New York State Energy Research and Development Authority

New York State Low-Level Radioactive Waste Status Report for 2013

Final Report

July 1, 2014

The New NY WORKS for Energy

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NYSERDA's Promise to New Yorkers:

NYSERDA provides resources, expertise, and objective information so New Yorkers can make confident, informed energy decisions.

Mission Statement:

Advance innovative energy solutions in ways that improve New York's economy and environment.

Vision Statement:

Serve as a catalyst—advancing energy innovation and technology, transforming New York's economy, empowering people to choose clean and efficient energy as part of their everyday lives.

Core Values:

Objectivity, integrity, public service, partnership, and innovation.

Portfolios

NYSERDA programs are organized into five portfolios, each representing a complementary group of offerings with common areas of energy-related focus and objectives.

Energy Efficiency and Renewable Energy Deployment

Helping New York State to achieve its aggressive energy efficiency and renewable energy goals – including programs to motivate increased efficiency in energy consumption by consumers (residential, commercial, municipal, institutional, industrial, and transportation), to increase production by renewable power suppliers, to support market transformation, and to provide financing.

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Helping to build a generation of New Yorkers ready to lead and work in a clean energy economy – including consumer behavior, youth education, workforce development, and training programs for existing and emerging technologies.

Energy and the Environment

Helping to assess and mitigate the environmental impacts of energy production and use in New York State – including environmental research and development, regional initiatives to improve environmental sustainability, and West Valley Site Management.

Energy Data, Planning, and Policy

Helping to ensure that New York State policymakers and consumers have objective and reliable information to make informed energy decisions – including State Energy Planning, policy analysis to support the Regional Greenhouse Gas Initiative and other energy initiatives, emergency preparedness, and a range of energy data reporting.

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1 Introduction

This report summarizes data on low-level radioactive waste (LLRW)[1] generated in New York State[2]. It is based on reports from generators[3] that file annually with the New York State Energy Research and Development Authority (NYSERDA). The New York State Low-Level Radioactive Waste Management Act[4] (State Act) requires LLRW generators in the State to submit annual reports to NYSERDA that provide detailed information on waste generated, stored, and disposed. To facilitate compliance, NYSERDA has developed report forms that can be downloaded from nyserda.ny.gov. Generators without Internet access are provided paper copies upon request. This is the 28th year that generators have submitted such reports to NYSERDA.

The State Act requires NYSERDA to prepare an annual report summarizing, by type of generator and county of generation within the State, the nature, characteristics and quantities of LLRW generated in New York. This report is designed to meet that requirement and summarizes the most recent year's data in a series of tables and figures. Section 2 reports volume, radioactivity,[5] and other characteristics of waste disposed in 2013. Section 3 summarizes volume, radioactivity, and other characteristics of waste held in storage pending future disposal as of December 31, 2013. Section 3 also summarizes the volume of waste held in storage for decay and subsequent disposal as non-radioactive waste as of December 31, 2013. Such waste may still be subject to special disposal requirements due to other hazardous characteristics (e.g., regulated medical waste). Section 4 shows historical LLRW generation data and includes generators' projections of waste quantities for the next five years.

In this report, volume is presented in cubic meters and radioactivity is presented in gigabecquerels (GBq) or megabecquerels (MBq). These units have been adopted to be consistent with U.S. Nuclear Regulatory Commission uniform national LLRW manifest requirements. The Conversions for Units tables [see p. 27] and footnotes to the relevant tables provide information for converting the data to the previously used units of cubic feet and curies.

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1 Low-level radioactive waste is one category of waste produced through processes that use radioactive materials. In the U.S., radioactive wastes are classified according to a number of different categories by federal law and U.S. Nuclear Regulatory Commission (NRC) regulations.

2 Waste generated by certain federal installations and programs, such as the Brookhaven National Laboratory, the Knolls Atomic Power Laboratory, and West Valley Demonstration Project, are not included in this report nor in the requirements for generator reporting to NYSERDA. Under the federal Low-Level Radioactive Waste (LLRW) Policy Act, as amended in 1985 (Public Law 99-240), the federal government (not the states) is responsible for disposal of LLRW owned and generated by the U.S. DOE, the U.S. Navy as a result of decommissioning vessels, and the federal government as a result of research, development, testing, and production of nuclear weapons.

3 "Generator" is defined in 21 NYCRR Part 502.2(e) as "A person who by his actions within New York, or through the actions within New York of any agent, employee, or independent contractor, generates low-level radioactive waste."

4 New York Public Authorities Law. §1854-d(1) (McKinney's Consolidated Laws of New York, 2000)

5 Radioactivity is the measure of a material's propensity to emit radiation, or the number of radiation-emitting events occurring each second.

2 Low-Level Radioactive Waste Disposed by New York State Generators in 2013

This section summarizes data reported by LLRW generators in New York State on waste transferred to licensed LLRW disposal facilities in Clive, Utah (Energy Solutions); Richland, Washington (U.S. Ecology); and Andrews, Texas (Waste Control Specialists) during 2013. LLRW is categorized as Class A, B, or C. These categories were established originally by the U.S. Nuclear Regulatory Commission (NRC) in Title 10 of the Code of Federal Regulations, Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste" and have since been adopted by the New York State Department of Environmental Conservation in 6 NYCRR Part 382, "Regulations for Low-Level Radioactive Waste Disposal Facilities." Class A contains the lowest concentration of short- and long-lived radioactive materials and represents the largest class by volume produced in the State. On the other end of the spectrum, Class C waste contains the greatest concentration of long-lived radioactive material and, although normally being the smallest in terms of volume generated, usually contains the greatest amount of radioactivity. Class B, as the name suggests, is an intermediate category.

The Clive facility can accept most Class A waste, but cannot accept Class B or C waste. The Clive facility can also accept, treat, and dispose of most solid, mixed waste (i.e., LLRW that also contains other hazardous constituents) that meets the site's radioactivity concentration limits. The Richland facility is authorized to accept limited volumes of LLRW containing small quantities of naturally occurring radioactive material (e.g., radium, uranium, and thorium) from New York State generators. The Andrews facility accepts Class A, B and C waste.

In 2013, generators in New York State reported disposing of 1,466 cubic meters (51,768 cubic feet) of LLRW containing 128,144 GBq (3,463 curies) of radioactivity. About 99.7% of the volume, containing 50% of the radioactivity, was shipped to the Clive facility. The Andrews facility received 0.3% of the volume, containing 50% of the radioactivity. A very small amount, less than 1% of the volume and radioactivity, was shipped to the Richland facility.

The volume of waste reported as being disposed in 2013 continues the 2008 return to the lower volumes reported prior to 2003. Very high volumes of low activity waste had been reported in 2003, 2004, and 2006 due to two significant projects; a major site decontamination effort and decommissioning of a research reactor. The volume reported disposed in 2007 represented a significant drop, but was still higher than expected due to a cleanout of a waste storage facility at the Nine Mile Point Unit 2 nuclear power plant. The elevated levels of radioactivity reported as being disposed by the nuclear plants in 2012 and 2013 are due to the 2012 opening of the Andrews facility. This disposal included Class B and C waste, which had been awaiting disposal since the closure of the Barnwell, South Carolina facility to generators outside of the Atlantic Compact on July 1, 2008.

Individual entries in the following tables have been rounded using standard practices as described below. The totals shown represent the sum of the rounded entries, therefore they may vary from one table to another and may not always equal 100%. Waste volumes have been rounded to the nearest 10th of a cubic meter. In most cases, radioactivity has been rounded to the nearest 10,000th of a GBq. Percentages have been rounded to the nearest 10th of a percent in the table and figures.

Table 1. Generators Reporting and Disposing[1] Waste

Generator Type	Number Reporting	Number Disposing
Medical		
Government	10	0
Private	113	9
College	15	10
Other	7	0
Total Medical	**145**	**19**
Industrial		
Manufacturing	8	3
Research & Development	2	0
Other	2	0
Total Industrial	**12**	**3**
Academic (nonmedical)		
College or University	25	10
Other	1	0
Total Academic	**26**	**10**
Government (nonmedical)		
New York State	3	1
Other	2	0
Total Government	**5**	**1**
Total Nonpower Plant	**188**	**33**
Nuclear Power Plant	**6**	**6**
Total	**194**	**39**

[1] Disposal refers to generators that reported transferring any class of LLRW directly or via brokers or processors to one of the able licensed LLRW disposal facilities. LLRW generators that did not dispose waste, are storing waste for future disposal, or storing waste for decay and subsequent disposal as non-radioactive waste. Section 3 addresses storage in detail.

Table 2. Volume and Radioactivity of Waste Disposed[1]

Generator Type	Volume[2] (m^3)	% of Total	Radioactivity[2] (GBq)	% of Total
Medical				
Government	0.0		0.0000	
Private	9.7		19.9444	
College	26.0		10.1287	
Other	0.0		0.0000	
Total Medical	**35.7**	**2.4**	**30.0731**	*
Industrial				
Manufacturing	1.3		0.0661	
Research & Development	0.0		0.0000	
Other	0.0		0.0000	
Total Industrial	**1.3**	**0.1**	**0.0661**	*
Academic (nonmedical)				
College or University	8.4		2.7600	
Other	0.0		0.0000	
Total Academic	**8.4**	**0.5**	**2.7600**	*
Government (nonmedical)				
New York State	*		0.0132	
Other	0.0		0.0000	
Total Government	*	*	**0.0132**	*
Total Nonpower Plant	**45.5**	**3.1**	**32.9124**	*
Nuclear Power Plant	**1,420.6**	**96.9**	**128,111.9082**	**99.9**
Total	**1,466.1**	**100.0**	**128,144.8206**	**100.0**
	(51,768 ft^3)		**(3,463 curies)**	

[1] Refers to all classes of LLRW transferred either directly or via broker or processor to one of the available licensed LLRW disposal facilities.

[2] To obtain volume in cubic feet (ft^3), multiply the number of cubic meters (m^3) by 35.31. To obtain radioactivity in curies, divide the number of gigabecquerels (GBq) by 37.

* Less than 0.1% or 0.1 cubic meters.

Table 3. Waste Disposed[1] by Class[2] and Generator Type

Generator Type	Class A		Class B		Class C	
	Volume[3] (m^3)	Radioactivity[3] (GBq)	Volume[3] (m^3)	Radioactivity[3] (GBq)	Volume[3] (m^3)	Radioactivity[3] (GBq)
Medical	35.7	30.0731	0.0	0.0000	0.0	0.0000
Industrial	1.3	0.0661	0.0	0.0000	0.0	0.0000
Academic	7.4	2.7599	1.0	0.0001	0.0	0.0000
Government	*	0.0132	0.0	0.0000	0.0	0.0000
Nuclear Power Plant	1,418.1	63,980.8816	2.2	58,697.8095	0.3	5,433.2171
Total	**1,462.5**	**64,013.7939**	**3.2**	**58,697.8096**	**0.3**	**5,433.2171**
	(51,641 ft^3)	**(1,730 curies)**	**(113 ft^3)**	**(1,586 curies)**	**(11 ft^3)**	**(147 curies)**

[1] Refers to LLRW transferred directly or via brokers or processors to one of the available licensed LLRW disposal facilities.

[2] Classes A, B and C are waste-classification categories established by the U.S. Nuclear Regulatory Commission (NRC) in Title 10 of the Code of Federal Regulations, Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," and adopted by the New York State Department of Environmental Conservation in 6 NYCRR Part 382, "Regulations for Low-Level Radioactive Waste Disposal Facilities."

[3] To obtain volume in cubic feet (ft^3), multiply the number of cubic meters (m^3) by 35.31. To obtain radioactivity in curies, divide the number of gigabecquerels (GBq) by 37.

* Less than 0.1 cubic meters, 0.0001 gigabecquerels, 0.1 curies, or 0.1%.

Table 4. Distribution of Waste Among Disposal Facilities[1]

Disposal Facility	Volume[2] (m^3)	% of Total	Radioactivity[2] (GBq)	% of Total
Andrews, Texas	4.0	0.3	64,131.4091	50.0
Clive, Utah	1,462.1	99.7	64,013.3855	50.0
Richland, Washington	*	*	0.0260	*
Total	**1,466.1**	**100.0**	**128,144.8206**	**100.0**
	(51,768 ft^3)		**(3,463 curies)**	

[1] Refers to all classes of LLRW transferred either directly or via a broker or processor to the respective disposal facility.

[2] To obtain volume in cubic feet (ft^3), multiply the number of cubic meters (m^3) by 35.31. To obtain radioactivity in curies, divide the number of gigabecquerels (GBq) by 37.

* Less than 0.1% or 0.1 cubic meters.

Table 5. Waste Disposed by County of Origin

County	Number of Generators Reporting	Number of Generators Disposing LLRW[1]	Volume[2] (m^3)	% of Total	Radioactivity[2] (GBq)	% of Total
Albany	7	4	0.8	0.1	1.4860	*
Allegany	0	0	0.0	0.0	0.0000	0.0
Bronx	6	1	3.8	0.3	1.1260	*
Broome	4	1	*	*	0.3824	*
Cattaraugus	1	0	0.0	0.0	0.0000	0.0
Cayuga	1	0	0.0	0.0	0.0000	0.0
Chautauqua	0	0	0.0	0.0	0.0000	0.0
Chemung	2	1	*	*	0.0297	*
Chenango	0	0	0.0	0.0	0.0000	0.0
Clinton	0	0	0.0	0.0	0.0000	0.0
Columbia	0	0	0.0	0.0	0.0000	0.0
Cortland	0	0	0.0	0.0	0.0000	0.0
Delaware	0	0	0.0	0.0	0.0000	0.0
Dutchess	8	2	0.5	*	0.0341	*
Erie	20	2	1.4	0.1	0.9404	*
Essex	0	0	0.0	0.0	0.0000	0.0
Franklin	1	0	0.0	0.0	0.0000	0.0
Fulton	0	0	0.0	0.0	0.0000	0.0
Genesee	0	0	0.0	0.0	0.0000	0.0
Greene	0	0	0.0	0.0	0.0000	0.0
Hamilton	0	0	0.0	0.0	0.0000	0.0
Herkimer	0	0	0.0	0.0	0.0000	0.0
Jefferson	1	0	0.0	0.0	0.0000	0.0
Kings	6	0	0.0	0.0	0.0000	0.0
Lewis	0	0	0.0	0.0	0.0000	0.0
Livingston	0	0	0.0	0.0	0.0000	0.0
Madison	1	0	0.0	0.0	0.0000	0.0
Monroe	8	3	10.9	0.7	5.3134	*
Montgomery	1	0	0.0	0.0	0.0000	0.0
Nassau	24	1	2.4	0.2	0.0981	*
New York	16	9	14.9	1.0	8.5680	*
Niagara	2	0	0.0	0.0	0.0000	0.0
Oneida	3	0	0.0	0.0	0.0000	0.0
Onondaga	13	0	0.0	0.0	0.0000	0.0

Table 5. continued

County	Number of Generators Reporting	Number of Generators Disposing LLRW[1]	Volume[2] (m^3)	% of Total	Radioactivity[2] (GBq)	% of Total
Ontario	2	0	0.0	0.0	0.0000	0.0
Orange	7	0	0.0	0.0	0.0000	0.0
Orleans	1	0	0.0	0.0	0.0000	0.0
Oswego	4	3	660.3	45.0	108,176.4738	84.4
Otsego	1	0	0.0	0.0	0.0000	0.0
Putnam	1	0	0.0	0.0	0.0000	0.0
Queens	6	1	2.0	0.1	0.0001	*
Rensselaer	1	0	0.0	0.0	0.0000	0.0
Richmond	0	0	0.0	0.0	0.0000	0.0
Rockland	3	1	0.2	*	1.0960	*
St. Lawrence	4	2	4.6	0.3	0.3788	*
Saratoga	3	0	0.0	0.0	0.0000	0.0
Schenectady	1	1	*	*	0.0221	*
Schoharie	0	0	0.0	0.0	0.0000	0.0
Schuyler	1	0	0.0	0.0	0.0000	0.0
Seneca	0	0	0.0	0.0	0.0000	0.0
Steuben	2	0	0.0	0.0	0.0000	0.0
Suffolk	14	1	0.8	0.1	0.7625	*
Sullivan	1	0	0.0	0.0	0.0000	0.0
Tioga	0	0	0.0	0.0	0.0000	0.0
Tompkins	1	1	0.1	*	0.4367	*
Ulster	1	0	0.0	0.0	0.0000	0.0
Warren	2	0	0.0	0.0	0.0000	0.0
Washington	0	0	0.0	0.0	0.0000	0.0
Wayne	1	1	280.2	19.1	2,000.0000	1.6
Westchester	13	4	483.1	33.0	17,947.6725	14.0
Wyoming	0	0	0.0	0.0	0.0000	0.0
Yates	0	0	0.0	0.0	0.0000	0.0
Totals	**194**	**39**	**1,466.1**		**128,144.8206**	
			(51,768 ft^3)		**(3,463 curies)**	

[1] Refers to the number of generators that reported transferring all classes of LLRW, either directly or via a broker or processor, to one of the available licensed LLRW disposal facilities.

[2] To obtain volume in cubic feet (ft3), multiply the number of cubic meters (m3) by 35.31. To obtain radioactivity in curies, divide the number of gigabecquerels (GBq) by 37.

* Less than 0.1 cubic meter or 0.1%.

Table 6. Radionuclide Content of Waste[1] Disposed[2] (MBq)

Radionuclide	Half-Life[3]	Academic	Government	Industrial	Medical	Nuclear Power Plants	Total
Ag-110m	249.8 d					48,520.503	4.9 E4
Am-241	432.7 y	0.105			2.800	27.296	3.0 E1
Ba-133	10.5 y	0.100					1.0 E-1
Be-7	53.3 d					91.000	9.1 E1
C-14	5.7 E3 y	260.776			1,990.717	128,566.098	1.3 E5
Ca-45	162.7 d				1.480		1.5 E0
Cd-109	461.0 d	0.100			370.000		3.7 E2
Ce-144	284.6 d					24,114.028	2.4 E4
Cl-36	3.0 E5 y	0.104					1.0 E-1
Cm-242	162.8 d					6.352	6.4 E0
Cm-243	29.1 y					50.975	5.1 E1
Cm-244	29.1 y				2.800	13.894	1.6 E1
Co-57	271.8 d	0.237				11,468.072	1.1 E4
Co-58	70.9 d					254,765.525	2.5 E5
Co-60	5.3 y	0.100			2.806	3,875,111.537	3.9 E7
Cr-51	27.7 d	0.185			135.700	9,473.990	9.6 E3
Cs-134	2.1 y					18,052.821	1.8 E4
Cs-136	13.1 d	3.330					3.3 E0
Cs-137	30.1 y	0.280			12,285.577	406,114.380	4.2 E5
Eu-154	8.6 y				3.687		3.7 E0
Fe-55	2.7 y	3.330			46.335	64,058,198.172	6.4 E7
Fe-59	44.5 d					4,455.898	4.5 E3
H-3	12.3 y	1,434.909	12.247	4.409	10,414.090	27,935.360	4.0 E4
I-125	59.4 d	1.302			535.128		5.4 E2
I-129	1.6 E7 y					484.732	4.9 E2
I-131	8.0 d					6.836	6.8 E0
Kr-85	10.8 y	370.000					3.7 E2
La-140	1.7 d					3.700	3.7 E0
Mn-54	312.1 d	74.640				2,961,339.115	3.0 E6
Na-22	2.6 y	28.420			0.974		3.0 E1
Nb-94	2.0 E4 y					1,560.660	1.6 E3
Nb-95	35.0 d					1,420.662	1.4 E3
Ni-59	7.6 E4 y					28,640.072	2.9 E4
Ni-63	101 y	37.000				18,604,556.062	1.9 E7
Np-237	2.1 E6 y				3.700		3.7 E0
P-32	14.3 d	89.433			21.460		1.1 E2
P-33	25.3 d				26.270		2.6 E1

Table 6. continued

Radionuclide	Half-Life[3]	Academic	Government	Industrial	Medical	Nuclear Power Plants	Total
Pa-231	3.3 E4y				1.739		1.7 E0
Pb-210	22.3 y		0.370		0.001		3.7 E-1
Po-210	138.4 d				0.037		3.7 E-2
Pu-236	2.87 y				0.185		1.9 E-1
Pu-238	87.7 y				0.185	145.422	1.5 E2
Pu-239	2.4 E4 y					945.714	9.5 E2
Pu-240	2.4 E4 y					6.799	6.8 E0
Pu-241	14.4 y					1,891.954	1.9 E3
Pu-242	3.7E5 y				74.970		7.5 E1
Ra-226	1.6 E3 y	0.850	0.370				1.2 E0
Ru-106	1.0 y	0.100			2.810		2.9 E0
S-35	87.2 d	383.330			912.889		1.3 E3
Sb-124	60.2 d					948.854	9.5 E2
Sb-125	2.8 y					134,001.904	1.3 E5
Sm-153	46 h				1567.100		1.6 E3
Sn-113	115.1 d					198.192	2.0 E2
Sr-89	50.5 d				835.700	1,601.698	2.4 E3
Sr-90	28.8 y	0.100			2.837	32,073.475	3.2 E4
Tc-99m	6.0 h	3.700				3,422.653	3.4 E3
Th-229	7.3 E3 y				0.042		4.2 E-2
Th-230	7.5 E4 y	0.002			0.002		4.0 E-3
Th-232	1.4 E10 y	0.385		31.970	0.785		3.3 E1
U-232	69.8 y				0.089		8.9 E-2
U-233	1.6 E5 y			0.089	736.300		7.4 E2
U-234	2.5 E5 y	0.100		28.583			2.9 E1
U-235	7.0 E8 y			0.922	0.002		9.2 E-1
U-236	2.3 E7 y			0.143	18.500		1.9 E1
U-238	4.5 E9 y	68.486	0.185	0.009	68.993		1.4 E2
Y-90	64 h				0.766		7.7 E-1
Zn-65	243.8 d				4.440	1,393,522.097	1.4 E6
Zr-95	64 d					1,545.988	1.5 E3
Others[4]	---	---	---	---	---	---	---
	Total	**2,761.505**	**13.172**	**66.125**	**30,072.257**	**128,111,908.398**	**1.3 E8**

[1] Some generator facilities have reported radionuclides with half-lives of less than 90 days in LLRW disposed. In the majority of these cases, these radionuclides cannot be separated readily from longer-lived radionuclides in the waste. The sum of individual radionuclide radioactivities frequently will not match the overall radioactivity totals reported for waste disposed due to rounding and other approximation techniques. Every effort is made to identify and resolve significant discrepancies.

[2] To obtain radioactivity in curies, divide the number of megabecquerels (MBq) by 37,000.

[3] Source: Chart of the Nuclides, General Electric Company under the direction of Naval Reactors, U.S. DOE; 16th edition, revised to 2002. NB: y=years, m=months, d=days, h=hours.

[4] In certain cases, LLRW generators are permitted by manifest to report a single activity for a group of radionuclides without assigning a value to each; those data are reported here.

Table 7. Number of Facilities Disposing Various Waste Types[1]

Waste Type[2]	Medical	Industrial	Academic	Government	Nuclear Power Plants	Total
Activated Material	0	0	0	0	0	0
Aqueous Liquids	3	1	2	0	0	6
Animal Carcasses	2	0	1	0	0	3
Anion Exchange Media	0	0	0	0	1	1
Biological Material (except animal carcasses)	2	0	0	0	0	2
Cation Exchange Medias	0	0	0	0	1	1
Charcoal	0	0	0	0	1	1
Compacted Trash	6	3	3	1	2	15
Contaminated Equipment	2	0	0	0	1	3
Demolition Rubble	1	0	0	0	1	2
Evaporator Bottoms/ Sludges/Concentrates	0	0	0	0	1	1
Filter Media	1	0	0	0	2	3
Filter (Mechanical)	0	0	0	0	0	0
Glassware/Labware	2	0	1	0	0	3
Incinerator Ash	0	0	0	0	0	0
Material to be Incinerated	2	0	1	0	0	3
Mixed Bed Ion-Exchange Media	0	0	0	0	2	2
Non-Compacted Trash	2	0	1	0	2	5
Oil	0	0	0	0	2	2
Organic Liquids (excluding oil)	3	0	1	0	0	4
Paint or Plating	0	1	0	0	0	1
Sealed Source/Device	3	0	2	0	0	5
Soil	0	0	0	0	1	1
Other[3]	1	0	1	0	0	2

[1] Refers to the number of generators that reported transferring any class of LLRW directly and via brokers and processors to one of the available licensed LLRW disposal facilities.

[2] Waste types listed are as defined by the U.S. Nuclear Regulatory Commission (NRC) Uniform Manifest. Generators frequently report disposal of several types of waste.

[3] In certain cases, generators reported disposing waste that did not fit into any of the categories listed. Those data are reported here.

3 Low-Level Radioactive Waste in Storage (as of December 31, 2013)

This section provides information on LLRW being stored by generators.

Many generators store LLRW to allow its radioactivity to diminish to levels that permit disposal as non-radioactive waste (i.e., storage for decay). In general, the regulatory agencies with jurisdiction over LLRW in New York State allow storage for decay only where the waste contains radionuclides with half-lives of less than 90 days. LLRW in storage for decay is normally held for 10 half-lives or until radioactivity has diminished to a level where it is indistinguishable from background radiation. Most generators hold LLRW in storage for decay at their own facilities, although approved off-site facilities may be used.

Generators also regularly store waste pending future transfer to a licensed LLRW disposal facility (i.e., storage pending disposal). Storage pending disposal can occur for extended periods, as when the Barnwell LLRW disposal facility in South Carolina closed to generators in New York from June 30, 1994 until June 30, 1995. The Barnwell facility again closed to generators in New York as of July 1, 2008. Such storage may also occur when the LLRW has a particular characteristic that makes it unacceptable at the available disposal facilities (e.g., contains chemically hazardous components).

For those cases where access to licensed disposal facilities is not available, most generators will store LLRW at their own sites, although approved off-site storage facilities may be used. In addition, most generators routinely store LLRW at their facilities for short periods as a normal part of operation or staging while accumulating a sufficient quantity for transfer to a waste broker or a treatment or disposal facility. Post-storage treatment or processing may significantly reduce the volume of waste requiring final disposal.

Individual entries in the following tables have been rounded using standard procedures as described below. The totals shown represent the sum of the rounded entries, therefore they may vary slightly from one table to another and may not always equal 100%. Waste volumes have been rounded to the nearest 10th of a cubic meter. In most cases, radioactivity has been rounded to the nearest 10,000th of a GBq. Percentages have been rounded to the nearest 10th of a percent in the tables and figures.

Table 8. Generators Reporting and Storing Waste Pending Disposal[1]

Generator Type	Number Reporting	Number Storing
Medical		
Government	10	2
Private	113	4
College	15	5
Other	7	1
Total Medical	**145**	**12**
Industrial		
Manufacturing	8	4
Research & Development	2	1
Other	2	2
Total Industrial	**12**	**7**
Academic (nonmedical)		
College or University	25	6
Other	1	0
Total Academic	**26**	**6**
Government (nonmedical)		
New York State	3	1
Other	2	2
Total Government	**5**	**3**
Total Nonpower Plant	**188**	**28**
Nuclear Power Plant	**6**	**1**
Total	**194**	**29**

[1] Includes any class of LLRW reported in storage at generator sites or an approved off-site location pending transfer to a licensed LLRW facility as of December 31, 2013. Does not include LLRW held in storage for decay.

Table 9. Volume and Radioactivity of Waste Stored Pending Disposal[1]

Generator Type	Volume[2] (m^3)	% of Total	Radioactivity[2] (GBq)	% of Total
Medical				
Government	1.2		0.1732	
Private	0.7		0.8519	
College	17.3		2.9630	
Other	*		3.1630	
Total Medical	**19.2**	**50.8**	**7.1511**	**0.5**
Industrial				
Manufacturing	11.5		142.4177	
Research & Development	0.1		0.0250	
Other	*		0.0005	
Total Industrial	**11.7**	**31.0**	**142.4432**	**9.1**
Academic (nonmedical)				
College or University	1.6		2.0424	
Other	0.0		0.0000	
Total Academic	**1.6**	**4.2**	**2.0424**	**0.1**
Government (nonmedical)				
New York State	0.2		0.0026	
Other	0.1		0.0052	
Total Government	**0.3**	**0.8**	**0.0078**	*
Total Nonpower Plant	**32.8**	**86.8**	**151.6445**	**9.7**
Nuclear Power Plant	**5.0**	**13.2**	**1,411.1070**	**90.3**
Total	**37.8**	**100.0**	**1,562.7515**	**100.0**
	(1,335 ft^3)		**(42 curies)**	

[1] Includes all classes of LLRW reported in storage at generator sites or an approved off-site location pending transfer to a licensed LLRW facility as of December 31, 2013. Does not include LLRW held in storage for decay.

[2] To obtain volume in cubic feet (ft^3), multiply the number of cubic meters (m^3) by 35.31. To obtain radioactivity in curies, divide the number of gigabecquerels (GBq) by 37.

* Less than 0.1% or 0.1 cubic meters.

Table 10. Waste in Storage Pending Disposal by Class[1] and Generator Type[2]

Generator Type	Class A		Class B		Class C	
	Volume[3] (m^3)	Radioactivity[3] (GBq)	Volume[3] (m^3)	Radioactivity[3] (GBq)	Volume[3] (m^3)	Radioactivity[3] (GBq)
Medical	19.2	7.1511	0.0	0.0000	0.0	0.0000
Industrial	11.7	142.4432	0.0	0.0000	0.0	0.0000
Academic	1.6	2.0424	0.0	0.0000	0.0	0.0000
Government	0.3	0.0078	0.0	0.0000	0.0	0.0000
Nuclear Power Plant	0.0	0.0000	5.0	1,411.1070	0.0	0.0000
Total	**32.8**	**151.6445**	**5.0**	**1,411.1070**	**0.0**	**0.0000**
	(1,158 ft^3)	**(4 curies)**	**(176 ft^3)**	**(38 curies)**	**(0.0 ft^3)**	**(0.0000 curies)**

[1] Classes A, B, and C are waste-classification categories established by the U.S. Nuclear Regulatory Commission (NRC) in Title 10 of the Code of Federal Regulations, Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," and adopted by the New York State Department of Environmental Conservation in 6 NYCRR Part 382, "Regulations for Low-Level Radioactive Waste Disposal Facilities."

[2] Refers to LLRW in storage at generator sites or an approved off-site location pending transfer to a licensed LLRW facility as of December 31, 2013. Does not include LLRW held in storage for decay.

[3] To obtain volume in cubic feet (ft^3), multiply the number of cubic meters (m^3) by 35.31. To obtain radioactivity in curies, divide the number of gigabecquerels (GBq) by 37.

* Less than 0.1% or 0.1 cubic meters.

Table 11. Number of Facilities Reporting Storage of Various Waste Types Pending Disposal

Waste Type[1]	Medical	Industrial	Academic	Government	Nuclear Power Plants	Total
Activated Material	0	0	0	0	0	0
Animal Carcasses	0	0	0	0	0	0
Anion Exchange Media	0	0	0	0	0	0
Aqueous Liquids	2	1	1	1	0	5
Biological Material (Except Animal Carcasses)	0	0	0	0	0	0
Cation Exchange Media	0	0	0	0	0	0
Contaminated Equipment	0	1	0	0	0	1
Compacted Trash	6	3	1	1	0	11
Demolition Rubble	0	0	0	0	0	0
Evaporator Bottoms/Sludge	0	1	0	0	1	2
Filter Media	0	1	0	0	0	1
Filter Media (Mechanical)	0	0	0	0	0	0
Glassware/Labware	0	1	1	1	0	3
Incinerator Ash	0	0	0	0	0	0
Material that will be Incinerated	0	0	0	0	0	0
Mixed Bed Ion-Exchange Media	0	0	0	0	0	0
Non-Compactible Trash	0	1	0	2	1	4
Organic Liquids (excluding oil)	0	0	1	0	0	1
Paint or Plating	0	0	0	0	0	0
Sealed Source/Device	1	1	1	0	0	3
Soil	0	0	0	0	0	0
Other[2]	0	1	0	0	0	1

[1] Waste types listed are as defined by the U.S. Nuclear Regulatory Commission (NRC) Uniform Manifest. Generators frequently report storage of several types of waste.

[2] In certain cases, generators reported storage of waste that did not fit into any of the categories listed. Those data are reported here.

Table 12. Waste in Storage[1] Pending Disposal by County of Origin

County	Number of Generators Reporting	Number of Generators Storing LLRW[2]	Volume[3] (m^3)	% of Total	Radioactivity[3] (GBq)	% of Total
Albany	7	2	0.2	0.5	0.0406	*
Allegany	0	0	0.0	0.0	0.0000	0.0
Bronx	6	2	1.0	2.6	0.5274	*
Broome	4	0	0.0	0.0	0.0000	0.0
Cattaraugus	1	1	0.2	0.5	0.0026	*
Cayuga	1	0	0.0	0.0	0.0000	0.0
Chautauqua	0	0	0.0	0.0	0.0000	0.0
Chemung	2	1	1.4	3.7	0.0023	*
Chenango	0	0	0.0	0.0	0.0000	0.0
Clinton	0	0	0.0	0.0	0.0000	0.0
Columbia	0	0	0.0	0.0	0.0000	0.0
Cortland	0	0	0.0	0.0	0.0000	0.0
Delaware	0	0	0.0	0.0	0.0000	0.0
Dutchess	8	1	0.1	0.3	0.0009	*
Erie	20	6	11.1	29.4	133.1645	8.5
Essex	0	0	0.0	0.0	0.0000	0.0
Franklin	1	0	0.0	0.0	0.0000	0.0
Fulton	0	0	0.0	0.0	0.0000	0.0
Genesee	0	0	0.0	0.0	0.0000	0.0
Greene	0	0	0.0	0.0	0.0000	0.0
Hamilton	0	0	0.0	0.0	0.0000	0.0
Herkimer	0	0	0.0	0.0	0.0000	0.0
Jefferson	1	0	0.0	0.0	0.0000	0.0
Kings	6	1	*	*	3.1630	0.2
Lewis	0	0	0.0	0.0	0.0000	0.0
Livingston	0	0	0.0	0.0	0.0000	0.0
Madison	1	0	0.0	0.0	0.0000	0.0
Monroe	8	2	15.1	40.0	0.7750	*
Montgomery	1	0	0.0	0.0	0.0000	0.0
Nassau	24	2	0.9	2.4	0.5248	*
New York	16	1	0.4	1.1	0.0494	*
Niagara	2	0	0.0	0.0	0.0000	0.0
Oneida	3	0	0.0	0.0	0.0000	0.0
Onondaga	13	2	0.2	0.5	10.4310	0.7
Ontario	2	0	0.0	0.0	0.0000	0.0

Table 12. continued

County	Number of Generators Reporting	Number of Generators Storing LLRW[2]	Volume[3] (m^3)	% of Total	Radioactivity[3] (GBq)	% of Total
Orange	7	0	0.0	0.0	0.0000	0.0
Orleans	1	0	0.0	0.0	0.0000	0.0
Oswego	4	1	5.0	13.2	1,411.1070	90.3
Otsego	1	0	0.0	0.0	0.0000	0.0
Putnam	1	0	0.0	0.0	0.0000	0.0
Queens	6	2	1.3	3.4	1.6578	0.1
Rensselaer	1	1	0.7	1.9	1.2976	0.1
Richmond	0	0	0.0	0.0	0.0000	0.0
Rockland	3	1	*	*	0.0002	*
St. Lawrence	4	1	*	*	0.0022	*
Saratoga	3	0	0.0	0.0	0.0000	0.0
Schenectady	1	0	0.0	0.0	0.0000	0.0
Schoharie	0	0	0.0	0.0	0.0000	0.0
Schuyler	1	0	0.0	0.0	0.0000	0.0
Seneca	0	0	0.0	0.0	0.0000	0.0
Steuben	2	0	0.0	0.0	0.0000	0.0
Suffolk	14	1	*	*	*	*
Sullivan	1	0	0.0	0.0	0.0000	0.0
Tioga	0	0	0.0	0.0	0.0000	0.0
Tompkins	1	0	0.0	0.0	0.0000	0.0
Ulster	1	0	0.0	0.0	0.0000	0.0
Warren	2	0	0.0	0.0	0.0000	0.0
Washington	0	0	0.0	0.0	0.0000	0.0
Wayne	1	0	0.0	0.0	0.0000	0.0
Westchester	13	1	0.1	0.3	0.0052	*
Wyoming	0	0	0.0	0.0	0.0000	0.0
Yates	0	0	0.0	0.0	0.0000	0.0
Totals	**194**	**29**	**37.8 (1,335 ft^3)**		**1,562.7515 (42 curies)**	

[1] Includes LLRW in storage at generator sites or an approved off-site location pending transfer to a licensed LLRW facility, as of December 31, 2013. Does not include LLRW held in storage for decay.

[2] Refers to the number of generators who reported LLRW in storage pending disposal as of December 31, 2013.

[3] To obtain volume in cubic feet (ft^3), multiply the number of cubic meters (m^3) by 35.31. To obtain radioactivity in curies, divide the number of gigabecquerels (GBq) by 37.

* Less than 0.1 cubic meter, or 0.1%, or 0.0001 GBq.

Table 13. Radionuclide Content of Waste[1] in Storage Pending Disposal[2] (MBq)

Radionuclide	Half-Life[3]	Academic	Government	Industrial	Medical	Nuclear Power Plants	Total
Am-241	432.7 y	17.760	0.074	151.822		0.651	1.7 E2
Ba-133	10.5 y	0.011					1.1 E-2
C-14	5.7 E3 y	149.920	0.042	22.179	805.380		9.8 E2
Ce-144	284.6 d					0.389	3.9 E-1
Cm-243	29.1 y					3.678	3.7 E0
Co-56	77.3 d				18.500		1.9 E1
Co-58	70.9 d				18.500		1.9 E1
Co-60	5.3 y	0.004			37.000	395,900.000	4.0 E5
Cr-51	27.7 d				24.670		2.5 E1
Cs-134	2.1 y					3,585.300	3.6 E3
Cs-137	30.1 y	3.700	0.441	0.037	18.000	72,890.000	7.3 E4
Eu-154	8.6 y				0.005		5.0E-3
Fe-55	2.7 y				18.500	839,900.000	8.4 E5
H-3	12.3 y	919.640	2.740	7,218.153	2,257.437	806.600	1.1 E4
I-125	59.4 d				3.700		3.7 E0
I-129	1.6 E7 y		3.480				3.5 E0
Ir-192	73.8 d				3,145.000		3.1 E3
Mn-54	312.1 d				18.500	910.200	1.5 E4
Na-22	2.6 y	20.000					2.0 E1
Ni-63	101 y	925.000		134,970.177		89,540.000	2.3 E5
P-32	14.3 d				0.037		3.7 E-2
Po-210	138.4 d y			75.902			7.6 E1
Pu-238	87.8 y					4.403	4.4 E0
Pu-239	2.4 E4 y					1.528	1.5 E0
Ra-226	1.6 E3 y	0.370	0.222	0.037			6.3 E-1
Ra-228	5.8 y		0.037	0.037			7.4 E-2
S-35	87.2 d				3.700		3.7 E0
Sm-153	1.9 y				748.800		7.5 E2

Table 13. continued

Radionuclide	Half-Life[3]	Academic	Government	Industrial	Medical	Nuclear Power Plants	Total
Sr-89	50.5 d				14.700		1.5 E1
Sr-90	28.8 y		0.111	0.037	0.185	7,474.000	7.5 E3
Tc-99m	6.0 h		0.001				1.0 E-3
Th-230	7.5 E4 y		0.440	0.418			8.6 E-1
Th-232	1.4 E10 y			1.880			1.9 E0
U-233	1.6 E5 y			0.007			7.0 E-3
U-234	2.5 E5 y			2.168			2.2 E0
U-235	7.0 E8 y			0.070			7.0 E-2
U-236	2.3 E7 y			0.011			1.1 E-3
U-238	4.5 E9 y	5.780	0.185	0.271			6.2 E0
Zn-65	243.8 d				18.500	89.910	1.1 E2
Others[4]	---	---	---	---	---	---	---
	Total	**2,042.185**	**7.773**	**142,443.206**	**7,151.150**	**1,411,106.659**	**1.6 E6**

[1] Some generator facilities have reported radionuclides with half-lives of less than 90 days in LLRW stored. In the majority of these cases, the shorter-lived radionuclides reported cannot be separated readily from longer-lived radionuclides in the waste. The sum of individual radionuclide radioactivities will frequently not match the overall radioactivity totals reported for waste stored due to rounding and other approximation techniques. Every effort is made to identify and resolve significant discrepancies with the affected generators.

[2] To obtain radioactivity in curies, divide the number of megabecquerels (MBq) by 37,000.

[3] Source: Chart of the Nuclides, General Electric Company under the direction of Naval Reactors, U.S. DOE; 16th edition, revised to 2002. NB: y=years, m=months, d=days, h=hours.

[4] In certain cases, LLRW generators are permitted by manifest to report a single activity for a group of radionuclides without assigning a value to each; those data are reported here.

Table 14. Waste Reported in Storage for Decay[1] by Generator Type

Generator Type	Number of Generators Reporting	Number of Generators Reporting Storage for Decay[2]	Number of Generators Reporting Only Storage for Decay	Estimated Maximum Volume in Storage for Decay at Any Time[3] (m^3)
Medical	145	129	112	223
Industrial	12	4	3	1
Academic	26	16	8	122
Government	5	2	0	4
Nuclear Power Plant	6	0	0	0
Total	**194**	**151**	**123**	**350 (12,359 ft^3)**

[1] Storage for decay means holding the LLRW until the level of radioactivity has diminished to the point where it can be disposed of as non-radioactive waste. Normally, such LLRW is held for 10 half-lives, or until the radioactivity has diminished to a level that is undetectable above background radiation. Typical radionuclides held for decay, with their respective half-lives, include: Iodine-123 (13.1 hours), Iodine-125 (59.7 days), Iodine-131 (8.0 days), Technetium-99m (6.0 hours), Phosphorous-32 (14.3 days), Gallium-67 (3.3 days), and Sulfur-35 (89.9 days).

[2] Some generators that store for decay also may have transferred other LLRW to one of the licensed LLRW disposal facilities or may be storing LLRW pending disposal.

[3] To obtain volume in cubic feet (ft^3), multiply the number of cubic meters (m^3) by 35.31.

4 Historic Data and Projections for Low-Level Radioactive Waste Generation in New York State

This section provides historic data on the volume and radioactivity of LLRW shipped for disposal, based on generator data reported to NYSERDA for years 2004 through 2013.

This section also provides a summary, based on information supplied in the 2013 generator reports, of generator projections of the volume and radioactivity of LLRW that will require disposal in a licensed LLRW facility for the years 2014 through 2018.

Volume projections have been rounded to the nearest 10th of a cubic meter, and radioactivity projections to the nearest GBq.

Table 15. Historic Overview of Waste Disposal by Volume[1, 2] (in m^3)

Generator Type	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Nonpower Plant	20,779	477	1,248	35	69	17	184	98	60	46
Nuclear Power Plant	525	718	1,588	2,106	372	449	596	1,239	713	1,420
Total	**21,304**	**1,195**	**2,836**	**2,141**	**441**	**466**	**780**	**1,337**	**773**	**1,466**

Table 16. Historic overview of Waste Disposal by Radioactivity[1, 2] (in GBq)

Generator Type	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Nonpower Plant	4,231	292	435	78	421	18	621	1,064	196	33
Nuclear Power Plant	30,669	197,148	120,080	1,877,537	3,433,317	11,851	13,786	13,205	178,962	128,112
Total	**34,900**	**197,440**	**120,515**	**1,877,615**	**3,433,738**	**11,869**	**14,407**	**14,269**	**179,158**	**128,145**

[1] Data are based on reports that must be filed annually with NYSERDA.

[2] To obtain volume in cubic feet, multiply the number of cubic meters by 35.31. To obtain radioactivity in curies, divide the number of gigabecquerels (GBq) by 37.

Figure 1. Historic Overview of Waste Disposal by Volume[1]

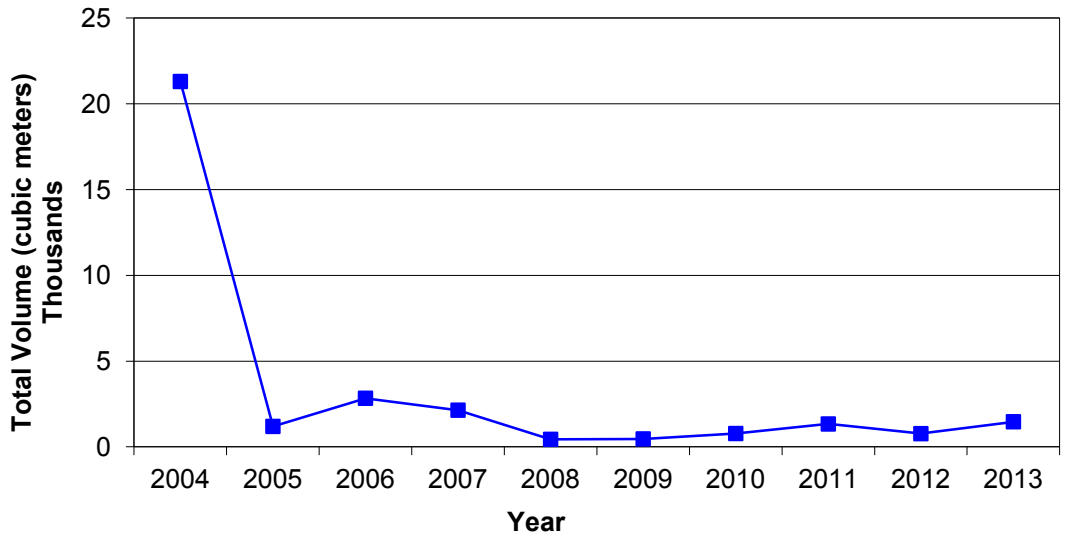
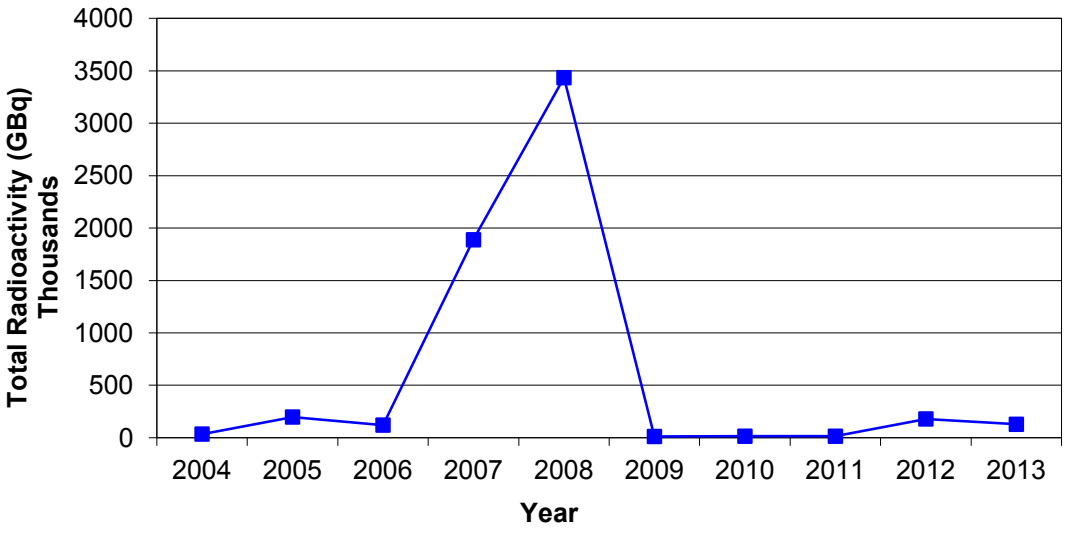


Figure 2. Historic Overview of Waste Disposal by Radioactivity[2]



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[1] The jump in volume shown in 2003 and 2004 is directly attributable to a major site decontamination effort at a former Sylvania nuclear fuel fabrication facility that is currently owned by GTE Verizon. The waste consisted primarily of lightly contaminated soil. Disposal volume dropped drastically in 2005 and the project was completed in 2006. The smaller jump in volume in 2006 is attributable to a one time decommissioning of a research reactor at Cornell University.

[2] In general, the radioactive content of the LLRW disposed continues to be a function of refueling and maintenance activities at New York's six nuclear power plants, and shows little or no correlation to overall volume. The large jump in radioactive content for 2007 and 2008 corresponds to an increase in disposal at the Barnwell facility prior to its closure to New York waste on July 1, 2008.

Table 17. Generators' Five-Year Projections of Waste[1, 2] by Volume (m^3)

Generator Type	2014	2015	2016	2017	2018
Medical	1,056.0	1,038.3	1,038.4	940.4	892.4
Industrial	18.64	19.8	18.8	17.6	17.8
Academic	13.8	13.3	13.2	13.2	13.3
Government	0.7	0.3	0.7	0.3	0.5
Total Nonpower Plant	**1,089.1**	**1,071.7**	**1,071.1**	**971.5**	**924.0**
Nuclear Power Plant	**767.8**	**827.8**	**663.9**	**827.8**	**767.0**
Total	**1,856.9**	**1,899.5**	**1,735.0**	**1,799.3**	**1,691.8**

Table 18: Generators' Five-Year Projections of Waste[1, 2] by Radioactivity (GBq)

Generator Type	2014	2015	2016	2017	2018
Medical	42.1	31.6	33.2	35.3	38.3
Industrial	1,010.1	1,010.1	1,010.1	1,010.1	1,010.1
Academic	9.6	7.4	7.4	7.4	7.4
Government	0.4	0.1	0.3	0.1	0.3
Total Nonpower Plant	**1,062.2**	**1,049.2**	**1,051.0**	**1,052.9**	**1,056.1**
Nuclear Power Plant	**71,040.0**	**74,440.0**	**70,650.0**	**74,440.0**	**71,040.0**
Total	**72,102.2**	**75,489.2**	**71,701.0**	**75,492.9**	**72,096.1**

[1] Refers to all classes of LLRW projected by generators to require disposal in a licensed LLRW facility.

[2] To obtain volume in cubic feet (ft^3), multiply the number of cubic meters (m^3) by 35.31. To obtain radioactivity in curies, divide the number of gigabecquerels (GBq) by 37.

Appendix A: Conversions for Units

The metric system is the standard set of measurement units used in science and technology today. Metric or SI system (Systeme International d'Unites) units have been incorporated into the U.S. Nuclear Regulatory Commission's (NRC) Uniform Waste Manifest.

Volume is presented in cubic meters and radioactivity is presented in gigabecquerels (GBq) and megabecquerels (MBq). These units have been adopted for this report to be consistent with the uniform national LLRW manifest requirements. Some conversions for SI units to the previously used units of cubic feet and curies are provided in the following tables.

Conversions For Units				
Measurement	**SI Unit**	**Previously Used Unit**	**Value of Conventional Unit in SI Units**	**Conversional Factors**
Radioactivity	**Gigabecquerel (GBq) Megabecquerel (MBq)**	**Curie (Ci) milliCurie (mCi)**	**1 Ci = 37 GBq 1 Ci = 37,000 MBq**	**Ci × 37 = GBq Ci × 37,000 = MBq GBq / 37 = Ci MBq / 37,000 = Ci**
Volume	**cubic meters (m^3)**	**cubic feet (ft^3)**	**1 ft^3 = 0.028 m^3**	**ft^3 × 0.028 = m^3 m^3 × 35.31 = ft^3**

Radioactivity Conversions		
mCi	**MBq**	**GBq**
500	**18,500**	**18.500**
200	**7,400**	**7.400**
100	**3,700**	**3.700**
50	**1,850**	**1.850**
20	**740**	**0.740**
10	**370**	**0.370**
5	**185**	**0.185**
2	**74**	**0.074**
1	**37**	**0.037**

Volume Conversions	
ft^3	**m^3**
11.9 (89 gallon drum)	**0.33**
11.1 (83 gallon drum)	**0.31**
7.5 (55 gallon drum)	**0.21**
4.01 (30 gallon drum)	**0.11**
0.67 (5 gallon pail)	**0.019**

NYSERDA, a public benefit corporation, offers objective information and analysis, innovative programs, technical expertise, and funding to help New Yorkers increase energy efficiency, save money, use renewable energy, and reduce reliance on fossil fuels. NYSERDA professionals work to protect the environment and create clean-energy jobs. NYSERDA has been developing partnerships to advance innovative energy solutions in New York State since 1975.

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State of New York
Andrew M. Cuomo, Governor

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New York State Energy Research and Development Authority
Richard L. Kauffman, Chair | John B. Rhodes, President and CEO

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