0	0.3	0.015	0.005	0.010
KS: Topeka	8	1.4	0.1	0.4	0.012	0.003	0.008
ME: Augusta	9	0.3	0.1	0.1	0.013	0.003	0.008
MI: Lansing	9	0.4	0.1	0.2	0.013	0.004	0.008
MN: Minneapolis	5	0.4	0.1	0.2	0.014	0.009	0.011
MN: Welch	2	0.1	0.1	0.1	0.007	0.006	0.007
MS: Jackson	9	0.6	0.1	0.3	0.030	0.009	0.014
NC: Charlotte	8	0.1	0.0	0.1	0.020	0.005	0.011
ND: Bismarck	4	0.7	0.1	0.3	0.009	0.004	0.006
NH: Concord	8	0.3	0.1	0.2	0.014	0.005	0.009
NV: Las Vegas	9	0.1	0.1	0.1	0.015	0.007	0.010
NY: Albany	4	0.2	0.0	0.1	0.012	0.007	0.009
NY: New York City	9	0.3	0.0	0.1	0.022	0.005	0.010
NY: Yaphank	9	0.2	0.0	0.1	0.013	0.005	0.008
OH: Painesville	8	0.4	0.1	0.2	0.014	0.004	0.010
OH: Ross	9				0.014	0.007	0.011
OR: Portland	8	0.1	0.0	0.1	0.003	0.001	0.003
PA: Harrisburg	8	0.5	0.1	0.3	0.012	0.007	0.009
PA: Pittsburgh	9	0.2	0.2	0.2	0.017	0.007	0.011
SC: Barnwell	1	0.0	0.0	0.0	0.001	0.001	0.001
SC: Columbia	9	0.4	0.0	0.2	0.014	0.005	0.010
SD: Pierre	3	0.2	0.1	0.1	0.007	0.004	0.005
TN: Knoxville	7	0.8	0.1	0.4	0.022	0.009	0.015

Table 4 (continued)

Gross Beta in Airborne Particulates
June 1999

Location	Number of Samples	5-hour Field Estimate (pCi/m³)			NAREL Lab Measurement (pCi/m³)		
		Max	Min	Avg	Max	Min	Avg
TN: Nashville	9	0.4	0.1	0.2	0.029	0.008	0.015
TN: Oak Ridge/Bethel	9	0.8	0.2	0.6	0.016	0.005	0.011
TN: Oak Ridge/K25	9	1.0	0.1	0.6	0.017	0.006	0.012
TN: Oak Ridge/Melton	9	1.0	0.1	0.6	0.016	0.006	0.011
TN: Oak Ridge/Y12 E	9	0.8	0.1	0.6	0.018	0.006	0.012
TN: Oak Ridge/Y12 W	9	0.5	0.1	0.3	0.019	0.005	0.012
TX: Austin	8	0.2	0.0	0.1	0.012	0.005	0.009
TX: El Paso	8	0.8	0.3	0.5	0.015	0.009	0.011
UT: Salt Lake City	3	0.1	0.0	0.1	0.010	0.007	0.008
VA: Lynchburg	8	1.0	0.2	0.6	0.015	0.005	0.009
WA: Olympia	4				0.003	0.002	0.002
WA: Spokane	9	0.3	0.1	0.1	0.010	0.002	0.006
WI: Madison	7	0.5	0.1	0.3	0.015	0.005	0.009

Table 5

Gross Beta and Specific Gamma in Precipitation
April 1999

Location	Gross Beta Activity		Specific Gamma Activity		
	pCi/L	± 2*u*	Nuclide	pCi/L	± 2*u*
AL: Montgomery	1.95	0.36		ND	
AR: Little Rock	1.41	0.37		ND	
AZ: Phoenix	1.57	0.40	K40	20	41
			Pb212	3.9	6.6
CO: Denver	1.02	0.33		ND	
CT: Hartford	5.28	0.56	Be7	132	44
DE: Wilmington	3.55	0.47	Be7	88	53
FL: Jacksonville	1.04	0.35		ND	
FL: Miami	1.69	0.36		ND	
HI: Honolulu	1.02	0.36		ND	
IA: Iowa City	1.60	0.39		ND	
ID: Boise	1.21	0.36		ND	
ID: Idaho Falls	4.05	0.53		ND	
MI: Lansing	0.93	0.29		ND	
MN: Minneapolis	1.82	0.39		ND	
MN: Welch	0.73	0.26		ND	
NC: Charlotte	2.18	0.41	Be7	40	33
NC: Wilmington	2.19	0.43		ND	
ND: Bismarck	3.25	0.49		ND	
NH: Concord	2.35	0.42	Be7	58	42
NM: Santa Fe	1.97	0.41	Tl208	2.2	3.2
NY: Albany	4.05	0.54	Be7	78	37
			Bi212	30	24
NY: Yaphank	3.84	0.47	Be7	68	41
OH: Painesville	2.00	0.37		ND	
OR: Portland	1.37	0.37	Be7	64	42
PA: Harrisburg	3.03	0.46	Be7	68	24
			Tl208	1.8	2.8
SC: Barnwell	4.29	0.47		ND	
SC: Columbia	2.56	0.39		ND	
TN: Knoxville	5.06	0.53		ND	
TN: Nashville	1.24	0.31		ND	
UT: Salt Lake City	1.30	0.36		ND	
VA: Lynchburg	1.45	0.40		ND	
WA: Olympia	1.20	0.35		ND	
WI: Madison	0.74	0.27	K40	21	43

Note: ND = Not Detected

Table 6

Gross Beta and Specific Gamma in Precipitation
May 1999

Location	Gross Beta Activity		Specific Gamma Activity		
	pCi/L	± 2*u*	Nuclide	pCi/L	± 2*u*
AL: Montgomery	2.40	0.39	Be7	92	42
AR: Little Rock	1.20	0.31		ND	
CA: Berkeley	2.26	0.39		ND	
CO: Denver	0.11	0.22		ND	
CT: Hartford	1.49	0.32		ND	
DE: Wilmington	3.14	0.42	Pb212	6.3	7.5
FL: Jacksonville	2.54	0.40	Be7	49	35
			Tl208	3.5	4.1
FL: Miami	3.41	0.46		ND	
HI: Honolulu	3.46	0.44		ND	
IA: Iowa City	0.75	0.28	Be7	33	31
ID: Idaho Falls	3.52	0.45	Tl208	2.1	2.3
ME: Augusta	1.56	0.32		ND	
MI: Lansing	1.92	0.37	K40	35	43
MN: Minneapolis	0.83	0.29		ND	
MN: Welch	1.97	0.36		ND	
NC: Charlotte	5.00	0.50	Be7	99	56
			Pb212	3.6	6.6
NC: Wilmington	0.78	0.28		ND	
ND: Bismarck	0.86	0.29	K40	23	42
NH: Concord	2.75	0.40		ND	
NM: Santa Fe	0.53	0.33	Tl208	3.9	4.1
NV: Las Vegas	9.80	0.71		ND	
NY: Albany	1.57	0.33		ND	
NY: Yaphank	2.82	0.40	Be7	61	32
OH: Painesville	1.39	0.32	Be7	39	43
			Tl208	3.8	5.3
OR: Portland	1.99	0.36		ND	
SC: Barnwell	1.68	0.33		ND	
SC: Columbia	1.17	0.31	K40	27	40
TN: Knoxville	2.20	0.37		ND	
TN: Nashville	2.58	0.40	Be7	43	32
TX: Austin	1.73	0.34	Ra224	35	40
UT: Salt Lake City	0.62	0.26		ND	
VA: Lynchburg	5.51	0.53	K40	41	62
WA: Olympia	0.63	0.27		ND	
WI: Madison	1.31	0.32	Pb212	5.9	7.0

Note: ND = Not Detected

Table 7

Gross Beta and Specific Gamma in Precipitation
June 1999

Location	Gross Beta Activity		Specific Gamma Activity		
	pCi/L	± 2*u*	Nuclide	pCi/L	± 2*u*
AL: Montgomery	1.28	0.36	Be7	68	35
AR: Little Rock	1.03	0.36	Be7	30	29
			Tl208	2.6	3.4
CO: Denver	2.78	0.41	Be7	85	21
DE: Wilmington	2.25	0.38	Be7	38	29
FL: Jacksonville	1.32	0.37	Pb212	4.5	6.0
FL: Miami	0.96	0.33	Be7	16	17
HI: Honolulu	1.21	0.31	K40	36	44
IA: Iowa City	0.95	0.37		ND	
ID: Boise	2.39	0.39	Tl208	2.5	3.7
ID: Idaho Falls	1.35	0.32		ND	
ME: Augusta	4.44	0.48	Be7	88	28
MI: Lansing	1.46	0.38		ND	
MN: Minneapolis	1.16	0.36		ND	
MN: Welch	5.53	0.66		ND	
NC: Charlotte	2.20	0.42		ND	
NC: Wilmington	1.32	0.31		ND	
ND: Bismarck	1.57	0.36		ND	
NH: Concord	2.04	0.35	Be7	30	23
NM: Santa Fe	4.71	0.55	Be7	34	34
			Pb212	6.8	6.8
NY: Albany	6.01	0.55	Pb212	4.1	7.1
NY: Yaphank	9.20	0.68		ND	
OH: Painesville	1.33	0.38	Be7	42	28
PA: Harrisburg	3.48	0.44	Be7	84	23
SC: Barnwell	4.77	0.52		ND	
SC: Columbia	1.16	0.36		ND	
TN: Knoxville	1.50	0.38	K40	20	38
TN: Nashville	4.84	0.55	Be7	35	29
			K40	24	35
TX: Austin	0.74	0.33	K40	33	40
			Tl208	2.6	3.5
TX: El Paso	1.32	0.38	Pb212	7.4	7.7
UT: Salt Lake City	2.92	0.41	Be7	49	30
VA: Lynchburg	21.3	1.5	K40	21	35
WA: Olympia	0.87	0.29		ND	
WI: Madison	0.82	0.36	K40	29	50

Note: ND = Not Detected

Table 8

Tritium in Precipitation
April - June 1999

Location	April 1999		May 1999		June 1999	
	pCi/L	± 2*u*	pCi/L	± 2*u*	pCi/L	± 2*u*
AL: Montgomery	21	73	34	77	-42	75
AR: Little Rock	27	77	24	76	-96	75
AZ: Phoenix	48	78	NS		NS	
CA: Berkeley	NS		34	70	NS	
CO: Denver	59	79	-2	75	46	81
CT: Hartford	52	75	-19	75	NS	
DE: Wilmington	84	76	33	77	-25	76
FL: Jacksonville	14	73	-50	73	-41	75
FL: Miami	34	74	-65	72	24	77
HI: Honolulu	7	76	39	71	-80	75
IA: Iowa City	32	77	-39	73	22	80
ID: Boise	-7	75	NS		-36	77
ID: Idaho Falls	35	77	72	72	-22	77
ME: Augusta	NS		-21	74	33	78
MI: Lansing	40	74	-26	74	27	78
MN: Minneapolis	2	76	2	75	-14	78
MN: Welch	71	76	15	76	13	77
NC: Charlotte	75	76	22	76	58	79
NC: Wilmington	35	74	-5	75	-24	76
ND: Bismarck	19	76	64	78	-2	79
NH: Concord	114	78	3	76	77	80
NM: Santa Fe	65	78	-4	76	14	79
NV: Las Vegas	NS		91	73	NS	
NY: Albany	74	76	-2	75	-36	75
NY: Yaphank	34	74	7	76	31	78
OH: Painesville	64	76	9	76	8	77
OR: Portland	-31	74	61	71	NS	
PA: Harrisburg	41	74	NS		6	77
SC: Barnwell	257	84	79	78	195	84
SC: Columbia	67	76	51	77	78	80
TN: Knoxville	29	74	51	77	6	77
TN: Nashville	40	74	2	75	60	79
TX: Austin	NS		-19	74	-39	77
TX: El Paso	NS		NS		50	81
UT: Salt Lake City	96	80	57	78	9	79
VA: Lynchburg	62	75	5	75	30	78
WA: Olympia	10	76	50	71	2	79
WI: Madison	26	73	9	76	46	79

Note: NS = No Sample

Plutonium and Uranium in Airborne Particulates and Precipitation

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

Concentrations of plutonium-238, combined plutonium-239 and 240, and uranium-234, 235, and 238 are determined by alpha spectrometry following chemical separation. The volume of air represented by the annual composite ranges from 120,000 to 500,000 cubic meters.

Plutonium and uranium results are published when they become available.

2. Water Program

The ERAMS water program provides data on radionuclide concentrations in the nation's rivers, streams, and drinking water supplies.

Surface Water

Quarterly grab samples are taken downstream from nuclear facilities in as many as 58 stations. Surface water samples are analyzed for tritium quarterly and gamma-emitting radionuclides annually. Tritium is a primary potential radioactive pollutant from nuclear power plants and weapons production activities.

Table 9

Tritium in Surface Water
April - June 1999

Location	Source	Date Collected	^{3}H pCi/L	± 2*u*
AL: Decatur	Tennessee River	04/15/99	-9	80
AL: Gordon	Chattahoochee River	04/01/99	21	75
AL: Scottsboro	Tennessee River	04/15/99	18	82
AR: Little Rock	Arkansas River	04/08/99	27	74
CA: Clay Station	Folsom S. Canal	04/19/99	-32	80
CA: Eureka	Humboldt Bay	04/07/99	22	75
CO: Platteville	South Platte River	04/14/99	-27	80
CT: E. Haddam	Connecticut River	04/09/99	62	76
CT: Waterford	Long Island Sound	04/08/99	1290	120
FL: Crystal River	Gulf Of Mexico	04/19/99	-54	78
FL: Ft. Pierce	Atlantic Ocean	04/20/99	-63	77
FL: Homestead	Biscayne Bay	04/14/99	-16	81
GA: Baxley	Altamaha River	04/23/99	14	80
IA: Cedar Rapids	Cedar River	04/19/99	-6	80
ID: Buhl	Snake River	04/14/99	-10	81
IL: Morris	Illinois River	04/12/99	0	76
KS: Le Roy	Neosho River	06/24/99	105	78
LA: New Orleans	Mississippi River	04/28/99	29	79
MA: Plymouth	Cape Cod Bay	04/27/99	57	81
MD: Conowingo	Susquehanna River	04/13/99	5	76
MD: Lusby	Chesapeake Bay	04/13/99	44	78
ME: Wiscasset	Montseway Bay	04/12/99	-7	73
MI: Bridgman	Lake Michigan	04/12/99	14	80
MI: Charlevoix	Lake Michigan	04/10/99	100	78
MI: Monroe	Lake Erie	04/12/99	49	78
MI: S. Haven	Lake Michigan	04/12/99	98	81
MN: Monticello	Mississippi River	04/26/99	-35	80
MN: Red Wing	Mississippi River	04/19/99	-25	80
MS: Port Gibson	Mississippi River	04/06/99	43	75
NC: Charlotte	Catawba River	04/23/99	323	92
NC: Southport	Atlantic Ocean	04/08/99	-16	73
NV: Boulder City	Colorado River	05/26/99	77	80
NY: Chelsea	Hudson River	04/12/99	-7	76
NY: Croton-On-Hudson	Hudson River	04/16/99	69	83
NY: Oswego	Lake Ontario	06/11/99	181	84
OH: Toledo	Lake Erie	06/29/99	8	74
OR: Bradwood	Columbia River	04/20/99	-27	80
PA: Danville	Susquehanna River	04/14/99	54	78
PA: Philadelphia	Delaware River - Baxter	04/15/99	34	82
PA: Philadelphia	Schuylkill River - Queen	04/15/99	9	81

Table 9 (continued)

Tritium in Surface Water
April - June 1999

Location	Source	Date Collected	^{3}H pCi/L	± 2*u*
SC: Allendale	Savannah River	04/07/99	910	110
SC: Broad River	Broad River	04/06/99	190	82
SC: Hartsville	Lake Robinson	04/21/99	4090	180
TN: Daisy	Tennessee River	04/12/99	217	83
TN: Kingston	Clinch River	04/13/99	2740	160
TN: Oak Ridge	Clinch River	05/17/99	1030	110
TX: Matagorda	Colorado River	04/12/99	12	76
VA: Doswell	North Anna River	04/07/99	3590	170
VA: Newport News	James River	04/21/99	37	79
VT: Vernon	Connecticut River	04/26/99	14	81
WA: Northport	Columbia River	04/05/99	86	77
WA: Richland	Columbia River	05/19/99	-17	76
WI: Two Creeks	Lake Michigan	04/14/99	16	82
WI: Victory	Mississippi River	04/13/99	27	82
WV: Wheeling	Ohio River	04/06/99	-22	72

Drinking Water

This program monitors ambient radiation levels in drinking water in as many as 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) iodine-131 on one quarterly sample per year for each station; and (e) an annual composite for plutonium-238, combined plutonium-239 and 240, and uranium-234, 235, and 238 for stations that demonstrate gross alpha levels greater than 2 pCi/L.

Table 10

Tritium in Drinking Water
April - June 1999

Location	Date Collected	^{3}H pCi/L	± 2*u*
AK: Fairbanks	05/17/99	30	78
AL: Dothan	04/01/99	-60	75
AL: Montgomery	04/01/99	6	79
AL: Muscle Shoals	04/16/99	26	78
AL: Scottsboro	04/15/99	57	80
AR: Little Rock	04/08/99	-10	74
CA: Berkeley	04/09/99	-24	73
CA: Los Angeles	04/06/99	-56	71
CO: Denver	04/14/99	37	78
CO: Platteville	04/14/99	22	77
CT: Hartford	04/05/99	-6	78
DC: Washington	04/29/99	21	78
DE: Dover	04/30/99	-43	75
FL: Miami	04/14/99	-50	75
FL: Tampa	06/21/99	16	77
GA: Baxley	04/20/99	-27	79
GA: Savannah	06/11/99	3	77
HI: Honolulu	04/07/99	-36	76
IA: Cedar Rapids	04/19/99	-51	74
ID: Boise	04/07/99	3	74
ID: Idaho Falls	04/26/99	70	83
IL: Morris	05/03/99	-63	75
IL: W. Chicago	04/23/99	-63	74
KS: Topeka	04/05/99	64	81
LA: New Orleans	04/13/99	132	83
MA: Lawrence	05/19/99	54	80
MD: Baltimore	04/05/99	-19	78
MD: Conowingo	04/13/99	24	75
ME: Augusta	04/22/99	-62	78
MI: Detroit	04/06/99	135	80
MI: Grand Rapids	05/18/99	52	79
MN: Minneapolis	05/03/99	49	80
MN: Red Wing	05/03/99	-68	74
MO: Jefferson City	04/05/99	-40	77
MS: Jackson	04/06/99	-42	72
MS: Port Gibson	04/06/99	-30	72
NC: Charlotte	04/23/99	400	94
NC: Wilmington	04/08/99	39	76
ND: Bismarck	04/07/99	46	76
NE: Lincoln	04/07/99	-5	74

Table 10 (continued)

Tritium in Drinking Water
April - June 1999

Location	Date Collected	^{3}H pCi/L ± 2*u*	
NH: Concord	04/23/99	-2	76
NM: Santa Fe	04/06/99	13	78
NV: Las Vegas	04/02/99	56	77
NY: Albany	04/05/99	11	81
NY: Syracuse	04/22/99	53	79
OH: Cincinnati	06/30/99	36	75
OH: E. Liverpool	06/11/99	850	110
OH: Painesville	04/06/99	183	85
OH: Toledo	04/06/99	73	77
OR: Portland	04/06/99	-20	73
PA: Columbia	04/15/99	-17	76
PA: Harrisburg	04/16/99	-38	75
PA: Philadelphia - Baxter	04/15/99	36	78
PA: Philadelphia - Queen	04/15/99	-19	76
PA: Pittsburgh	06/11/99	46	79
PC: Corozal	04/12/99	2	74
RI: Providence	04/06/99	14	75
SC: Barnwell	04/05/99	-75	70
SC: Columbia	04/06/99	310	87
SC: Jenkinsville	04/27/99	11	81
TN: Chattanooga	04/06/99	193	85
TN: Knoxville	04/13/99	19	78
TN: Oak Ridge - Roane Co #4442	06/23/99	128	81
TN: Oak Ridge - Knox Co#371	06/23/99	78	77
TN: Oak Ridge - Roane Co#360	06/23/99	63	77
TN: Oak Ridge - Anderson Co#768	06/23/99	24	74
TN: Oak Ridge - Anderson Co #772	06/23/99	2	77
TX: Austin	04/19/99	-32	75
VA: Doswell	04/05/99	40	80
WA: Seattle	04/05/99	15	74
WI: Genoa	04/13/99	-65	74
WI: Madison	04/05/99	3	75

3. Milk Program

Pasteurized Milk

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 significant 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.

In April, 1999, the collection of pasteurized milk samples was changed from monthly to quarterly.

Quarterly samples are collected at approximately 55 sampling sites. 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-40. Total potassium concentrations in g/L are determined from potassium-40 activities assuming natural isotopic abundances. All samples collected in July are analyzed for strontium-90.

Iodine-131, barium-140, cesium-137, and potassium-40 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.

Table 11

Radionuclides in Pasteurized Milk
April - June 1999

Location	Date Collected	K g/L ± 2*u*		^{137}Cs pCi/L ± 2*u*		^{140}Ba pCi/L ± 2*u*	^{131}I pCi/L ± 2*u*
AL: Montgomery	04/09/99	1.54	0.15	ND		ND	ND
AR: Little Rock	04/07/99	1.51	0.12	ND		ND	ND
CA: Los Angeles	04/07/99	1.50	0.17	ND		ND	ND
CA: Sacramento	04/20/99	1.58	0.11	ND		ND	ND
CA: San Francisco	04/13/99	1.64	0.12	ND		ND	ND
CT: Hartford	04/08/99	1.60	0.17	ND		ND	ND
FL: Tampa	04/06/99	1.67	0.11	4.4	1.6	ND	ND
GA: Atlanta	04/27/99	1.61	0.15	ND		ND	ND
HI: Honolulu	04/06/99	1.58	0.12	ND		ND	ND
IA: Des Moines	04/05/99	1.61	0.15	ND		ND	ND
IL: Chicago	04/01/99	1.63	0.13	ND		ND	ND
IN: Indianapolis	04/05/99	1.50	0.12	ND		ND	ND
KS: Wichita	04/13/99	1.61	0.13	ND		ND	ND
KY: Louisville	04/05/99	1.55	0.15	ND		ND	ND
MA: Boston	04/09/99	1.51	0.14	ND		ND	ND
MA: Boston	05/07/99	1.49	0.13	ND		ND	ND
MD: Baltimore	04/02/99	1.58	0.13	ND		ND	ND
ME: Portland	04/22/99	1.63	0.13	ND		ND	ND
MI: Detroit	04/13/99	1.57	0.12	ND		ND	ND
MI: Grand Rapids	04/05/99	1.62	0.13	ND		ND	ND
MO: Jefferson City	04/15/99	1.72	0.14	ND		ND	ND
MS: Jackson	04/06/99	1.57	0.12	ND		ND	ND
NC: Charlotte	04/15/99	1.67	0.13	ND		ND	ND
NJ: Trenton	04/09/99	1.64	0.17	ND		ND	ND
NM: Albuquerque	04/21/99	1.81	0.13	ND		ND	ND
NV: Las Vegas	04/05/99	1.62	0.11	ND		ND	ND
NY: Buffalo	04/12/99	1.44	0.17	ND		ND	ND
NY: Syracuse	04/05/99	1.61	0.11	ND		ND	ND
OH: Cincinnati	04/14/99	1.49	0.13	ND		ND	ND
OR: Portland	04/09/99	1.56	0.12	ND		ND	ND
PA: Philadelphia	04/06/99	1.69	0.12	ND		ND	ND
PA: Pittsburgh	04/06/99	1.60	0.12	ND		ND	ND
PA: Pittsburgh	05/03/99	1.51	0.15	ND		ND	ND
PR: San Juan	04/08/99	1.66	0.14	ND		ND	ND
SD: Rapid City	04/14/99	1.58	0.12	ND		ND	ND
TN: Chattanooga	04/12/99	1.47	0.12	ND		ND	ND
TN: Knoxville	04/27/99	1.57	0.13	ND		ND	ND
TN: Memphis	05/21/99	1.57	0.15	ND		ND	ND
TX: Austin	04/20/99	1.45	0.16	ND		ND	ND

Note: ND = Not Detected

Table 11 (continued)

Radionuclides in Pasteurized Milk
April - June 1999

Location	Date Collected	K g/L ± 2*u*		^{137}Cs pCi/L ± 2*u*	^{140}Ba pCi/L ± 2*u*	^{131}I pCi/L ± 2*u*
TX: Austin	05/06/99	1.49	0.13	ND	ND	ND
TX: Ft. Worth	04/19/99	1.56	0.14	ND	ND	ND
VA: Norfolk	04/07/99	1.62	0.12	ND	ND	ND
VT: Burlington	04/28/99	1.68	0.14	ND	ND	ND
WA: Seattle	04/05/99	1.57	0.12	ND	ND	ND
WA: Spokane	04/06/99	1.60	0.12	ND	ND	ND
WV: Charleston	04/05/99	1.58	0.12	ND	ND	ND
WV: Charleston	05/02/99	1.58	0.12	ND	ND	ND

Note: ND = Not Detected

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For More Information

Environmental Radiation Data (ERD) is published quarterly by the U.S. Environmental Protection Agency's Office of Radiation and Indoor Air.

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For System Operations–

Rhonda Sears
National Air and Radiation Environmental Laboratory
540 South Morris Avenue
Montgomery, Alabama 36115-2601
e-mail: sears.rhonda@epa.gov

For Analytical Information and Data–

John Griggs
National Air and Radiation Environmental Laboratory
540 South Morris Avenue
Montgomery, Alabama 36115-2601
e-mail: griggs.john@epa.gov

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Washington, DC 20001
e-mail: conklin.craig@epa.gov

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