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ENVIRONMENTAL RADIATION DATA

REVIEW DRAFT

National Air and Radiation Environmental Laboratory
540 S. Morris Avenue, Montgomery, AL 36115

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ENVIRONMENTAL RADIATION DATA

REPORT 134

April - June 2008

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 RadNet monitoring system (formerly 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 RadNet in 1973 with an emphasis on identifying trends in the accumulation of long-lived radionuclides in the environment. RadNet is comprised of a nationwide network of sampling stations that provide air particulate, precipitation, drinking water, and milk samples.

Sampling locations are selected to provide population and geographic coverage for the United States. The radiation analyses performed on these samples include gross alpha and gross beta analysis, 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 RadNet samples are contained in the *NAREL Radiochemistry Procedures Manual*. 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 RadNet monitoring system (formerly ERAMS) is performed by volunteer collectors who are frequently members of 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 RadNet. 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 sample that is analyte-free.

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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 m^3.

‡ 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 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 5 hours after collection to allow natural radon isotopes and their progeny to 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 analysis in a low background beta counter. Gamma scans are performed on all filters showing gross beta activity greater than 1 pCi/m^3. The laboratory obtained values are usually lower than the field estimates because of the decay of naturally occurring radionuclides during the time between the two measurements.

Precipitation samples are collected at most field stations that collect 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 2008

Location	Number of Samples	5-hour Field Estimate (pCi/m³) Max	Min	Avg	NAREL Lab Measurement (pCi/m³) Max	Min	Avg
AL: Birmingham	7	0.6	0.0	0.2	0.009	0.005	0.007
AL: Montgomery/408	8	0.1	0.0	0.0	0.011	0.005	0.007
AR: Little Rock	7	0.0	0.0	0.0	0.045	0.008	0.017
AZ: Phoenix	5	0.4	0.2	0.3	0.017	0.012	0.014
AZ: Phoenix/956	9	0.5	0.1	0.3	0.022	0.009	0.017
CA: Anaheim	8	0.1	0.0	0.0	0.022	0.006	0.012
CA: Fresno	4	0.0	0.0	0.0	0.011	0.008	0.009
CA: Los Angeles	8	0.2	0.1	0.1	0.019	0.005	0.010
CA: Richmond	4	0.1	0.0	0.1	0.007	0.004	0.005
CA: Riverside	9	0.0	0.0	0.0	0.010	0.004	0.007
CA: San Bernardino Cty.	9	0.0	0.0	0.0	0.014	0.007	0.011
CA: San Diego	4	0.1	0.0	0.1	0.014	0.007	0.011
CA: San Francisco	4	0.0	0.0	0.0	0.005	0.003	0.004
CA: San Jose	8	0.1	0.0	0.0	0.008	0.002	0.004
CO: Denver	8	0.7	0.3	0.5	0.016	0.006	0.010
DC: Washington	8	0.1	0.0	0.1	0.010	0.003	0.006
DE: Wilmington	6	0.5	0.1	0.2	0.012	0.004	0.009
FL: Jacksonville	7	0.1	0.0	0.0	0.009	0.004	0.007
FL: Miami	9	0.0	0.0	0.0	0.037	0.003	0.011
FL: Orlando	5	0.1	0.0	0.0	0.016	0.004	0.011
FL: Tampa	5	0.0	0.0	0.0	0.010	0.006	0.008
GA: Atlanta	4	0.0	0.0	0.0	0.006	0.005	0.005
HI: Honolulu	1				0.006	0.006	0.006
IA: Des Moines	8	0.4	0.0	0.2	0.011	0.005	0.008
IA: Iowa City	8	1.2	0.2	0.5	0.021	0.005	0.012
ID: Idaho Falls	8				0.011	0.006	0.009
IL: Chicago	8	0.7	0.0	0.2	0.018	0.005	0.012
IN: Indianapolis	7	0.6	0.1	0.3	0.023	0.007	0.017
KS: Kansas City	8	0.2	0.1	0.1	0.013	0.005	0.009
KS: Topeka	8	0.4	0.1	0.2	0.015	0.007	0.012
KY: Lexington	3	0.1	0.0	0.0	0.007	0.003	0.005
LA: Baton Rouge	7	0.2	0.0	0.1	0.013	0.005	0.008
MD: Baltimore	5	0.0	0.0	0.0	0.016	0.007	0.011
MI: Detroit	8	0.3	0.0	0.1	0.017	0.005	0.009
MI: Lansing	8	0.2	0.0	0.1	0.016	0.005	0.011
MN: St. Paul	4	0.1	0.0	0.1	0.011	0.005	0.008
MN: Welch/510	5	0.0	0.0	0.0	0.016	0.006	0.011
MO: St. Louis	5	0.0	-0.0	-0.0	0.007	0.003	0.005

Table 2 (continued)
Gross Beta in Airborne Particulates
April 2008

Location	Number of Samples	5-hour Field Estimate Max (pCi/m³)	5-hour Field Estimate Min (pCi/m³)	5-hour Field Estimate Avg (pCi/m³)	NAREL Lab Measurement Max (pCi/m³)	NAREL Lab Measurement Min (pCi/m³)	NAREL Lab Measurement Avg (pCi/m³)
MS: Jackson	7	0.3	0.0	0.1	0.014	0.003	0.008
NC: Charlotte	9	0.2	0.0	0.1	0.011	0.004	0.007
NC: Wilmington	5				0.010	0.004	0.007
ND: Bismarck	4	1.4	0.1	0.6	0.016	0.010	0.012
NH: Concord	7	0.1	0.0	0.0	0.011	0.004	0.007
NJ: Edison	6	0.0	0.0	0.0	0.007	0.001	0.005
NJ: Trenton	8	0.2	0.1	0.1	0.013	0.005	0.009
NM: Santa Fe	1	6.3	6.3	6.3	0.016	0.016	0.016
NV: Las Vegas/913	2				0.008	0.005	0.006
NY: Albany	5	0.0	0.0	0.0	0.012	0.004	0.008
NY: Lockport	8	0.0	-0.0	0.0	0.010	0.003	0.006
NY: New York City	6	0.0	0.0	0.0	0.022	0.006	0.014
NY: Yaphank	8	0.1	0.0	0.1	0.006	0.003	0.005
OH: Cincinnati	8	0.1	0.0	0.0	0.007	0.002	0.005
OH: Cleveland	8	0.1	0.0	0.0	0.017	0.006	0.011
OH: Columbus	4	0.0	0.0	0.0	0.037	0.007	0.015
OH: Painesville	7	0.1	0.0	0.1	0.013	0.006	0.010
OH: Ross	9				0.026	0.006	0.014
OK: Oklahoma City	8	0.1	0.0	0.0	0.007	0.002	0.005
OR: Portland	9	0.1	0.0	0.0	0.013	0.002	0.007
PA: Harrisburg	8	0.7	0.1	0.2	0.025	0.005	0.013
PA: Pittsburgh	5	0.1	0.0	0.0	0.019	0.005	0.008
RI: Providence	4	0.1	0.0	0.1	0.006	0.003	0.005
SC: Barnwell	3	0.0	0.0	0.0	0.009	0.005	0.008
SC: Columbia	3	0.0	0.0	0.0	0.015	0.005	0.011
SD: Pierre	7	3.5	0.5	1.1	0.028	0.002	0.014
TN: Knoxville	8	0.8	0.1	0.3	0.022	0.007	0.012
TN: Memphis	3	0.1	0.0	0.0	0.015	0.011	0.013
TN: Oak Ridge/Bethel	8	0.7	0.1	0.4	0.012	0.006	0.009
TN: Oak Ridge/K25	7	0.8	0.1	0.5	0.011	0.006	0.008
TN: Oak Ridge/Melton	8	0.7	0.2	0.3	0.013	0.008	0.010
TN: Oak Ridge/Y12 E	8	1.0	0.1	0.5	0.013	0.007	0.009
TN: Oak Ridge/Y12 W	8	0.6	0.1	0.2	0.012	0.006	0.009
TX: Austin	9	0.4	0.0	0.2	0.013	0.004	0.010
TX: Austin/Concordia	9	0.2	0.1	0.2	0.047	0.005	0.013
TX: Dallas	9	0.2	0.0	0.1	0.015	0.004	0.008
TX: El Paso	8	0.2	0.1	0.2	0.016	0.010	0.013
TX: Ft. Worth	9	0.1	0.1	0.1	0.007	0.002	0.005

Table 2 (continued)
Gross Beta in Airborne Particulates
April 2008

Location	Number of Samples	5-hour Field Estimate (pCi/m³) Max	Min	Avg	NAREL Lab Measurement (pCi/m³) Max	Min	Avg
TX: Houston	9	0.1	0.0	0.1	0.011	0.005	0.008
TX: San Antonio	9	0.1	0.1	0.1	0.012	0.007	0.010
UT: Salt Lake City	7	0.3	0.0	0.1	0.043	0.009	0.016
VA: Lynchburg	8	0.6	0.1	0.3	0.012	0.004	0.007
VA: Richmond	8	0.0	0.0	0.0	0.009	0.002	0.006
VA: Virginia Beach	9	0.1	0.0	0.0	0.011	0.002	0.006
WA: Olympia	7	0.0	0.0	0.0	0.010	0.003	0.005
WA: Spokane	8	0.6	0.2	0.3	0.014	0.004	0.009
WI: Milwaukee	8	0.3	0.0	0.1	0.025	0.006	0.014

Table 3
Gross Beta in Airborne Particulates
May 2008

Location	Number of Samples	5-hour Field Estimate Max (pCi/m³)	5-hour Field Estimate Min (pCi/m³)	5-hour Field Estimate Avg (pCi/m³)	NAREL Lab Measurement Max (pCi/m³)	NAREL Lab Measurement Min (pCi/m³)	NAREL Lab Measurement Avg (pCi/m³)
AL: Birmingham	9	0.1	0.0	0.0	0.021	0.007	0.012
AL: Montgomery/408	9	0.1	0.0	0.0	0.014	0.007	0.010
AR: Little Rock	5	0.1	0.0	0.0	0.020	0.009	0.014
AZ: Phoenix	4	0.4	0.1	0.2	0.018	0.010	0.013
AZ: Phoenix/956	9	0.5	0.2	0.3	0.023	0.011	0.015
CA: Anaheim	8	0.0	0.0	0.0	0.014	0.004	0.008
CA: Fresno	5	0.6	0.0	0.3	0.013	0.006	0.009
CA: Los Angeles	6	0.2	0.1	0.1	0.013	0.004	0.009
CA: Richmond	4	0.1	0.0	0.0	0.004	0.002	0.004
CA: Riverside	9	0.0	0.0	0.0	0.009	0.002	0.006
CA: San Bernardino Cty.	9	0.3	0.0	0.0	0.012	0.004	0.009
CA: San Diego	4	0.1	0.0	0.0	0.010	0.004	0.007
CA: San Francisco	4	0.0	0.0	0.0	0.004	0.001	0.002
CA: San Jose	9	0.1	0.0	0.1	0.006	0.002	0.003
CO: Denver	9	0.9	0.2	0.5	0.013	0.005	0.009
DC: Washington	9	0.1	0.0	0.1	0.009	0.003	0.005
DE: Wilmington	9	0.8	0.1	0.3	0.016	0.006	0.010
FL: Jacksonville	7	0.0	0.0	0.0	0.011	0.005	0.008
FL: Miami	8	0.0	0.0	0.0	0.015	0.006	0.011
FL: Orlando	9	0.1	0.0	0.0	0.012	0.004	0.008
FL: Tampa	9	0.0	0.0	0.0	0.014	0.006	0.010
GA: Atlanta	4	0.0	0.0	0.0	0.011	0.006	0.008
HI: Honolulu	8	0.1	0.0	0.0	0.007	0.003	0.005
IA: Des Moines	9	0.4	0.1	0.2	0.011	0.005	0.007
IA: Iowa City	9	1.3	0.4	0.8	0.014	0.004	0.009
ID: Idaho Falls	9				0.012	0.004	0.008
IL: Chicago	8	0.2	0.0	0.1	0.017	0.004	0.010
IN: Indianapolis	4	4.0	0.2	1.2	0.024	0.012	0.019
KS: Kansas City	9	0.4	0.0	0.2	0.014	0.005	0.009
KS: Topeka	9	0.4	0.0	0.2	0.014	0.006	0.009
KY: Lexington	8	0.1	0.0	0.0	0.007	0.004	0.006
LA: Baton Rouge	9	0.2	0.0	0.1	0.013	0.007	0.009
MD: Baltimore	4	0.1	0.0	0.1	0.014	0.006	0.009
MI: Detroit	8	0.2	0.0	0.1	0.014	0.003	0.006
MI: Lansing	9	0.2	0.1	0.1	0.015	0.003	0.008
MN: St. Paul	4	0.1	0.0	0.0	0.005	0.002	0.004
MO: St. Louis	5	0.0	-0.0	0.0	0.009	0.004	0.006
MS: Jackson	8	0.1	0.0	0.1	0.017	0.009	0.012

Table 3 (continued)
Gross Beta in Airborne Particulates
May 2008

Location	Number of Samples	5-hour Field Estimate Max (pCi/m³)	5-hour Field Estimate Min (pCi/m³)	5-hour Field Estimate Avg (pCi/m³)	NAREL Lab Measurement Max (pCi/m³)	NAREL Lab Measurement Min (pCi/m³)	NAREL Lab Measurement Avg (pCi/m³)
NC: Charlotte	9	0.9	0.1	0.3	0.065	0.005	0.023
NC: Wilmington	4				0.010	0.007	0.008
ND: Bismarck	2	0.5	0.1	0.3	0.010	0.007	0.008
NE: Lincoln	2	0.2	0.1	0.2	0.006	0.005	0.006
NE: Omaha	3	0.2	0.1	0.2	0.007	0.004	0.005
NH: Concord	7	0.1	0.0	0.1	0.009	0.002	0.006
NJ: Edison	6	0.0	0.0	0.0	0.010	0.003	0.006
NJ: Trenton	9	0.3	0.0	0.1	0.013	0.003	0.007
NV: Las Vegas/913	4				0.010	0.006	0.008
NY: Albany	4	0.1	0.0	0.1	0.009	0.005	0.006
NY: Hauppauge	6	0.1	0.0	0.0	0.004	0.003	0.004
NY: Lockport	9	0.0	0.0	0.0	0.010	0.002	0.005
NY: Yaphank	7	0.0	0.0	0.0	0.008	0.002	0.004
OH: Cincinnati	9	0.1	0.0	0.1	0.012	0.003	0.006
OH: Cleveland	8	0.2	0.0	0.1	0.015	0.005	0.009
OH: Columbus	8	0.0	0.0	0.0	0.011	0.005	0.007
OH: Painesville	7	0.1	0.0	0.1	0.013	0.003	0.008
OH: Ross	8				0.016	0.006	0.012
OK: Oklahoma City	7	0.0	0.0	0.0	0.007	0.004	0.006
OR: Portland	8	0.1	0.0	0.0	0.011	0.003	0.007
PA: Harrisburg	8	0.3	0.1	0.1	0.024	0.006	0.011
PA: Pittsburgh	8	0.2	0.0	0.1	0.013	0.005	0.008
RI: Providence	5	0.1	0.0	0.1	0.007	0.002	0.005
SC: Barnwell	3	0.0	0.0	0.0	0.010	0.006	0.008
SC: Columbia	3	0.3	0.0	0.1	0.011	0.009	0.010
SD: Pierre	6	1.6	0.3	0.9	0.019	0.007	0.011
TN: Knoxville	9	0.3	0.1	0.2	0.019	0.005	0.009
TN: Memphis	3	0.1	0.0	0.0	0.066	0.005	0.030
TN: Oak Ridge/Bethel	8	0.6	0.1	0.3	0.018	0.007	0.012
TN: Oak Ridge/K25	8	0.6	0.1	0.4	0.016	0.007	0.011
TN: Oak Ridge/Melton	8	0.7	0.1	0.4	0.017	0.008	0.012
TN: Oak Ridge/Y12 E	8	0.6	0.1	0.4	0.018	0.007	0.011
TN: Oak Ridge/Y12 W	8	0.3	0.1	0.2	0.017	0.007	0.012
TX: Austin	9	0.7	0.1	0.3	0.014	0.007	0.011
TX: Austin/Concordia	9	0.2	0.1	0.2	0.012	-0.004	0.008
TX: Dallas	8	0.2	0.1	0.1	0.011	0.005	0.006
TX: El Paso	9	0.3	0.1	0.2	0.015	0.009	0.011
TX: Ft. Worth	9	0.2	0.0	0.1	0.008	0.005	0.006

Table 3 (continued)
Gross Beta in Airborne Particulates
May 2008

Location	Number of Samples	5-hour Field Estimate (pCi/m³) Max	Min	Avg	NAREL Lab Measurement (pCi/m³) Max	Min	Avg
TX: Houston	8	0.1	0.0	0.0	0.034	0.006	0.014
TX: San Antonio	8	0.8	0.0	0.3	0.014	0.005	0.010
UT: Salt Lake City	8	0.4	0.0	0.2	0.018	0.009	0.012
VA: Lynchburg	8	0.8	0.1	0.4	0.015	0.006	0.010
VA: Richmond	9	0.1	0.0	0.0	0.010	0.002	0.007
VA: Virginia Beach	7	0.1	0.0	0.0	0.010	0.004	0.006
WA: Olympia	9	0.1	0.0	0.0	0.007	0.001	0.003
WA: Spokane	9	0.6	0.1	0.3	0.013	0.003	0.007
WI: Milwaukee	9	0.3	0.0	0.1	0.024	0.005	0.011
WV: Charleston	2	0.0	0.0	0.0	0.007	0.006	0.006

Table 4
Gross Beta in Airborne Particulates
June 2008

Location	Number of Samples	5-hour Field Estimate (pCi/m³)			NAREL Lab Measurement (pCi/m³)		
		Max	Min	Avg	Max	Min	Avg
AK: Anchorage	3				0.003	0.002	0.002
AL: Birmingham	4	0.1	0.0	0.1	0.010	0.007	0.008
AL: Montgomery/408	8	0.1	0.0	0.1	0.011	0.005	0.008
AR: Little Rock	9	0.2	0.0	0.1	0.015	0.005	0.009
AZ: Phoenix	4	0.6	0.2	0.4	0.016	0.012	0.014
AZ: Phoenix/956	10	0.1	-0.1	0.0	0.020	0.006	0.015
CA: Anaheim	8	0.0	0.0	0.0	0.011	0.006	0.009
CA: Fresno	5	0.4	0.0	0.2	0.011	0.004	0.008
CA: Los Angeles	8	0.2	0.1	0.1	0.010	0.006	0.008
CA: Richmond	4	0.1	0.0	0.0	0.005	0.002	0.004
CA: Riverside	8	0.0	0.0	0.0	0.009	0.005	0.007
CA: San Bernardino Cty.	8	0.1	0.0	0.0	0.015	0.008	0.012
CA: San Diego	4	0.0	0.0	0.0	0.010	0.004	0.007
CA: San Francisco	4	0.0	0.0	0.0	0.005	0.001	0.003
CA: San Jose	9	0.1	0.0	0.1	0.005	0.001	0.004
CO: Denver	9	0.8	0.2	0.3	0.016	0.005	0.008
DC: Washington	7	0.1	0.0	0.0	0.008	0.002	0.005
DE: Wilmington	8	1.1	0.1	0.5	0.010	0.006	0.008
FL: Jacksonville	4	0.0	0.0	0.0	0.007	0.005	0.006
FL: Miami	9	0.0	0.0	0.0	0.012	0.003	0.007
FL: Orlando	7	0.0	0.0	0.0	0.013	0.005	0.007
FL: Tampa	9	0.0	0.0	0.0	0.014	0.004	0.007
GA: Atlanta	4	0.0	0.0	0.0	0.013	0.006	0.009
HI: Honolulu	9	0.1	0.0	0.0	0.004	0.001	0.002
IA: Des Moines	9	0.5	0.0	0.2	0.009	0.004	0.006
IA: Iowa City	9	1.7	0.2	0.8	0.009	0.004	0.007
ID: Idaho Falls	9	1.1	0.5	0.8	0.013	0.005	0.008
IL: Chicago	9	0.2	0.0	0.1	0.011	0.004	0.008
KS: Kansas City	8	0.3	0.0	0.2	0.015	0.006	0.010
KS: Topeka	9	0.4	0.1	0.2	0.012	0.005	0.008
KY: Lexington	7	0.1	0.0	0.0	0.008	0.004	0.007
LA: Baton Rouge	9	0.2	0.1	0.1	0.009	0.004	0.007
MD: Baltimore	4	0.1	0.0	0.1	0.010	0.009	0.010
MI: Detroit	9	0.1	0.0	0.1	0.010	0.002	0.006
MI: Lansing	9	0.3	0.0	0.1	0.010	0.002	0.006
MN: St. Paul	4	0.1	0.0	0.0	0.006	0.003	0.004
MO: St. Louis	2	-0.0	-0.0	-0.0	0.004	0.003	0.003
MS: Jackson	7	0.2	0.0	0.1	0.017	0.006	0.010

Table 4 (continued)
Gross Beta in Airborne Particulates
June 2008

Location	Number of Samples	5-hour Field Estimate (pCi/m³) Max	Min	Avg	NAREL Lab Measurement (pCi/m³) Max	Min	Avg
NC: Charlotte	3	0.1	0.0	0.1	0.013	0.004	0.010
NC: Wilmington	3				0.009	0.007	0.008
ND: Bismarck	6	1.2	0.2	0.7	0.013	0.003	0.009
NE: Lincoln	9	0.6	0.1	0.2	0.008	0.004	0.006
NE: Omaha	7	0.3	0.0	0.1	0.008	0.004	0.006
NH: Concord	5	0.2	0.0	0.1	0.008	0.005	0.006
NJ: Edison	6	0.0	0.0	0.0	0.006	0.003	0.005
NJ: Trenton	7	0.3	0.1	0.2	0.009	0.005	0.007
NV: Las Vegas/913	2				0.009	0.006	0.007
NY: Albany	4	0.0	0.0	0.0	0.006	0.005	0.006
NY: Hauppauge	9	0.1	0.0	0.0	0.007	0.003	0.005
NY: Lockport	9	0.0	0.0	0.0	0.009	0.001	0.006
NY: Yaphank	9	0.1	0.0	0.0	0.009	0.003	0.005
OH: Cincinnati	8	0.2	0.0	0.1	0.007	0.002	0.005
OH: Cleveland	9	0.1	0.0	0.0	0.012	0.004	0.010
OH: Columbus	7	0.0	-0.0	0.0	0.010	0.004	0.007
OH: Painesville	7	0.1	0.0	0.1	0.009	0.003	0.007
OH: Ross	8				0.028	0.007	0.012
OK: Oklahoma City	8	0.0	0.0	0.0	0.007	0.002	0.004
OR: Portland	4	0.1	0.0	0.0	0.007	0.003	0.005
PA: Harrisburg	9	0.7	0.1	0.3	0.013	0.007	0.010
PA: Pittsburgh	8	0.2	0.0	0.1	0.011	0.003	0.007
RI: Providence	4	0.1	0.0	0.1	0.007	0.004	0.005
SC: Barnwell	3	0.1	0.0	0.0	0.008	0.007	0.008
SC: Columbia	1	0.1	0.1	0.1	0.013	0.013	0.013
SD: Pierre	8	2.0	0.4	1.0	0.013	0.006	0.010
TN: Knoxville	9	0.5	0.2	0.4	0.010	0.004	0.007
TN: Memphis	2	0.0	0.0	0.0	0.009	0.006	0.008
TN: Oak Ridge/Bethel	9	1.2	0.2	0.6	0.025	0.007	0.012
TN: Oak Ridge/K25	9	1.2	0.2	0.6	0.025	0.006	0.011
TN: Oak Ridge/Melton	9	1.0	0.2	0.6	0.023	0.008	0.012
TN: Oak Ridge/Y12 E	9	1.0	0.2	0.6	0.021	0.007	0.012
TN: Oak Ridge/Y12 W	9	0.6	0.1	0.3	0.018	0.005	0.011
TX: Austin	7	0.3	0.0	0.2	0.013	0.004	0.007
TX: Dallas	7	0.3	0.1	0.2	0.009	0.003	0.006
TX: El Paso	7	0.3	0.0	0.2	0.012	0.006	0.010
TX: Ft. Worth	8	0.2	0.0	0.1	0.007	0.003	0.004
TX: Houston	7	0.8	0.1	0.2	0.029	-0.005	0.008

Table 4 (continued)
Gross Beta in Airborne Particulates
June 2008

Location	Number of Samples	5-hour Field Estimate (pCi/m³) Max	Min	Avg	NAREL Lab Measurement (pCi/m³) Max	Min	Avg
TX: San Antonio	7	0.8	0.0	0.4	0.009	0.004	0.006
UT: Salt Lake City	2	0.3	0.1	0.2	0.015	0.009	0.012
VA: Lynchburg	8	1.0	0.1	0.6	0.013	0.006	0.010
VA: Richmond	7	0.0	0.0	0.0	0.011	0.006	0.009
VA: Virginia Beach	7	0.1	0.0	0.1	0.011	0.007	0.009
WA: Olympia	9	0.1	0.0	0.0	0.004	0.001	0.002
WA: Seattle	8	0.0	-0.0	0.0	0.004	0.002	0.003
WA: Spokane	9	0.2	0.0	0.1	0.009	0.002	0.005
WI: Milwaukee	7	0.5	0.0	0.2	0.017	0.009	0.012
WV: Charleston	5	0.0	-0.0	0.0	0.011	0.007	0.009

Table 5
Gross Beta and Specific Gamma in Precipitation
April 2008

Location	Gross Beta Activity pCi/L	± 2*u*	Gamma-Emitting Radionuclides Nuclide	pCi/L	± 2*u*
AL: Montgomery/408	1.97	0.45	Be7	27	18
			Pb212	1.7	2.4
AR: Little Rock	0.23	0.59	Be7	24	18
			K40	17	14
CA: Richmond	1.7	2.9	Tl208	14	14
CO: Denver	6.3	1.2	Be7	37	17
CT: Hartford	1.45	0.41	Be7	39	19
DE: Wilmington	1.80	0.45	Be7	34	17
FL: Jacksonville	1.63	0.45		ND	
GA: Atlanta	1.65	0.43	Be7	51	12
			Pb212	1.0	1.0
IA: Iowa City	0.20	0.58		ND	
ID: Idaho Falls	0.67	0.64		ND	
KS: Kansas City	1.04	0.63	Be7	48	18
MA: Boston	1.88	0.43	Be7	55	18
MI: Lansing	1.14	0.69	Be7	54	42
			K40	20	35
MN: St. Paul	1.53	0.70		ND	
NC: Charlotte	1.14	0.38	Be7	38	19
			Tl208	0.9	1.2
NC: Wilmington	1.42	0.41	Tl208	1.3	1.3
ND: Bismarck	1.19	0.70		ND	
NY: Albany	1.61	0.43	Be7	27	18
NY: Yaphank	2.64	0.53	Be7	39	10
OH: Painesville	1.30	0.65		ND	
OR: Portland	1.18	0.64		ND	
PA: Harrisburg	1.99	0.46		ND	
TN: Knoxville	1.12	0.37	Be7	95	38
TN: Oak Ridge/K25	1.9	1.6	Be7	47	18
TN: Oak Ridge/Melton	2.10	0.47	Be7	34	18
TN: Oak Ridge/Y12 E	1.51	0.40	Be7	44	18
TX: Austin	1.85	0.75		ND	
UT: Salt Lake City	1.83	0.76		ND	
VA: Lynchburg	1.02	0.36	Be7	82	38
			K40	21	34
			Pb212	5.9	6.7
WA: Olympia	1.17	0.64	Be7	35	17

Note: ND = Not Detected

Table 6
Gross Beta and Specific Gamma in Precipitation
May 2008

Location	Gross Beta Activity pCi/L	± 2*u*	Gamma-Emitting Radionuclides Nuclide	pCi/L	± 2*u*
AL: Montgomery/408	1.65	0.43	Be7	39	16
			Tl208	1.6	1.3
AR: Little Rock	1.49	0.41	Be7	31.2	9.8
CA: Richmond	0.89	0.65		ND	
CO: Denver	1.25	0.39		ND	
CT: Hartford	2.14	0.48	Be7	81	19
DE: Wilmington	1.13	0.39	Be7	29	14
			K40	9	12
FL: Jacksonville	0.86	0.38		ND	
GA: Atlanta	1.61	0.43	Be7	54	16
			Th227	4.2	3.6
IA: Iowa City	1.26	0.39		ND	
ID: Idaho Falls	5.4	1.3	K40	28	46
KS: Kansas City	1.66	0.43	Be7	29.7	8.8
			Pb212	0.70	0.82
MA: Boston	4.96	0.74	Be7	118	22
MI: Lansing	1.69	0.46		ND	
MN: St. Paul	1.82	0.45	Be7	35	18
			K40	12	13
			Tl208	1.0	1.3
NC: Charlotte	2.09	0.48	Be7	100	32
			Pb212	4.5	5.9
NC: Wilmington	0.64	0.34	K40	19	34
			Pb212	9.7	6.0
NY: Albany	4.28	0.71	Be7	32	14
NY: Yaphank	1.61	0.43	Be7	29	14
OH: Painesville	1.59	0.42		ND	
OR: Portland	1.65	0.42	Be7	31	21
PA: Harrisburg	3.23	0.58	Be7	71	32
			K40	32	34
TN: Knoxville	1.68	0.44	Pb212	10.2	5.9
			Tl208	2.8	3.3
TN: Nashville	0.90	0.35	Be7	65	36
			K40	37	36
			Pb212	5.2	6.3
TN: Oak Ridge/K25	1.85	0.44	Be7	80	19
			K40	12	13

Note: ND = Not Detected

Table 6 (continued)
Gross Beta and Specific Gamma in Precipitation
May 2008

Location	Gross Beta Activity pCi/L	± 2*u*	Gamma-Emitting Radionuclides Nuclide	pCi/L	± 2*u*
TN: Oak Ridge/Melton	3.49	0.60	Be7	58	18
TN: Oak Ridge/Y12 E	1.96	0.47	Be7	58	17
TX: Austin	4.41	0.72	Be7	30	27
UT: Salt Lake City	3.68	0.65	Be7	18	15
VA: Lynchburg	2.69	0.53		ND	
WA: Olympia	5.64	0.83	Be7	152	33

Note: ND = Not Detected

Table 7
Gross Beta and Specific Gamma in Precipitation
June 2008

Location	Gross Beta Activity pCi/L	± 2*u*	Gamma-Emitting Radionuclides Nuclide	pCi/L	± 2*u*
AL: Montgomery/408	0.78	0.34		ND	
AR: Little Rock	0.74	0.39		ND	
CO: Denver	1.41	0.40		ND	
CT: Hartford	3.71	0.63	Be7	89	20
DE: Wilmington	1.15	0.40		ND	
FL: Jacksonville	1.57	0.45	K40	11	12
GA: Atlanta	3.02	0.56	Be7	110	38
			Pb212	5.2	6.8
IA: Iowa City	1.12	0.43		ND	
ID: Idaho Falls	1.51	0.45		ND	
MA: Boston	3.70	0.62	Be7	92	20
MI: Lansing	1.49	0.44	Be7	18	13
			K40	11	12
MN: St. Paul	1.49	0.41		ND	
NC: Wilmington	0.78	0.35	Pb212	3.9	6.2
ND: Bismarck	1.52	0.41	K40	8	12
NH: Concord	3.19	0.58	Be7	72	40
NY: Albany	2.32	0.50	Be7	53	17
NY: Yaphank	7.6	1.9	Be7	28	15
OH: Painesville	1.99	0.46	Be7	42	16
PA: Harrisburg	6.89	0.96		ND	
TN: Knoxville	2.33	0.52		ND	
TN: Oak Ridge/K25	1.88	0.45	Be7	76	20
			K40	20	13
			Tl208	1.3	1.4
TN: Oak Ridge/Melton	3.03	0.57	Be7	52	17
TN: Oak Ridge/Y12 E	1.98	0.52	Be7	37	16
			K40	10	11
TX: Austin	3.1	1.4		ND	
UT: Salt Lake City	1.35	0.46	Tl208	3.6	3.3
VA: Lynchburg	4.26	0.69		ND	
WA: Olympia	0.87	0.35	Be7	18	16
			K40	9	13

Note: ND = Not Detected

Table 8
Tritium in Precipitation
April - June 2008

Location	April 2008 pCi/L	± 2*u*	May 2008 pCi/L	± 2*u*	June 2008 pCi/L	± 2*u*
AL: Montgomery/408	-3	72	23	86	27	80
AR: Little Rock	11	87	54	79	-73	75
CA: Richmond	30	88	79	79	NS	
CO: Denver	22	87	57	78	-34	77
CT: Hartford	17	74	84	90	58	82
DE: Wilmington	42	74	40	88	-12	79
FL: Jacksonville	-22	72	-9	84	12	79
GA: Atlanta	-2	73	53	87	23	80
IA: Iowa City	0	73	108	81	-37	77
ID: Idaho Falls	45	88	75	79	-64	75
KS: Kansas City	17	88	113	82	-39	77
MA: Boston	-2	72	65	89	38	80
MI: Lansing	76	76	30	87	75	82
MN: St. Paul	-20	71	77	79	56	82
NC: Charlotte	23	74	-13	84	NS	
NC: Wilmington	-12	72	47	88	17	80
ND: Bismarck	28	88	NS		66	82
NH: Concord	NS		NS		59	81
NY: Albany	25	74	15	86	-13	78
NY: Yaphank	27	75	4	86	81	83
OH: Painesville	-3	72	8	86	14	80
OR: Portland	-2	86	55	79	NS	
PA: Harrisburg	67	81	53	88	17	79
TN: Knoxville	16	74	37	87	-6	79
TN: Nashville	NS		-6	85	NS	
TN: Oak Ridge/K25	91	77	26	86	-40	76
TN: Oak Ridge/Melton	116	77	137	91	71	82
TN: Oak Ridge/Y12 E	72	76	2	85	-36	76
TX: Austin	44	89	120	82	-42	77
UT: Salt Lake City	60	89	27	77	-43	76
VA: Lynchburg	33	74	27	88	25	80
WA: Olympia	9	86	70	80	-31	76

Note: NS = No Sample

Plutonium and Uranium in Airborne Particulates

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-particle spectrometry following chemical separation. The volume of air represented by the annual composite typically ranges from 120,000 to 500,000 cubic meters.

Plutonium and uranium results are published when they become available.

Beta Activity in Precipitation

All stations routinely submit precipitation samples as rainfall, snow, or sleet occurs. The precipitation samples are composited at NAREL into single monthly samples for each station. Each month that precipitation occurs, an aliquant of the composited sample is analyzed for gross beta, tritium, and gamma-emitting radionuclides.

2. Drinking Water Program

The RadNet drinking water program provides data on radionuclide concentrations in the nation's drinking water supplies. Samples are taken at 78 sites which are either major population centers or selected nuclear facility environs.

Drinking water data are used 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.

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 9
Tritium in Drinking Water
April - June 2008

Location	Date Collected	^{3}H pCi/L	± 2*u*
AK: Fairbanks	05/07/08	-4	87
AL: Dothan	04/01/08	18	86
AL: Montgomery	04/03/08	-27	83
AL: Muscle Shoals	04/15/08	49	90
AL: Scottsboro	04/14/08	9	88
AR: Little Rock	04/02/08	27	83
CA: Los Angeles	04/02/08	74	85
CA: Richmond	04/02/08	6	80
CO: Denver	04/01/08	47	86
CT: Hartford	04/04/08	17	80
DE: Dover	04/01/08	4	74
FL: Miami	04/07/08	61	85
FL: Tampa	04/07/08	40	85
GA: Baxley	05/21/08	-28	88
GA: Savannah	05/28/08	-49	85
HI: Honolulu	06/27/08	-31	75
IA: Cedar Rapids	04/04/08	14	75
ID: Boise	04/28/08	17	81
ID: Idaho Falls	04/14/08	24	89
IL: Morris	04/03/08	-33	79
IL: W. Chicago	04/07/08	-15	81
KS: Topeka	04/01/08	33	85
LA: New Orleans	06/25/08	65	80
MD: Baltimore	04/01/08	2	84
MD: Conowingo	04/15/08	-15	87
MI: Detroit	04/01/08	42	82
MI: Grand Rapids	04/30/08	10	90
MN: St. Paul	04/23/08	-20	86
MN: Welch - Red Wing Location Ch	04/08/08	-14	74
MO: Jefferson City	04/07/08	48	76
MS: Jackson	04/02/08	-31	83
MS: Port Gibson	04/02/08	-17	85
MT: Helena	04/09/08	29	75
NC: Raleigh	04/21/08	6	88
ND: Bismarck	04/29/08	-31	80
NE: Lincoln	04/04/08	-4	79
NJ: Trenton	04/04/08	-21	77
NJ: Waretown	04/08/08	-23	73
NM: Santa Fe	05/07/08	4	88
NY: Albany	04/03/08	33	81

Table 9 (continued)
Tritium in Drinking Water
April - June 2008

Location	Date Collected	^{3}H pCi/L	± 2*u*
NY: New York City	04/30/08	-62	85
NY: Niagara Falls	05/14/08	-45	87
NY: Syracuse	04/17/08	15	88
OH: Cincinnati	05/13/08	29	91
OH: Columbus	05/21/08	36	91
OH: E. Liverpool	04/23/08	6	87
OH: Painesville	04/30/08	70	91
OH: Toledo	04/03/08	-30	77
PA: Columbia	04/16/08	0	90
PA: Harrisburg	04/16/08	15	88
PA: Philadelphia/Baxter	04/28/08	57	91
PA: Philadelphia/Belmont	04/28/08	19	88
PA: Philadelphia/Queen	04/28/08	-22	87
PA: Pittsburgh	04/22/08	58	90
RI: Providence	04/03/08	-50	77
SC: Barnwell	04/01/08	24	83
SC: Columbia	04/28/08	35	89
SC: Jenkinsville	04/04/08	78	86
SC: Seneca	04/02/08	51	84
TN: Chattanooga	04/01/08	24	86
TN: Knoxville	04/17/08	11	88
TN: Oak Ridge/#360	04/01/08	0	84
TN: Oak Ridge/#371	04/01/08	-27	82
TN: Oak Ridge/#4442	04/01/08	167	92
TN: Oak Ridge/#768	04/01/08	-23	80
TN: Oak Ridge/#772	04/01/08	-37	83
TX: Austin	04/02/08	18	83
VA: Ashland	04/10/08	1370	130
VA: Lynchburg	04/03/08	8	80
WA: Richland	04/11/08	98	80
WA: Seattle	04/09/08	10	76

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3. Milk Program

Pasteurized Milk

Milk is a reliable indicator of the general population's intake of certain 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.

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. During the third quarter collection, one-fourth of the samples are also analyzed for strontium-90 on a four year rotating schedule.

Table 10

Radionuclides in Pasteurized Milk

April - June 2008

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*
AR: Little Rock	06/23/08	1.58 0.20	ND	ND	ND
AZ: Phoenix	06/10/08	1.53 0.20	ND	ND	ND
CA: San Francisco	04/02/08	1.57 0.20	ND	ND	ND
DE: Wilmington	06/18/08	1.58 0.20	ND	ND	ND
FL: Tampa	04/07/08	1.53 0.23	ND	ND	ND
IA: Des Moines	04/16/08	1.53 0.20	ND	ND	ND
KS: Wichita	04/07/08	1.73 0.21	ND	ND	ND
KY: Louisville	04/07/08	1.63 0.20	ND	ND	ND
MA: Boston	06/02/08	1.55 0.23	ND	ND	ND
MD: Baltimore	04/04/08	1.58 0.20	ND	ND	ND
MI: Detroit	05/20/08	1.58 0.20	ND	ND	ND
MO: Jefferson City	04/17/08	1.56 0.20	ND	ND	ND
NJ: Trenton	04/04/08	1.70 0.21	ND	ND	ND
NM: Albuquerque	04/21/08	1.53 0.23	ND	ND	ND
NY: Buffalo	04/04/08	1.47 0.19	ND	ND	ND
NY: Syracuse	04/04/08	1.61 0.20	ND	ND	ND
OH: Cincinnati	04/22/08	1.57 0.21	ND	ND	ND
OH: Cleveland	05/12/08	1.55 0.19	ND	ND	ND
OR: Portland	04/07/08	1.53 0.19	ND	ND	ND
TN: Chattanooga	05/14/08	1.69 0.25	ND	ND	ND
TN: Knoxville	04/23/08	1.53 0.19	ND	ND	ND
TN: Memphis	04/07/08	1.53 0.19	ND	ND	ND
TX: Austin	04/07/08	1.49 0.20	ND	ND	ND
TX: Dallas	04/28/08	1.54 0.19	ND	ND	ND
VT: Montpelier	06/26/08	1.57 0.20	ND	ND	ND
WA: Spokane	04/01/08	1.54 0.19	ND	ND	ND
WA: Tacoma	06/30/08	1.55 0.23	ND	ND	ND
WV: Charleston	04/04/08	1.57 0.20	ND	ND	ND

Note: ND = Not Detected

For More Information

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

Requests for information concerning the operation of RadNet and the data that are generated should be directed as follows:

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