ENVIRONMENTAL

RADIATION

DATA

REPORT 156

October–December 2013

United States Environmental Protection Agency

Office of Radiation and Indoor Air

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Preface

Environmental Radiation Data (ERD) contains data from the RadNet monitoring system (formerly ERAMS), which is operated by the Office of Radiation and Indoor Air's National Analytical Radiation Environmental Laboratory (NAREL) in Montgomery, Alabama. ERD is published in both hard-copy and electronic formats. Electronic reports are available online at http://www.epa.gov/narel. RadNet data are also available online in a searchable database at:

http://www.epa.gov/enviro/facts/radnet

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 RadNet samples may include gross alpha and gross beta analysis, gamma analyses, and radionuclide-specific analyses for isotopes of uranium, plutonium, strontium, iodine, radium, and tritium. This monitoring effort also provides information on natural background levels and possible accidental releases into the environment.

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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 Analytical 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	0.0006
	Water	pCi/L	2
	Precipitation	pCi/L	2
Tritium	Water	pCi/L	150
* Plutonium-238,239/240	Air	aCi/m³	6
	Water	pCi/L	0.3
† Uranium-234,238	Air	aCi/m³	7.5
	Water	pCi/L	0.35
† Uranium-235	Air	aCi/m³	9
	Water	pCi/L	0.4
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 10,000 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 MDCs for air are based on an assumed total sample volume of 10,000 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. Continuous air samplers collect airborne particulates at field stations representing wide geographic coverage throughout the United States.

Filters (10 cm diameter synthetic fiber) from air samplers are changed routinely, and generally field measurements are made with a dual-phosphor scintillation counter at least 5 hours after collection to allow ^{222}Rn progeny to decay. Field estimates are reported to appropriate EPA officials by telephone or mail depending on the activity levels found; however, as of the first quarter of 2012, NAREL no longer reports field estimates in *Environmental Radiation Data*.

The filters are sent to NAREL for more sensitive analysis in a gas proportional counter. Gamma scans are performed on all filters showing gross beta activity greater than 1 pCi/m^3.

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 gamma-emitting radionuclides. NAREL discontinued gross beta analysis of precipitation in January 2010 and discontinued tritium analysis of precipitation in January 2012.

Table 2
Gross Beta in Airborne Particulates
October 2013

Location	Number of Samples	NAREL Lab Measurement (pCi/m³) Max	Min	Avg
AK: Anchorage	5	0.003	0.001	0.002
AK: Fairbanks	10	0.007	0.002	0.003
AK: Juneau	4	0.001	0.001	0.001
AL: Birmingham	9	0.017	0.006	0.010
AL: Montgomery/408	5	0.017	0.006	0.011
AR: Fort Smith	5	0.013	0.005	0.010
AR: Little Rock	7	0.017	0.005	0.009
AZ: Phoenix/956	7	0.023	0.011	0.017
AZ: Tucson	7	0.017	0.008	0.012
CA: Anaheim	7	0.032	0.004	0.017
CA: Eureka	4	0.006	0.002	0.004
CA: Fresno	2	0.059	0.051	0.055
CA: Los Angeles	6	0.037	0.009	0.019
CA: Richmond	5	0.017	0.003	0.009
CA: Riverside	9	0.054	0.008	0.021
CA: Sacramento	9	0.051	0.003	0.025
CA: San Bernardino Cty.	7	0.026	0.010	0.015
CA: San Diego	5	0.027	0.006	0.016
CA: San Francisco	9	0.016	0.002	0.010
CA: San Jose	3	0.022	0.007	0.016
CO: Colorado Springs	3	0.012	0.007	0.010
CO: Denver	9	0.027	0.008	0.015
CO: Grand Junction	4	0.013	0.008	0.011
CT: Hartford	2	0.006	0.004	0.005
DC: Washington	5	0.014	0.004	0.008
DE: Dover	2	0.007	0.005	0.006
FL: Jacksonville	8	0.015	0.003	0.008
FL: Miami	3	0.005	0.003	0.004
FL: Orlando	6	0.005	0.003	0.004
FL: Tallahassee	4	0.008	0.005	0.006
FL: Tampa	7	0.014	0.004	0.008
GA: Atlanta	2	0.014	0.012	0.013
GA: Augusta	6	0.010	0.004	0.007
HI: Honolulu	9	0.003	0.001	0.002
IA: Des Moines	7	0.010	0.004	0.007
IA: Mason City	4	0.012	0.005	0.007
ID: Boise	2	0.016	0.010	0.013
ID: Idaho Falls	9	0.024	0.007	0.013

Table 2 (continued)
Gross Beta in Airborne Particulates
October 2013

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
IL: Aurora	8	0.013	0.006	0.010
IL: Champaign	8	0.010	0.005	0.006
IL: Chicago	2	0.011	0.007	0.009
IN: Fort Wayne	3	0.013	0.012	0.013
IN: Indianapolis	9	0.020	0.007	0.011
KS: Kansas City	4	0.009	0.008	0.008
KS: Wichita	6	0.010	0.006	0.008
KY: Lexington	8	0.018	0.008	0.013
KY: Louisville	8	0.016	0.006	0.011
LA: Baton Rouge	8	0.013	0.004	0.008
LA: Shreveport	2	0.009	0.007	0.008
MA: Boston	7	0.009	0.005	0.007
MA: Worcester	9	0.013	0.005	0.009
MD: Baltimore	7	0.016	0.004	0.010
ME: Orono	3	0.010	0.007	0.009
ME: Portland	8	0.008	0.002	0.004
MI: Bay City 48708	9	0.008	0.003	0.006
MI: Detroit	9	0.010	0.004	0.007
MI: Grand Rapids	5	0.011	0.006	0.008
MN: Duluth	5	0.007	0.003	0.004
MN: St. Paul	5	0.010	0.004	0.006
MO: Jefferson City	8	0.010	0.004	0.007
MO: Springfield	9	0.013	0.005	0.009
MO: St. Louis	5	0.011	0.005	0.008
MS: Jackson/Deq	3	0.013	0.006	0.009
MT: Billings	4	0.010	0.005	0.008
NC: Charlotte	8	0.013	0.003	0.008
NC: Greensboro	2	0.014	0.007	0.011
NC: Wilmington	5	0.009	0.003	0.006
ND: Bismarck	6	0.008	0.005	0.007
NE: Kearney	8	0.011	0.006	0.008
NE: Lincoln	8	0.011	0.003	0.006
NE: Omaha	3	0.009	0.006	0.007
NH: Concord	6	0.008	0.003	0.005
NJ: Edison	6	0.014	0.006	0.009
NM: Albuquerque	3	0.020	0.010	0.014
NM: Carlsbad	7	0.012	0.003	0.007
NM: Navajo Lake St Park	5	0.016	0.010	0.013

Table 2 (continued)
Gross Beta in Airborne Particulates
October 2013

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
NV: Las Vegas/913	9	0.013	0.004	0.008
NV: Reno	8	0.022	0.006	0.014
NY: Albany	8	0.014	0.005	0.009
NY: Lockport	7	0.010	0.004	0.007
NY: New York City	3	0.006	0.006	0.006
NY: Rochester	6	0.010	0.003	0.006
NY: Syracuse	3	0.011	0.005	0.008
NY: Yaphank	7	0.010	0.002	0.005
OH: Cincinnati	10	0.014	0.006	0.009
OH: Cleveland	9	0.018	0.007	0.012
OH: Painesville	9	0.015	0.005	0.009
OH: Toledo	9	0.010	0.004	0.007
OK: Oklahoma City	8	0.012	0.008	0.011
OK: Tulsa	9	0.012	0.005	0.008
OR: Corvallis	5	0.018	0.003	0.010
OR: Portland	10	0.013	0.002	0.006
PA: Bloomsburg	8	0.011	0.003	0.006
PA: Philadelphia	5	0.017	0.006	0.009
PA: Pittsburgh	6	0.016	0.005	0.009
PR: San Juan	6	0.013	0.002	0.007
RI: Providence	4	0.011	0.006	0.008
SC: Columbia	8	0.019	0.005	0.012
SD: Pierre	8	0.014	0.005	0.008
SD: Rapid City	6	0.010	0.005	0.008
TN: Knoxville	3	0.018	0.012	0.014
TN: Memphis	6	0.014	0.006	0.009
TN: Nashville	9	0.014	0.006	0.010
TN: Oak Ridge/Bethel	9	0.023	0.008	0.014
TN: Oak Ridge/K25	8	0.023	0.009	0.014
TN: Oak Ridge/Melton	9	0.020	0.006	0.011
TN: Oak Ridge/Y12 E	9	0.028	0.008	0.015
TN: Oak Ridge/Y12 W	9	0.026	0.008	0.014
TX: Amarillo	6	0.025	0.010	0.015
TX: Austin	4	0.011	0.006	0.008
TX: Dallas	6	0.011	0.005	0.008
TX: El Paso	8	0.027	0.012	0.018
TX: Ft. Worth	4	0.012	0.005	0.009
TX: Harlingen	1	0.009	0.009	0.009

Table 2 (continued)
Gross Beta in Airborne Particulates
October 2013

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
TX: Houston	8	0.013	0.005	0.009
TX: Laredo	2	0.005	0.004	0.005
TX: Lubbock	8	0.002	0.001	0.001
TX: San Angelo	3	0.012	0.009	0.010
TX: San Antonio	10	0.009	0.004	0.007
UT: Salt Lake City	9	0.017	0.005	0.011
UT: St. George	3	0.019	0.011	0.017
VA: Harrisonburg	9	0.019	0.005	0.010
VA: Lynchburg	8	0.024	0.002	0.011
VA: Richmond	9	0.014	0.002	0.008
VA: Virginia Beach	6	0.014	0.001	0.006
VT: Burlington	3	0.029	0.002	0.012
WA: Olympia	8	0.009	0.001	0.005
WA: Richland	6	0.016	0.002	0.009
WA: Seattle	3	0.009	0.003	0.006
WA: Spokane	8	0.023	0.002	0.013
WI: Lacrosse	2	0.005	0.005	0.005
WI: Madison	9	0.010	0.004	0.007
WI: Milwaukee	3	0.005	0.003	0.004
WI: Shawano	9	0.010	0.002	0.006
WV: Charleston	6	0.016	0.009	0.012
WY: Casper	2	0.013	0.008	0.010

Table 3
Gross Beta in Airborne Particulates
November 2013

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
AK: Anchorage	3	0.005	0.002	0.003
AK: Fairbanks	7	0.011	0.004	0.007
AK: Juneau	4	0.006	0.002	0.003
AL: Birmingham	8	0.011	0.005	0.008
AL: Montgomery/408	7	0.009	0.005	0.007
AR: Fort Smith	3	0.010	0.008	0.009
AR: Little Rock	3	0.010	0.006	0.008
AZ: Phoenix/956	5	0.017	0.006	0.011
AZ: Tucson	8	0.017	0.003	0.010
CA: Anaheim	8	0.018	0.003	0.008
CA: Eureka	1	0.006	0.006	0.006
CA: Fresno	3	0.072	0.028	0.044
CA: Los Angeles	7	0.023	0.006	0.014
CA: Richmond	4	0.014	0.005	0.011
CA: Riverside	8	0.023	0.008	0.014
CA: Sacramento	6	0.053	0.013	0.030
CA: San Bernardino Cty.	6	0.022	0.006	0.013
CA: San Diego	4	0.011	0.004	0.009
CA: San Francisco	7	0.028	0.003	0.010
CA: San Jose	7	0.016	0.005	0.011
CO: Colorado Springs	1	0.014	0.014	0.014
CO: Denver	6	0.023	0.009	0.015
CO: Grand Junction	3	0.023	0.009	0.017
CT: Hartford	8	0.011	0.004	0.005
DC: Washington	9	0.019	0.005	0.008
DE: Dover	3	0.008	0.004	0.006
FL: Jacksonville	5	0.017	0.005	0.008
FL: Miami	3	0.008	0.003	0.005
FL: Orlando	7	0.009	0.003	0.005
FL: Tallahassee	3	0.009	0.004	0.006
FL: Tampa	6	0.008	0.003	0.005
GA: Atlanta	2	0.009	0.008	0.009
GA: Augusta	3	0.005	0.004	0.005
HI: Honolulu	9	0.003	0.001	0.002
IA: Des Moines	7	0.013	0.007	0.010
IA: Mason City	4	0.015	0.010	0.013
ID: Boise	4	0.020	0.004	0.011
ID: Idaho Falls	8	0.024	0.006	0.014

Table 3 (continued)
Gross Beta in Airborne Particulates
November 2013

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
IL: Aurora	1	0.018	0.018	0.018
IL: Champaign	8	0.015	0.005	0.009
IL: Chicago	6	0.021	0.009	0.012
IN: Fort Wayne	3	0.017	0.009	0.012
IN: Indianapolis	8	0.016	0.006	0.010
KS: Kansas City	1	0.016	0.016	0.016
KS: Wichita	7	0.017	0.006	0.009
KY: Lexington	4	0.021	0.009	0.012
KY: Louisville	4	0.017	0.008	0.011
LA: Baton Rouge	7	0.009	0.004	0.007
LA: Shreveport	7	0.009	0.003	0.006
MA: Boston	9	0.010	0.004	0.006
MA: Worcester	8	0.015	0.004	0.007
MD: Baltimore	7	0.023	0.005	0.009
ME: Orono	3	0.008	0.004	0.007
ME: Portland	7	0.007	0.002	0.004
MI: Bay City 48708	6	0.011	0.005	0.008
MI: Detroit	6	0.015	0.005	0.009
MI: Grand Rapids	3	0.008	0.007	0.007
MN: Duluth	4	0.009	0.006	0.007
MN: St. Paul	4	0.016	0.009	0.011
MO: Jefferson City	3	0.009	0.006	0.008
MO: Springfield	6	0.014	0.005	0.009
MO: St. Louis	2	0.010	0.007	0.009
MS: Jackson/Deq	3	0.016	0.005	0.010
MT: Billings	4	0.014	0.006	0.009
NC: Charlotte	7	0.016	0.005	0.008
NC: Greensboro	1	0.009	0.009	0.009
NC: Wilmington	4	0.005	0.003	0.004
ND: Bismarck	5	0.013	0.006	0.011
NE: Kearney	1	0.011	0.011	0.011
NE: Lincoln	7	0.009	0.005	0.007
NE: Omaha	4	0.014	0.010	0.011
NH: Concord	5	0.007	0.004	0.005
NJ: Edison	9	0.019	0.004	0.007
NM: Albuquerque	4	0.025	0.014	0.018
NM: Carlsbad	5	0.034	0.008	0.016
NM: Navajo Lake St Park	4	0.018	0.012	0.014

Table 3 (continued)
Gross Beta in Airborne Particulates
November 2013

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
NV: Las Vegas/913	8	0.016	0.004	0.010
NV: Reno	8	0.025	0.006	0.017
NY: Albany	7	0.019	0.005	0.008
NY: Lockport	9	0.009	0.004	0.005
NY: New York City	2	0.006	0.004	0.005
NY: Rochester	5	0.009	0.003	0.005
NY: Syracuse	3	0.009	0.006	0.007
NY: Yaphank	4	0.004	0.003	0.004
OH: Cincinnati	8	0.015	0.004	0.008
OH: Cleveland	8	0.015	0.005	0.009
OH: Painesville	7	0.015	0.007	0.009
OH: Toledo	7	0.013	0.005	0.007
OK: Oklahoma City	7	0.018	0.007	0.013
OK: Tulsa	8	0.015	0.006	0.010
OR: Corvallis	7	0.019	0.002	0.007
OR: Portland	8	0.041	0.003	0.010
PA: Bloomsburg	7	0.009	0.003	0.005
PA: Philadelphia	3	0.011	0.004	0.007
PA: Pittsburgh	3	0.008	0.006	0.007
PR: San Juan	8	0.007	0.002	0.003
RI: Providence	3	0.010	0.005	0.007
SC: Columbia	7	0.021	0.006	0.011
SD: Pierre	7	0.015	0.007	0.011
SD: Rapid City	7	0.017	0.006	0.010
TN: Knoxville	4	0.017	0.009	0.012
TN: Memphis	8	0.012	0.004	0.008
TN: Nashville	5	0.012	0.006	0.008
TN: Oak Ridge/Bethel	6	0.015	0.008	0.011
TN: Oak Ridge/K25	6	0.034	0.008	0.017
TN: Oak Ridge/Melton	6	0.012	0.006	0.009
TN: Oak Ridge/Y12 E	6	0.018	0.008	0.012
TN: Oak Ridge/Y12 W	6	0.015	0.009	0.011
TX: Amarillo	8	0.022	0.015	0.017
TX: Austin	3	0.008	0.007	0.008
TX: Dallas	6	0.009	0.006	0.008
TX: El Paso	4	0.025	0.014	0.020
TX: Ft. Worth	4	0.011	0.007	0.008
TX: Harlingen	2	0.006	0.006	0.006

Table 3 (continued)
Gross Beta in Airborne Particulates
November 2013

Location	Number of Samples	NAREL Lab Measurement (pCi/m³) Max	Min	Avg
TX: Houston	9	0.010	0.006	0.008
TX: Lubbock	6	0.003	0.001	0.002
TX: San Angelo	4	0.011	0.007	0.009
TX: San Antonio	7	0.009	0.006	0.007
UT: Salt Lake City	6	0.012	0.004	0.009
UT: St. George	3	0.018	0.010	0.015
VA: Harrisonburg	6	0.009	0.005	0.007
VA: Lynchburg	7	0.014	0.006	0.009
VA: Richmond	7	0.017	0.004	0.008
VA: Virginia Beach	7	0.015	0.004	0.007
VT: Burlington	6	0.008	0.003	0.005
WA: Olympia	5	0.007	0.002	0.004
WA: Richland	6	0.018	0.003	0.009
WA: Seattle	5	0.011	0.002	0.005
WA: Spokane	7	0.032	0.003	0.010
WI: Lacrosse	1	0.008	0.008	0.008
WI: Madison	9	0.018	0.007	0.011
WI: Milwaukee	4	0.009	0.003	0.005
WI: Shawano	8	0.013	0.005	0.008
WV: Charleston	5	0.015	0.003	0.008
WY: Casper	6	0.020	0.006	0.012

Table 4
Gross Beta in Airborne Particulates
December 2013

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
AK: Anchorage	5	0.007	0.004	0.006
AK: Fairbanks	9	0.018	0.006	0.012
AK: Juneau	7	0.009	0.002	0.005
AL: Birmingham	9	0.012	0.006	0.010
AL: Montgomery/408	8	0.013	0.005	0.010
AR: Little Rock	1	0.010	0.010	0.010
AZ: Phoenix/956	4	0.020	0.011	0.014
AZ: Tucson	4	0.020	0.007	0.012
CA: Anaheim	7	0.010	0.004	0.007
CA: Eureka	2	0.009	0.003	0.006
CA: Los Angeles	4	0.017	0.010	0.012
CA: Richmond	4	0.030	0.012	0.022
CA: Riverside	9	0.017	0.006	0.011
CA: Sacramento	5	0.046	0.018	0.028
CA: San Bernardino Cty.	9	0.015	0.005	0.010
CA: San Diego	5	0.011	0.005	0.008
CA: San Francisco	9	0.027	0.005	0.017
CA: San Jose	6	0.031	0.007	0.019
CO: Denver	7	0.039	0.007	0.015
CO: Grand Junction	5	0.057	0.023	0.035
CT: Hartford	8	0.013	0.007	0.009
DC: Washington	8	0.022	0.007	0.013
DE: Dover	3	0.012	0.006	0.009
FL: Jacksonville	6	0.010	0.005	0.008
FL: Miami	2	0.003	0.002	0.003
FL: Orlando	6	0.006	0.004	0.005
FL: Tallahassee	4	0.007	0.004	0.006
FL: Tampa	6	0.008	0.004	0.006
GA: Atlanta	4	0.012	0.006	0.008
GA: Augusta	5	0.006	0.004	0.005
HI: Honolulu	9	0.002	0.001	0.001
IA: Des Moines	9	0.033	0.010	0.018
IA: Mason City	5	0.042	0.013	0.022
ID: Boise	6	0.057	0.012	0.029
ID: Idaho Falls	9	0.043	0.011	0.027
IL: Aurora	1	0.016	0.016	0.016
IL: Champaign	7	0.021	0.011	0.016
IL: Chicago	8	0.025	0.010	0.016

Table 4 (continued)
Gross Beta in Airborne Particulates
December 2013

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
IN: Fort Wayne	5	0.021	0.014	0.016
IN: Indianapolis	9	0.027	0.010	0.018
KS: Kansas City	9	0.029	0.011	0.020
KS: Wichita	8	0.024	0.010	0.019
KY: Lexington	7	0.023	0.012	0.016
KY: Louisville	4	0.017	0.013	0.015
LA: Baton Rouge	9	0.017	0.005	0.012
LA: Shreveport	5	0.015	0.010	0.013
MA: Boston	9	0.016	0.006	0.009
MA: Worcester	8	0.017	0.006	0.011
MD: Baltimore	8	0.024	0.005	0.012
ME: Orono	4	0.011	0.004	0.008
ME: Portland	7	0.009	0.003	0.007
MI: Bay City 48708	7	0.018	0.010	0.014
MI: Detroit	7	0.021	0.011	0.015
MI: Grand Rapids	4	0.020	0.014	0.016
MN: Duluth	8	0.017	0.005	0.013
MN: St. Paul	5	0.021	0.010	0.015
MO: Jefferson City	9	0.020	0.009	0.015
MO: Springfield	7	0.018	0.010	0.016
MO: St. Louis	3	0.018	0.013	0.016
MS: Jackson/Deq	5	0.013	0.009	0.011
MT: Billings	4	0.019	0.006	0.014
NC: Charlotte	8	0.011	0.003	0.008
NC: Greensboro	1	0.010	0.010	0.010
NC: Wilmington	4	0.007	0.003	0.005
ND: Bismarck	6	0.020	0.011	0.014
NE: Lincoln	8	0.017	0.008	0.013
NE: Omaha	5	0.019	0.013	0.016
NH: Concord	6	0.014	0.005	0.008
NJ: Edison	7	0.023	0.006	0.012
NM: Albuquerque	3	0.023	0.016	0.019
NM: Carlsbad	6	0.100	0.007	0.027
NM: Navajo Lake St Park	5	0.023	0.012	0.019
NV: Las Vegas/913	7	0.016	0.007	0.010
NV: Reno	8	0.069	0.007	0.038
NY: Albany	6	0.028	0.011	0.015
NY: Lockport	7	0.011	0.003	0.009

Table 4 (continued)
Gross Beta in Airborne Particulates
December 2013

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
NY: New York City	3	0.010	0.005	0.008
NY: Rochester	8	0.015	0.005	0.008
NY: Yaphank	5	0.012	0.004	0.008
OH: Cincinnati	8	0.017	0.007	0.012
OH: Cleveland	9	0.023	0.007	0.017
OH: Columbus	1	0.013	0.013	0.013
OH: Painesville	6	0.017	0.011	0.015
OH: Toledo	10	0.022	0.005	0.012
OK: Oklahoma City	7	0.038	0.015	0.025
OK: Tulsa	9	0.028	0.013	0.019
OR: Corvallis	9	0.017	0.002	0.008
OR: Portland	8	0.033	0.003	0.012
PA: Bloomsburg	6	0.017	0.006	0.010
PA: Philadelphia	5	0.015	0.007	0.010
PA: Pittsburgh	5	0.016	0.010	0.012
PR: San Juan	8	0.003	0.001	0.002
RI: Providence	2	0.011	0.009	0.010
SC: Columbia	4	0.012	0.007	0.010
SD: Pierre	9	0.031	0.009	0.017
SD: Rapid City	7	0.015	0.007	0.012
TN: Knoxville	4	0.017	0.008	0.013
TN: Memphis	7	0.019	0.012	0.014
TN: Nashville	7	0.014	0.007	0.011
TN: Oak Ridge/Bethel	8	0.023	0.005	0.015
TN: Oak Ridge/K25	7	0.078	0.006	0.023
TN: Oak Ridge/Melton	7	0.016	0.004	0.011
TN: Oak Ridge/Y12 E	8	0.026	0.004	0.015
TN: Oak Ridge/Y12 W	8	0.023	0.005	0.015
TX: Amarillo	5	0.028	0.012	0.021
TX: Austin	5	0.027	0.007	0.015
TX: Dallas	6	0.037	0.013	0.021
TX: El Paso	3	0.029	0.012	0.022
TX: Ft. Worth	4	0.032	0.007	0.017
TX: Harlingen	2	0.030	0.015	0.023
TX: Houston	8	0.026	0.008	0.015
TX: Lubbock	4	0.004	0.002	0.003
TX: San Angelo	3	0.023	0.009	0.016
TX: San Antonio	9	0.028	0.008	0.018

Table 4 (continued)
Gross Beta in Airborne Particulates
December 2013

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
UT: Salt Lake City	8	0.028	0.006	0.018
UT: St. George	5	0.032	0.016	0.025
VA: Harrisonburg	8	0.016	0.006	0.009
VA: Lynchburg	7	0.024	0.005	0.012
VA: Richmond	4	0.015	0.006	0.010
VA: Virginia Beach	8	0.016	0.006	0.009
VT: Burlington	9	0.015	0.005	0.010
WA: Olympia	9	0.015	0.001	0.006
WA: Richland	8	0.072	0.010	0.024
WA: Seattle	2	0.012	0.011	0.011
WA: Spokane	9	0.055	0.009	0.023
WI: Lacrosse	4	0.016	0.011	0.014
WI: Madison	7	0.027	0.012	0.017
WI: Shawano	9	0.018	0.008	0.013
WV: Charleston	5	0.014	0.008	0.011
WY: Casper	6	0.029	0.005	0.015

Table 5
Specific Gamma in Precipitation
October 2013

Location	Nuclide	pCi/L ± 2*u*	
AL: Montgomery/408		ND	
AR: Little Rock		ND	
CO: Denver		ND	
CT: Hartford	Be-7	35	26
FL: Jacksonville	Be-7	29	22
GA: Atlanta	Ra-228	3.6	3.5
HI: Honolulu		ND	
ID: Idaho Falls		ND	
KS: Kansas City		ND	
MA: Boston	Be-7	42	23
MI: Lansing		ND	
MN: St. Paul		ND	
MN: Welch/510		ND	
NC: Charlotte		ND	
NC: Wilmington		ND	
NY: Albany		ND	
OH: Painesville		ND	
PA: Harrisburg		ND	
TN: Knoxville		ND	
TN: Nashville		ND	
TN: Oak Ridge/K25	Be-7	28	16
TN: Oak Ridge/Melton		ND	
TN: Oak Ridge/Y12 E		ND	
TX: Austin		ND	
UT: Salt Lake City	Be-7	34	28
VA: Lynchburg	K-40	47	28
WA: Olympia	Be-7	29	27

Table 6
Specific Gamma in Precipitation
November 2013

Location	Nuclide	pCi/L ± 2*u*	
AL: Montgomery/408		ND	
AR: Little Rock		ND	
AZ: Phoenix		ND	
CA: Richmond		ND	
CT: Hartford	Be-7	55	22
FL: Jacksonville		ND	
GA: Atlanta		ND	
HI: Honolulu		ND	
ID: Idaho Falls		ND	
KS: Kansas City		ND	
MA: Boston	Be-7	87	26
MI: Lansing		ND	
MN: St. Paul	Be-7	16	12
MN: Welch/510		ND	
NC: Charlotte		ND	
NC: Wilmington		ND	
NH: Concord		ND	
NY: Albany		ND	
NY: Yaphank		ND	
OR: Portland		ND	
PA: Harrisburg		ND	
TN: Nashville		ND	
TN: Oak Ridge/K25	Be-7	46	23
TN: Oak Ridge/Melton	Be-7	54	24
TN: Oak Ridge/Y12 E	Be-7	25	21
UT: Salt Lake City	Be-7	62	24
VA: Lynchburg	Pb-212	2.3	2.3
WA: Olympia	Be-7	22	21

Table 7
Specific Gamma in Precipitation
December 2013

Location	Nuclide	pCi/L ± 2*u*	
AL: Montgomery/408		ND	
AR: Little Rock	Be-7	24	18
AZ: Phoenix		ND	
CA: Richmond	K-40	12	10
CT: Hartford	Be-7	19	16
FL: Jacksonville		ND	
GA: Atlanta	Be-7	30	18
HI: Honolulu	Be-7	20	15
ID: Idaho Falls	Be-7	22	18
MA: Boston	Be-7	109	27
MI: Lansing	Be-7	23	15
MN: St. Paul		ND	
NC: Charlotte		ND	
NC: Wilmington		ND	
NH: Concord		ND	
NY: Albany		ND	
OR: Portland	Be-7	43	19
PA: Harrisburg		ND	
TN: Knoxville		ND	
TN: Nashville	Be-7	34	18
TN: Oak Ridge/K25	Be-7	46	20
TN: Oak Ridge/Melton	Be-7	50	19
TN: Oak Ridge/Y12 E	Be-7	49	21
UT: Salt Lake City		ND	
VA: Lynchburg		ND	
WA: Olympia	Be-7	31	18

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 airborne particulate samplers. Plutonium and uranium results are published in the ERD for the third quarter of the following year.

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 total volume of air represented by all the samples received from one sampling location during a year typically ranges from 120,000 m^3 to 500,000 m^3. The aliquot analyzed is a fraction of the total volume and is typically between 5,000 m^3 and 30,000 m^3.

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2. Drinking Water Program

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

Drinking water data are used to assess trends and anomalies in concentrations. The analysis scheme for RadNet samples is similar to that of EPA's "National Interim Primary Drinking Water Regulations." The analyses include (a) tritium on a quarterly basis; (b) gross alpha, gross beta, 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 on annual composites; (d) iodine-131 on one quarterly sample per year for each station; (e) 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 on annual composites; and (f) strontium-90 on one-fourth of the annual composites on a four year rotating schedule. Composite results are published in the ERD for the third quarter of the following year.

RadNet drinking water data should not be used to monitor compliance with drinking water regulations or for comparisons to those data since different procedures for collection and analysis may be used.

Table 8
Tritium in Drinking Water
October–December 2013

Location	Date Collected	^{3}H pCi/L	± 2*u*
AK: Fairbanks	10/16/13	−18	81
AL: Dothan	10/08/13	−94	90
AL: Montgomery	10/16/13	−51	80
AL: Muscle Shoals	10/02/13	129	98
AL: Scottsboro	10/01/13	96	97
AR: Little Rock	10/03/13	−114	87
CT: Hartford	10/01/13	−32	92
DE: Dover	11/19/13	−14	85
GA: Baxley	10/09/13	−68	79
GA: Savannah	12/11/13	32	87
HI: Honolulu	11/12/13	16	87
IA: Cedar Rapids	11/01/13	34	88
ID: Boise	10/01/13	−40	91
ID: Idaho Falls	10/10/13	−44	80
IL: W. Chicago	10/22/13	−53	80
KS: Topeka	10/17/13	−17	81
LA: New Orleans	10/22/13	80	85
MD: Baltimore	10/16/13	−18	81
MD: Conowingo	10/03/13	−113	88
MI: Detroit	11/14/13	127	92
MN: St. Paul	10/02/13	−4	93
MN: Welch	10/02/13	−6	94
MO: Jefferson City	12/10/13	4	88
MS: Jackson	11/12/13	4	86
MS: Port Gibson	11/12/13	45	88
MT: Helena	10/23/13	−82	78
ND: Bismarck	11/05/13	79	90
NE: Lincoln	10/07/13	−20	92
NH: Concord	11/12/13	30	88
NJ: Trenton	10/29/13	13	82
NJ: Waretown	10/29/13	−48	80
NY: Albany	10/30/13	−27	81
NY: New York City	12/18/13	38	89
NY: Niagara Falls	10/22/13	36	83
NY: Syracuse	12/03/13	95	90
OH: Cincinnati	10/22/13	−48	80
OH: Columbus	10/17/13	−63	78
OH: E. Liverpool	10/30/13	400	100
OH: Painesville	11/25/13	68	90
OH: Toledo	12/10/13	118	91

Table 8 (continued)
Tritium in Drinking Water
October–December 2013

Location	Date Collected	^{3}H pCi/L	± 2*u*
OR: Portland	12/27/13	83	91
PA: Columbia	10/03/13	2130	180
PA: Harrisburg	10/03/13	−74	89
PA: Pittsburgh	10/29/13	93	90
RI: Providence	10/04/13	−24	81
SC: Barnwell	11/27/13	16	86
SC: Columbia	10/31/13	62	90
SC: Jenkinsville	10/09/13	−4	83
SC: Seneca	11/12/13	50	89
TN: Knoxville	10/03/13	−57	91
TN: Oak Ridge/#360	10/01/13	−49	91
TN: Oak Ridge/#371	10/01/13	−34	91
TN: Oak Ridge/#4442	10/01/13	0	93
TN: Oak Ridge/#768	10/01/13	−36	91
TN: Oak Ridge/#772	10/01/13	−67	91
TX: Austin	10/15/13	−78	79
VA: Ashland	12/12/13	22	86
VA: Lynchburg	12/19/13	30	87
WA: Richland	11/13/13	33	87
WI: Madison	10/10/13	−16	81

Table 9
Iodine-131 in Drinking Water
January–December 2013

Location	Date Collected	^{131}I pCi/L	± 2*u*
AL: Dothan	04/04/13	−0.04	0.14
AL: Montgomery	04/18/13	0.01	0.11
AL: Muscle Shoals	04/04/13	0.04	0.15
AL: Scottsboro	04/03/13	−0.08	0.17
AR: Little Rock	04/15/13	0.07	0.15
CO: Denver	01/18/13	0.08	0.17
CT: Hartford	04/10/13	−0.02	0.14
DE: Dover	04/22/13	0.21	0.16
FL: Tampa	07/11/13	0.02	0.16
GA: Baxley	04/17/13	0.03	0.15
GA: Savannah	03/29/13	0.00	0.16
HI: Honolulu	08/12/13	0.00	0.32
IA: Cedar Rapids	05/07/13	−0.03	0.16
IL: Morris	04/05/13	−0.06	0.13
IL: W. Chicago	05/06/13	0.20	0.32
KS: Topeka	01/23/13	0.06	0.18
LA: New Orleans	01/11/13	0.06	0.18
MD: Baltimore	04/08/13	0.06	0.15
MI: Detroit	04/11/13	0.00	0.17
MN: St. Paul	04/03/13	−0.05	0.17
MO: Jefferson City	04/08/13	−0.14	0.33
MS: Jackson	01/29/13	0.06	0.14
MS: Port Gibson	01/29/13	0.09	0.16
MT: Helena	01/27/13	0.10	0.19
ND: Bismarck	04/12/13	0.04	0.15
NE: Lincoln	04/08/13	−0.06	0.15
NH: Concord	11/12/13	0.15	0.17
NJ: Trenton	10/29/13	0.26	0.28
NJ: Waretown	10/29/13	0.06	0.26
NY: Albany	10/30/13	−0.07	0.26
NY: New York City	12/18/13	−0.03	0.45
NY: Niagara Falls	10/22/13	0.21	0.28
NY: Syracuse	01/24/13	0.35	0.18
OH: Cincinnati	01/18/13	−0.01	0.21
OH: Columbus	04/16/13	−0.01	0.14
OH: E. Liverpool	03/13/13	0.56	0.20
OH: Painesville	03/11/13	0.15	0.32
OH: Toledo	01/03/13	0.22	0.30
PA: Columbia	07/03/13	0.20	0.16
PA: Harrisburg	07/03/13	0.04	0.16
PA: Pittsburgh	03/13/13	0.12	0.13

Table 9 (continued)
Iodine-131 in Drinking Water
January–December 2013

Location	Date Collected	^{131}I pCi/L	± 2*u*
SC: Barnwell	01/30/13	−0.03	0.16
SC: Columbia	01/24/13	−0.04	0.35
SC: Jenkinsville	10/09/13	0.4	1.6
SC: Seneca	11/12/13	0.04	0.16
TN: Chattanooga	04/08/13	0.01	0.16
TX: Austin	04/03/13	0.13	0.19
VA: Ashland	12/12/13	0.3	1.6
VA: Lynchburg	03/21/13	0.15	0.13
WA: Richland	05/14/13	0.06	0.19
WI: Madison	07/03/13	0.22	0.34

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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.

Milk samples are collected quarterly at each of the sampling sites. 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

October–December 2013

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: Fayetteville	11/18/13	1.68 0.19	ND	ND	ND
AZ: Phoenix	11/14/13	1.63 0.19	ND	ND	ND
CA: Oakland	10/15/13	1.65 0.20	ND	ND	ND
CT: Hartford	11/12/13	1.65 0.19	ND	ND	ND
DE: Wilmington	11/04/13	1.59 0.19	ND	ND	ND
FL: Plant City	10/15/13	1.54 0.18	ND	ND	ND
HI: Hilo	10/08/13	1.61 0.18	ND	ND	ND
IA: Des Moines	12/02/13	1.68 0.19	ND	ND	ND
KS: Wichita	10/23/13	1.59 0.18	ND	ND	ND
KY: Louisville	10/21/13	1.69 0.19	ND	ND	ND
MA: Boston	12/11/13	1.64 0.20	ND	ND	NR
MD: Baltimore	10/18/13	1.73 0.20	ND	ND	ND
MI: Detroit	11/18/13	1.70 0.20	ND	ND	ND
NJ: Trenton	10/22/13	1.67 0.20	ND	ND	ND
NM: Albuquerque	10/07/13	1.65 0.19	ND	ND	ND
NV: Las Vegas	11/18/13	1.66 0.20	ND	ND	ND
NV: Reno	12/12/13	1.64 0.20	ND	ND	NR
NY: Buffalo	12/11/13	1.66 0.19	ND	ND	NR
NY: Syracuse	10/03/13	1.62 0.20	ND	ND	ND
OH: Cincinnati	12/09/13	1.72 0.20	ND	ND	ND
OH: Cleveland	11/01/13	1.65 0.19	ND	ND	ND
OR: Portland	12/23/13	1.75 0.21	ND	ND	ND
PA: Pittsburgh	10/22/13	1.73 0.20	ND	ND	ND
SC: Charleston	10/15/13	1.58 0.19	ND	ND	ND
TN: Chattanooga	12/02/13	1.58 0.19	ND	ND	ND
TN: Knoxville	11/12/13	1.51 0.19	ND	ND	ND
TN: Memphis	10/02/13	1.60 0.19	ND	ND	ND
TX: Austin	10/07/13	1.71 0.20	ND	ND	ND
VT: Montpelier	12/26/13	1.65 0.19	ND	ND	ND
WA: Spokane	11/15/13	1.53 0.18	ND	ND	ND
WA: Tacoma	12/30/13	1.74 0.20	ND	ND	ND

Note: ND = Not detected
NR = No result (not analyzed within 5 half-lives of collection)

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:

Requests for information concerning the operation of RadNet, the data that are generated, or publication and distribution of ERD should be directed to:

Charles M. Petko
Office of the Director
National Analytical Radiation Environmental Laboratory
540 South Morris Avenue
Montgomery, Alabama 36115-2601
email: petko.charles@epa.gov

Requests for information concerning policies of the Office of Radiation and Indoor Air should be directed to:

Jonathan Edwards
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Radiation Protection Division (MC6608J)
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