ENVIRONMENTAL RADIATION DATA

REPORT 164

October–December 2015

United States Environmental Protection Agency

Office of Radiation and Indoor Air

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Contents

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List of Tables

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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 electronic format, which is 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, and drinking water 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, and radium, and for tritium. This monitoring effort also provides information on natural background levels and possible 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
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	Water	pCi/L	1
‡ Iodine-131	Water (gamma)	pCi/L	4
	Water	pCi/L	0.3
Cesium-137	Water	pCi/L	5
‡ Barium-140	Water	pCi/L	15
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 the exposed filters are sent to NAREL for 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.

Table 2
Gross Beta in Airborne Particulates
October 2015

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
AK: Anchorage	4	0.004	0.002	0.003
AK: Fairbanks	7	0.008	0.003	0.004
AK: Juneau	5	0.003	0.001	0.002
AL: Birmingham	9	0.011	0.003	0.006
AL: Mobile	5	0.016	0.005	0.009
AL: Montgomery/408	7	0.010	0.002	0.005
AR: Fort Smith	4	0.012	0.007	0.009
AR: Little Rock	9	0.015	0.006	0.009
AZ: Phoenix/956	5	0.014	0.006	0.009
AZ: Tucson	1	0.009	0.009	0.009
CA: Anaheim	7	0.015	0.008	0.010
CA: Bakersfield	1	0.007	0.007	0.007
CA: Eureka	5	0.008	0.003	0.005
CA: Los Angeles	3	0.016	0.007	0.011
CA: Richmond	4	0.010	0.006	0.008
CA: Riverside	7	0.019	0.007	0.011
CA: Sacramento	7	0.022	0.008	0.015
CA: San Bernardino Cty.	6	0.019	0.009	0.013
CA: San Diego	1	0.008	0.008	0.008
CA: San Francisco	9	0.013	0.003	0.007
CA: San Jose	6	0.010	0.005	0.007
CO: Colorado Springs	4	0.020	0.010	0.016
CO: Denver	8	0.026	0.006	0.015
CT: Hartford	10	0.010	0.002	0.005
DC: Washington	7	0.015	0.004	0.008
DE: Dover	4	0.005	0.002	0.004
FL: Jacksonville	4	0.007	0.002	0.004
FL: Miami	5	0.010	0.004	0.006
FL: Orlando	6	0.005	0.002	0.003
FL: Tallahassee	4	0.008	0.003	0.005
GA: Atlanta	4	0.009	0.003	0.007
GA: Augusta	5	0.008	0.002	0.006
HI: Honolulu	9	0.004	0.002	0.003
IA: Des Moines	9	0.009	0.002	0.005
IA: Mason City	1	0.010	0.010	0.010
ID: Boise	6	0.015	0.005	0.010
ID: Idaho Falls	9	0.013	0.005	0.010
IL: Aurora	1	0.011	0.011	0.011

Table 2 (continued)
Gross Beta in Airborne Particulates
October 2015

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
IL: Champaign	6	0.020	0.005	0.012
IL: Chicago	6	0.008	0.003	0.005
IN: Fort Wayne	2	0.008	0.005	0.007
IN: Indianapolis	7	0.008	0.003	0.006
KS: Kansas City	7	0.017	0.006	0.010
KS: Wichita	6	0.013	0.006	0.010
KY: Lexington	7	0.015	0.007	0.009
KY: Louisville	5	0.010	0.004	0.008
KY: Paducah	7	0.012	0.006	0.009
LA: Baton Rouge	8	0.013	0.003	0.008
LA: Shreveport	4	0.014	0.008	0.010
MA: Boston	10	0.012	0.002	0.005
MA: Worcester	7	0.007	0.002	0.004
MD: Baltimore	5	0.011	0.003	0.006
ME: Orono	3	0.006	0.003	0.005
ME: Portland	3	0.009	0.003	0.006
MI: Bay City 48708	7	0.008	0.003	0.005
MI: Detroit	8	0.015	0.003	0.007
MI: Grand Rapids	5	0.013	0.005	0.009
MN: Duluth	4	0.005	0.003	0.004
MN: St. Paul	2	0.014	0.007	0.010
MO: Jefferson City	7	0.014	0.005	0.009
MO: Springfield	8	0.019	0.007	0.011
MS: Jackson/Deq	3	0.018	0.006	0.011
MT: Billings	3	0.014	0.011	0.012
NC: Charlotte	9	0.017	0.002	0.009
NC: Greensboro	1	0.004	0.004	0.004
NC: Raleigh	4	0.008	0.001	0.005
NC: Wilmington	4	0.006	0.002	0.005
ND: Bismarck	6	0.012	0.004	0.009
NE: Lincoln	9	0.011	0.004	0.008
NE: Omaha	2	0.016	0.006	0.011
NH: Concord	4	0.011	0.003	0.006
NJ: Edison	5	0.008	0.003	0.005
NM: Carlsbad	6	0.019	0.006	0.012
NM: Navajo Lake St Park	2	0.011	0.010	0.011
NV: Las Vegas/913	1	0.007	0.007	0.007
NV: Reno	9	0.018	0.009	0.013

Table 2 (continued)
Gross Beta in Airborne Particulates
October 2015

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

Table 2 (continued)
Gross Beta in Airborne Particulates
October 2015

Location	Number of Samples	NAREL Lab Measurement (pCi/m³) Max	Min	Avg
TX: San Angelo	9	0.030	0.007	0.015
TX: San Antonio	9	0.014	0.003	0.009
UT: Salt Lake City	7	0.011	0.005	0.009
UT: St. George	3	0.010	0.007	0.009
VA: Harrisonburg	9	0.014	0.003	0.008
VA: Richmond	4	0.009	0.003	0.007
VA: Virginia Beach	9	0.010	0.002	0.006
VT: Burlington	9	0.008	0.002	0.004
WA: Olympia	8	0.013	0.003	0.007
WA: Richland	7	0.017	0.006	0.010
WA: Seattle	5	0.010	0.005	0.007
WA: Spokane	9	0.017	0.005	0.010
WI: Lacrosse	5	0.007	0.003	0.005
WI: Madison	7	0.016	0.005	0.009
WI: Milwaukee	9	0.018	0.005	0.009
WI: Shawano	7	0.013	0.004	0.007
WV: Charleston	5	0.013	0.004	0.008
WY: Casper	3	0.011	0.007	0.009

Table 3
Gross Beta in Airborne Particulates
November 2015

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
AK: Anchorage	1	0.004	0.004	0.004
AK: Fairbanks	7	0.021	0.005	0.009
AK: Juneau	4	0.003	0.001	0.002
AL: Birmingham	9	0.008	0.003	0.005
AL: Mobile	1	0.007	0.007	0.007
AL: Montgomery/408	8	0.009	0.004	0.006
AR: Fort Smith	4	0.011	0.005	0.008
AR: Little Rock	6	0.013	0.005	0.009
AZ: Phoenix/956	5	0.015	0.005	0.008
AZ: Yuma	4	0.012	0.006	0.010
CA: Anaheim	7	0.009	0.004	0.008
CA: Eureka	4	0.003	0.002	0.003
CA: Fresno	2	0.018	0.013	0.016
CA: Los Angeles	4	0.009	0.006	0.008
CA: Richmond	4	0.008	0.004	0.006
CA: Riverside	8	0.009	0.005	0.007
CA: Sacramento	6	0.024	0.006	0.014
CA: San Bernardino Cty.	7	0.010	0.005	0.008
CA: San Diego	3	0.009	0.005	0.007
CA: San Francisco	9	0.010	0.002	0.006
CA: San Jose	5	0.012	0.003	0.006
CO: Colorado Springs	2	0.011	0.010	0.010
CO: Denver	8	0.018	0.006	0.009
CT: Hartford	7	0.009	0.003	0.005
DC: Washington	5	0.014	0.006	0.009
DE: Dover	5	0.011	0.003	0.005
FL: Jacksonville	2	0.008	0.004	0.006
FL: Miami	4	0.005	0.003	0.004
FL: Orlando	6	0.007	0.002	0.004
FL: Tallahassee	4	0.005	0.003	0.004
GA: Atlanta	2	0.005	0.005	0.005
GA: Augusta	4	0.005	0.003	0.005
HI: Honolulu	8	0.003	0.001	0.002
IA: Des Moines	6	0.005	0.004	0.004
IA: Mason City	5	0.012	0.007	0.009
ID: Boise	2	0.004	0.004	0.004
ID: Idaho Falls	8	0.016	0.004	0.008
IL: Aurora	4	0.011	0.008	0.010

Table 3 (continued)
Gross Beta in Airborne Particulates
November 2015

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
IL: Champaign	8	0.016	0.007	0.011
IL: Chicago	8	0.011	0.004	0.008
IN: Fort Wayne	5	0.011	0.006	0.009
IN: Indianapolis	9	0.009	0.005	0.007
KS: Kansas City	8	0.013	0.004	0.008
KS: Wichita	7	0.010	0.004	0.007
KY: Lexington	4	0.016	0.007	0.010
KY: Louisville	4	0.009	0.004	0.007
KY: Paducah	8	0.011	0.005	0.008
LA: Baton Rouge	6	0.009	0.005	0.007
LA: Shreveport	3	0.012	0.008	0.009
MA: Boston	9	0.009	0.003	0.006
MA: Worcester	8	0.014	0.005	0.008
MD: Baltimore	7	0.009	0.004	0.006
ME: Orono	4	0.012	0.004	0.006
MI: Bay City 48708	7	0.012	0.004	0.007
MI: Detroit	8	0.013	0.005	0.009
MI: Grand Rapids	4	0.015	0.009	0.011
MN: Duluth	8	0.013	0.005	0.009
MN: St. Paul	4	0.016	0.009	0.012
MO: Jefferson City	9	0.010	0.004	0.007
MO: Springfield	6	0.011	0.005	0.008
MO: St. Louis	4	0.011	0.007	0.009
MS: Jackson/Deq	5	0.009	0.005	0.008
MT: Billings	4	0.009	0.005	0.007
NC: Charlotte	7	0.011	0.005	0.008
NC: Greensboro	2	0.007	0.005	0.006
NC: Raleigh	4	0.007	0.003	0.005
NC: Wilmington	4	0.008	0.003	0.005
ND: Bismarck	8	0.017	0.005	0.010
NE: Kearney	7	0.015	0.004	0.010
NE: Lincoln	9	0.010	0.004	0.007
NE: Omaha	5	0.016	0.008	0.013
NH: Concord	4	0.008	0.004	0.005
NJ: Edison	6	0.008	0.003	0.006
NM: Carlsbad	4	0.009	0.005	0.007
NM: Navajo Lake St Park	3	0.008	0.006	0.007
NV: Las Vegas/913	7	0.010	0.003	0.007

Table 3 (continued)
Gross Beta in Airborne Particulates
November 2015

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
NV: Reno	8	0.013	0.005	0.009
NY: Albany	7	0.015	0.004	0.008
NY: Lockport	9	0.012	0.004	0.007
NY: New York City	3	0.007	0.003	0.005
NY: Rochester	1	0.009	0.009	0.009
NY: Syracuse	2	0.006	0.005	0.005
NY: Yaphank	5	0.006	0.004	0.005
OH: Cincinnati	7	0.011	0.005	0.008
OH: Cleveland	9	0.016	0.005	0.009
OH: Columbus	1	0.007	0.007	0.007
OH: Toledo	8	0.013	0.005	0.010
OK: Oklahoma City	8	0.012	0.004	0.009
OK: Tulsa	8	0.011	0.005	0.008
OR: Corvallis	5	0.015	0.003	0.007
OR: Portland	8	0.010	0.001	0.004
PA: Bloomsburg	8	0.006	0.003	0.004
PA: Philadelphia	3	0.010	0.006	0.008
PA: Pittsburgh	5	0.010	0.007	0.008
PR: San Juan	8	0.005	0.001	0.003
RI: Providence	3	0.007	0.003	0.006
SC: Columbia	7	0.009	0.004	0.006
SD: Pierre	9	0.012	0.005	0.008
SD: Rapid City	5	0.009	0.005	0.007
TN: Knoxville	5	0.009	0.006	0.007
TN: Memphis	8	0.015	0.005	0.009
TN: Nashville	6	0.012	0.006	0.009
TN: Oak Ridge/Bethel	8	0.014	0.006	0.010
TN: Oak Ridge/K25	8	0.013	0.006	0.009
TN: Oak Ridge/Melton	8	0.010	0.004	0.006
TN: Oak Ridge/Y12 E	8	0.019	0.006	0.010
TN: Oak Ridge/Y12 W	8	0.012	0.005	0.008
TX: Amarillo	3	0.017	0.012	0.014
TX: Corpus Christi	8	0.009	0.004	0.007
TX: Dallas	7	0.014	0.004	0.010
TX: El Paso	8	0.010	0.005	0.007
TX: Ft. Worth	1	0.009	0.009	0.009
TX: Harlingen	2	0.010	0.005	0.008
TX: Houston	7	0.008	0.006	0.007

Table 3 (continued)
Gross Beta in Airborne Particulates
November 2015

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

Table 4
Gross Beta in Airborne Particulates
December 2015

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
AK: Fairbanks	5	0.017	0.008	0.012
AK: Juneau	6	0.004	0.001	0.002
AL: Birmingham	7	0.015	0.003	0.008
AL: Mobile	2	0.006	0.003	0.004
AL: Montgomery/408	8	0.015	0.003	0.007
AR: Little Rock	7	0.016	0.008	0.011
AZ: Tucson	1	0.014	0.014	0.014
AZ: Yuma	1	0.020	0.020	0.020
CA: Anaheim	9	0.019	0.003	0.009
CA: Bakersfield	3	0.021	0.004	0.013
CA: Eureka	5	0.006	0.001	0.002
CA: Los Angeles	4	0.011	0.005	0.008
CA: Richmond	5	0.013	0.003	0.006
CA: Riverside	3	0.015	0.010	0.012
CA: Sacramento	8	0.017	0.004	0.010
CA: San Bernardino Cty.	9	0.015	0.003	0.009
CA: San Diego	4	0.012	0.005	0.008
CA: San Francisco	8	0.027	0.002	0.006
CA: San Jose	7	0.018	0.002	0.005
CO: Colorado Springs	4	0.014	0.006	0.010
CO: Denver	3	0.006	0.005	0.006
CT: Hartford	9	0.014	0.003	0.007
DC: Washington	8	0.025	0.005	0.013
DE: Dover	5	0.019	0.004	0.009
FL: Jacksonville	5	0.010	0.003	0.006
FL: Miami	5	0.003	0.002	0.002
FL: Orlando	7	0.008	0.002	0.005
FL: Tallahassee	4	0.008	0.003	0.006
FL: Tampa	6	0.011	0.003	0.006
GA: Atlanta	3	0.018	0.009	0.013
GA: Augusta	5	0.009	0.002	0.006
HI: Honolulu	10	0.005	0.001	0.003
IA: Des Moines	8	0.015	0.002	0.007
IA: Mason City	4	0.019	0.009	0.013
ID: Boise	4	0.020	0.002	0.010
ID: Idaho Falls	8	0.033	0.003	0.012
IL: Aurora	5	0.020	0.010	0.013
IL: Champaign	9	0.026	0.004	0.015

Table 4 (continued)
Gross Beta in Airborne Particulates
December 2015

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
IL: Chicago	8	0.021	0.003	0.011
IN: Fort Wayne	3	0.021	0.008	0.016
IN: Indianapolis	8	0.017	0.004	0.010
KS: Kansas City	9	0.026	0.008	0.015
KS: Wichita	5	0.017	0.008	0.012
KY: Lexington	5	0.027	0.009	0.016
KY: Louisville	6	0.018	0.004	0.011
KY: Paducah	7	0.021	0.004	0.012
LA: Baton Rouge	8	0.015	0.003	0.008
LA: Shreveport	4	0.009	0.005	0.008
MA: Boston	9	0.011	0.004	0.007
MA: Worcester	8	0.017	0.003	0.008
MD: Baltimore	7	0.020	0.003	0.009
ME: Orono	3	0.009	0.003	0.006
ME: Portland	7	0.012	0.003	0.007
MI: Bay City 48708	7	0.019	0.004	0.011
MI: Detroit	9	0.021	0.004	0.011
MI: Grand Rapids	5	0.021	0.009	0.013
MN: Duluth	9	0.028	0.002	0.012
MN: St. Paul	4	0.026	0.012	0.018
MO: Jefferson City	9	0.019	0.005	0.012
MO: Springfield	7	0.020	0.007	0.012
MO: St. Louis	3	0.018	0.010	0.014
MS: Jackson/Deq	4	0.014	0.003	0.010
MT: Billings	2	0.016	0.009	0.013
NC: Charlotte	8	0.023	0.003	0.012
NC: Greensboro	2	0.005	0.005	0.005
NC: Raleigh	3	0.009	0.004	0.007
NC: Wilmington	5	0.009	0.002	0.005
ND: Bismarck	9	0.034	0.005	0.017
NE: Kearney	5	0.018	0.007	0.013
NE: Lincoln	8	0.027	0.006	0.015
NE: Omaha	4	0.023	0.007	0.016
NH: Concord	5	0.013	0.004	0.007
NJ: Edison	6	0.022	0.004	0.010
NM: Albuquerque	2	0.014	0.011	0.012
NM: Carlsbad	6	0.011	0.005	0.008
NM: Navajo Lake St Park	4	0.010	0.008	0.009

Table 4 (continued)
Gross Beta in Airborne Particulates
December 2015

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
NV: Las Vegas/913	2	0.014	0.004	0.009
NV: Reno	5	0.007	0.002	0.004
NY: Albany	7	0.017	0.004	0.008
NY: Lockport	8	0.024	0.006	0.012
NY: New York City	5	0.023	0.005	0.012
NY: Rochester	6	0.029	0.007	0.014
NY: Syracuse	1	0.006	0.006	0.006
NY: Yaphank	6	0.015	0.004	0.009
OH: Cincinnati	9	0.018	0.004	0.010
OH: Cleveland	9	0.033	0.005	0.014
OH: Columbus	5	0.027	0.005	0.010
OH: Toledo	6	0.028	0.010	0.015
OK: Oklahoma City	8	0.026	0.009	0.013
OK: Tulsa	10	0.017	0.006	0.011
OR: Corvallis	9	0.021	0.001	0.005
OR: Portland	9	0.026	0.001	0.008
PA: Bloomsburg	7	0.025	0.003	0.010
PA: Philadelphia	2	0.026	0.008	0.017
PA: Pittsburgh	3	0.019	0.006	0.014
PR: San Juan	9	0.003	0.001	0.002
RI: Providence	3	0.008	0.006	0.007
SC: Columbia	5	0.016	0.004	0.011
SD: Pierre	8	0.037	0.006	0.016
SD: Rapid City	3	0.009	0.005	0.007
TN: Knoxville	4	0.016	0.003	0.010
TN: Memphis	8	0.016	0.005	0.010
TN: Nashville	8	0.020	0.004	0.011
TN: Oak Ridge/Bethel	7	0.025	0.005	0.014
TN: Oak Ridge/K25	7	0.024	0.005	0.013
TN: Oak Ridge/Melton	7	0.015	0.003	0.009
TN: Oak Ridge/Y12 E	7	0.023	0.005	0.013
TN: Oak Ridge/Y12 W	7	0.021	0.004	0.011
TX: Amarillo	4	0.022	0.011	0.016
TX: Austin	3	0.014	0.010	0.011
TX: Corpus Christi	8	0.014	0.007	0.009
TX: Dallas	3	0.015	0.008	0.012
TX: El Paso	8	0.014	0.004	0.008
TX: Ft. Worth	5	0.016	0.004	0.009

Table 4 (continued)
Gross Beta in Airborne Particulates
December 2015

Location	Number of Samples	NAREL Lab Measurement (pCi/m³) Max	Min	Avg
TX: Harlingen	1	0.007	0.007	0.007
TX: Houston	8	0.016	0.003	0.008
TX: Laredo	4	0.014	0.006	0.010
TX: Lubbock	6	0.009	0.005	0.007
TX: San Angelo	5	0.021	0.004	0.012
TX: San Antonio	8	0.017	0.004	0.010
UT: Salt Lake City	4	0.018	0.004	0.009
UT: St. George	2	0.014	0.012	0.013
VA: Harrisonburg	7	0.021	0.005	0.012
VA: Richmond	5	0.014	0.004	0.008
VA: Virginia Beach	7	0.024	0.003	0.010
VT: Burlington	10	0.017	0.003	0.008
WA: Olympia	8	0.018	0.001	0.004
WA: Richland	2	0.011	0.007	0.009
WA: Seattle	3	0.004	0.002	0.003
WA: Spokane	7	0.038	0.002	0.008
WI: Lacrosse	4	0.014	0.005	0.011
WI: Madison	8	0.029	0.006	0.016
WI: Milwaukee	8	0.018	0.005	0.012
WI: Shawano	8	0.026	0.002	0.012
WV: Charleston	5	0.025	0.002	0.013
WY: Casper	2	0.005	0.004	0.004

Table 5
Gamma-Emitters in Precipitation
October 2015

Location	Nuclide	pCi/L ± 2*u*	
AL: Montgomery/408		ND	
AR: Little Rock		ND	
CT: Hartford	Be-7	36	20
GA: Atlanta		ND	
HI: Honolulu		ND	
ID: Idaho Falls		ND	
MA: Boston		ND	
MN: St. Paul		ND	
MN: Welch/510		ND	
NC: Charlotte	K-40	19	10
NC: Wilmington		ND	
NH: Concord	K-40	11	11
NY: Albany		ND	
OR: Portland		ND	
PA: Harrisburg		ND	
TN: Knoxville		ND	
TN: Nashville		ND	
TN: Oak Ridge/K25	Be-7	29	19
	K-40	19	13
TN: Oak Ridge/Melton		ND	
TN: Oak Ridge/Y12 E	Be-7	40	21
	K-40	15	14
TX: Austin	Ra-228	4.4	4.0
UT: Salt Lake City		ND	
VA: Lynchburg		ND	
WA: Olympia	K-40	16	12

Table 6
Gamma-Emitters in Precipitation
November 2015

Location	Nuclide	pCi/L ± 2*u*	
AL: Montgomery/408		ND	
AR: Little Rock		ND	
CA: Richmond	Be-7	22	18
CT: Hartford		ND	
GA: Atlanta		ND	
HI: Honolulu		ND	
ID: Idaho Falls		ND	
KS: Kansas City		ND	
MA: Boston	Be-7	33	21
MN: St. Paul		ND	
MN: Welch/510		ND	
NC: Charlotte		ND	
NY: Albany		ND	
OR: Portland	K-40	13	12
PA: Harrisburg		ND	
TN: Knoxville		ND	
TN: Nashville		ND	
TN: Oak Ridge/K25		ND	
TN: Oak Ridge/Melton		ND	
TN: Oak Ridge/Y12 E		ND	
TX: Austin		ND	
UT: Salt Lake City		ND	
VA: Lynchburg		ND	

Table 7
Gamma-Emitters in Precipitation
December 2015

Location	Nuclide	pCi/L ± 2*u*	
AL: Montgomery/408		ND	
AR: Little Rock	Be-7	31	15
CA: Richmond		ND	
CT: Hartford	Be-7	39	18
GA: Atlanta	Be-7	16	13
	K-40	24	14
HI: Honolulu		ND	
ID: Idaho Falls	Be-7	24	14
KS: Kansas City		ND	
MA: Boston		ND	
MN: Welch/510		ND	
NC: Charlotte		ND	
NY: Albany		ND	
OR: Portland		ND	
PA: Harrisburg		ND	
TN: Knoxville		ND	
TN: Nashville		ND	
TN: Oak Ridge/K25		ND	
TN: Oak Ridge/Melton	Be-7	74	26
TN: Oak Ridge/Y12 E		ND	
TX: Austin		ND	
UT: Salt Lake City	Be-7	17	14
VA: Lynchburg		ND	

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 2015

Location	Date Collected	^{3}H pCi/L	± 2*u*
AK: Fairbanks	10/29/15	24	61
AL: Dothan	10/05/15	−75	68
AL: Montgomery	10/05/15	38	66
AL: Muscle Shoals	10/08/15	90	70
AL: Scottsboro	10/06/15	235	77
AR: Little Rock	10/27/15	0	60
CT: Hartford	12/16/15	10	61
DE: Dover	10/13/15	39	93
FL: Miami	12/30/15	−6	77
FL: Tampa	12/29/15	67	81
GA: Savannah	12/11/15	24	79
HI: Honolulu	11/12/15	10	62
IA: Cedar Rapids	10/22/15	70	94
ID: Idaho Falls	11/09/15	−33	60
KS: Topeka	12/10/15	33	64
LA: New Orleans	12/04/15	48	64
MD: Baltimore	10/15/15	29	94
MD: Conowingo	10/06/15	14	67
MI: Detroit	10/13/15	320	110
MN: St. Paul	10/06/15	−4	66
MN: Welch	10/06/15	−56	62
MO: Jefferson City	10/09/15	−23	63
MT: Helena	12/18/15	−4	60
ND: Bismarck	10/15/15	69	96
NE: Lincoln	10/08/15	666	99
NH: Concord	11/16/15	6	61
NJ: Trenton	10/26/15	35	64
NJ: Waretown	10/27/15	6	62
NM: Santa Fe	11/18/15	42	63
NY: Albany	12/30/15	−2	78
NY: New York City	12/17/15	37	79
NY: Niagara Falls	10/26/15	43	65
NY: Syracuse	12/24/15	68	80
OH: Columbus	12/08/15	−14	61
OH: E. Liverpool	11/02/15	40	66
OH: Painesville	12/16/15	11	60
OH: Toledo	11/02/15	67	65
OK: Oklahoma City	12/31/15	−6	77
OR: Portland	12/31/15	9	78
PA: Pittsburgh	11/03/15	19	63

Table 8 (continued)
Tritium in Drinking Water
October–December 2015

Location	Date Collected	^{3}H pCi/L	± 2*u*
SC: Barnwell	10/21/15	144	97
SC: Columbia	10/15/15	−31	91
SC: Jenkinsville	10/14/15	19	94
SC: Seneca	10/07/15	−36	71
TN: Knoxville	10/20/15	132	97
TN: Oak Ridge/#360	10/06/15	−84	70
TN: Oak Ridge/#371	10/06/15	−43	69
TN: Oak Ridge/#768	10/06/15	−34	71
TN: Oak Ridge/#772	10/06/15	6	72
TX: Austin	11/15/15	13	61
WA: Richland	11/03/15	60	65

Table 9
Iodine-131 in Drinking Water
January–December 2015

Location	Date Collected	^{131}I pCi/L	± 2*u*
AK: Fairbanks	08/18/15	0.07	0.23
AL: Dothan	01/09/15	0.04	0.19
AL: Montgomery	05/01/15	0.13	0.19
AL: Muscle Shoals	01/07/15	0.06	0.17
AL: Scottsboro	01/06/15	0.26	0.20
AR: Little Rock	07/07/15	0.06	0.29
CO: Denver	07/30/15	−0.13	0.55
CT: Hartford	04/07/15	0.14	0.18
DE: Dover	04/13/15	0.03	0.24
FL: Miami	03/26/15	−0.08	0.27
FL: Tampa	03/30/15	0.09	0.19
GA: Baxley	05/18/15	0.02	0.42
GA: Savannah	12/11/15	0.8	1.4
HI: Honolulu	02/17/15	0.08	0.21
IA: Cedar Rapids	02/20/15	−0.01	0.17
ID: Idaho Falls	02/26/15	0.19	0.18
IL: Morris	02/17/15	0.29	0.45
KS: Topeka	01/28/15	0.17	0.36
LA: New Orleans	01/30/15	0.19	0.15
MD: Baltimore	07/21/15	−0.18	0.42
MD: Conowingo	10/06/15	0.23	0.20
MI: Detroit	01/05/15	0.02	0.17
MN: St. Paul	01/20/15	−0.05	0.18
MN: Welch	01/20/15	0.21	0.20
MO: Jefferson City	01/28/15	0.02	0.22
MS: Jackson	08/17/15	−0.02	0.37
MS: Port Gibson	08/11/15	−0.08	0.21
MT: Helena	03/30/15	−0.08	0.19
ND: Bismarck	04/27/15	0.19	0.47
NE: Lincoln	01/07/15	−0.04	0.20
NH: Concord	11/16/15	1.2	1.4
NJ: Trenton	07/13/15	0.13	0.18
NJ: Waretown	07/15/15	0.10	0.29
NM: Santa Fe	04/08/15	0.52	0.17
NV: Las Vegas	01/15/15	0.06	0.20
NY: Albany	12/30/15	−0.09	0.33
NY: New York City	03/26/15	0.11	0.32
NY: Niagara Falls	07/31/15	0.22	0.17
NY: Syracuse	07/24/15	0.11	0.22
OH: Columbus	08/18/15	0.05	0.26
OH: E. Liverpool	01/28/15	0.62	0.20

Table 9 (continued)
Iodine-131 in Drinking Water
January–December 2015

Location	Date Collected	^{131}I pCi/L	± 2*u*
OH: Painesville	02/24/15	0.12	0.16
OH: Toledo	05/13/15	−0.23	0.39
OK: Oklahoma City	03/24/15	0.16	0.41
OR: Portland	12/31/15	0.00	0.16
PA: Harrisburg	09/28/15	0.06	0.41
PA: Pittsburgh	11/03/15	0.15	0.14
RI: Providence	07/07/15	0.05	0.32
SC: Barnwell	07/20/15	0.33	0.52
SC: Columbia	01/28/15	0.13	0.20
SC: Jenkinsville	07/08/15	0.02	0.26
SC: Seneca	07/08/15	0.21	0.27
TN: Knoxville	07/09/15	−0.11	0.24
TN: Knoxville	10/20/15	0.05	0.39
TN: Oak Ridge/#360	01/05/15	0.11	0.19
TN: Oak Ridge/#371	01/05/15	−0.01	0.20
TN: Oak Ridge/#768	01/05/15	−0.05	0.19
TN: Oak Ridge/#772	01/05/15	0.06	0.16
TX: Austin	01/14/15	0.38	0.46
WA: Richland	05/12/15	0.01	0.22
WI: Madison	04/13/15	0.04	0.43

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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.

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:

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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:

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