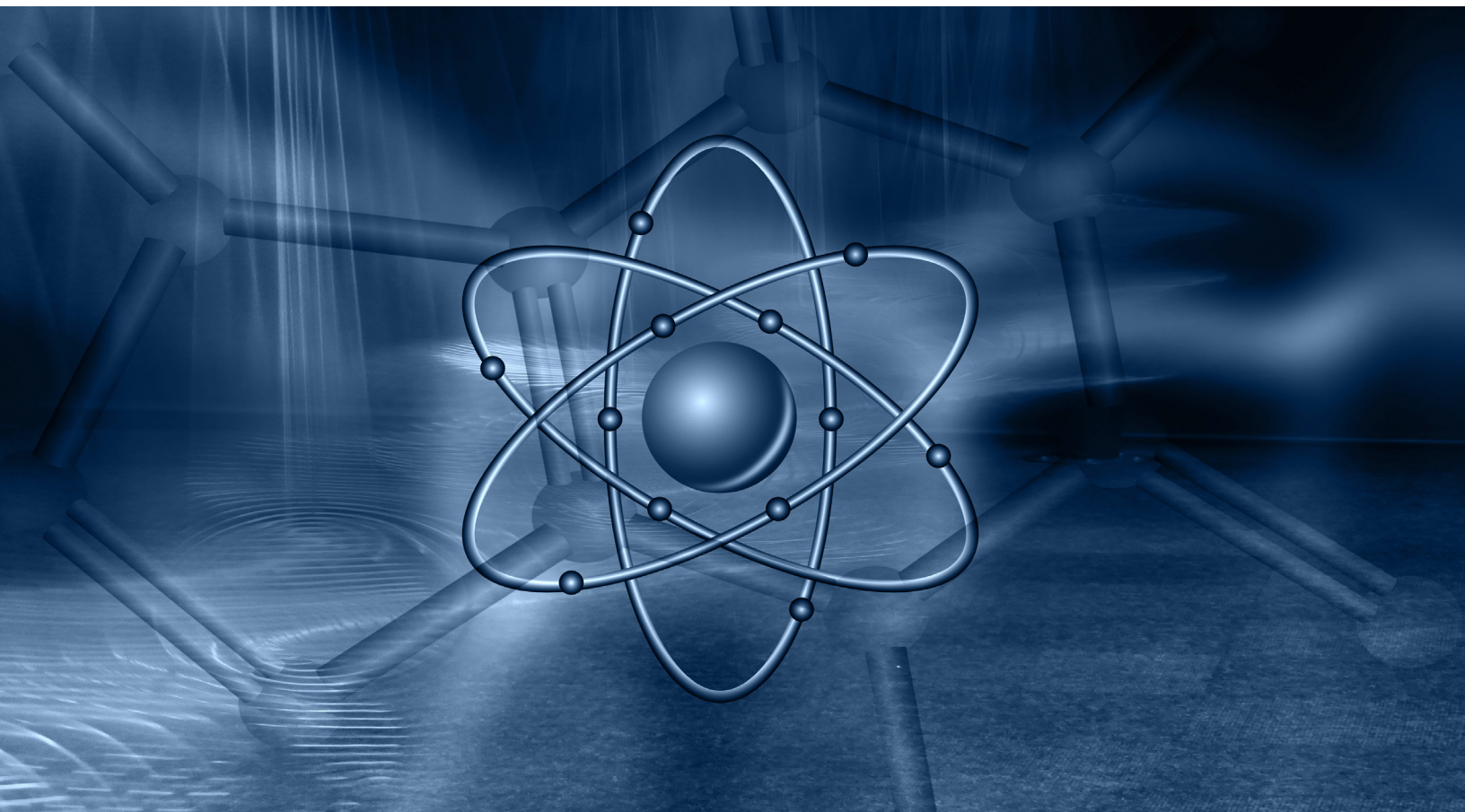


New York State Low-Level Radioactive Waste Status Report for 2021

Final Report | July 2022



NYSERDA

NYSERDA's Promise to New Yorkers:

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

Our Vision:

New York is a global climate leader building a healthier future with thriving communities; homes and businesses powered by clean energy; and economic opportunities accessible to all New Yorkers.

Our Mission:

Advance clean energy innovation and investments to combat climate change, improving the health, resiliency, and prosperity of New Yorkers and delivering benefits equitably to all.

New York State Low-Level Radioactive Waste Status Report for 2021

Final Report

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July 2022

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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 generators³ that are filed annually with the New York State Energy Research and Development Authority (NYSERDA). The New York State Low-Level Radioactive Waste Management Act⁴ (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 developed report forms available on its website. Generators without internet access are provided paper copies upon request. This is the 36th 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—the nature, characteristics, and quantities of LLRW generated in the State. 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 2021. Section 3 summarizes volume, radioactivity, and other characteristics of waste held in storage pending future disposal as of December 31, 2021. Section 3 also summarizes the volume of waste held in storage for decay and subsequent disposal as nonradioactive waste as of December 31, 2021. 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 United States Nuclear Regulatory Commission LLRW uniform manifest requirements. Information for converting the data to cubic feet and curies is provided in footnotes throughout the report and the conversion tables in appendix A.

¹ Low-level radioactive waste is one category of waste produced through processes using 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 Policy Act, as amended in 1985 (Public Law 99-240), the federal government is responsible for disposal of LLRW owned and generated by the United States Department of Energy (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 2021

This section summarizes data reported by LLRW generators in the 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 2021. LLRW is categorized as Class A, B, or C. These categories were established originally by the U.S. Nuclear Regulatory Commission 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 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 State generators. The Andrews facility accepts Class A, B, and C waste.

In 2021, generators in the State reported disposing 2,839.2 cubic meters (100,252 cubic feet) of LLRW containing 7,350 GBq (199 curies) of radioactivity. About 66.7% of the volume, containing 76.4% of the radioactivity, was shipped to the Clive facility. The Andrews facility received about 33.3% of the volume, containing 23.6% of the radioactivity. The Richland facility received no LLRW from State generators this year.

In general, variability in volume and activity of LLRW disposed is primarily a function of refueling and maintenance activities at nuclear power plants. The high disposal volumes in 2015 and 2016 can be attributed to three separate disposal actions: decommissioning of a university research reactor, disposal of both irradiated hardware, and a large volume of resin from one of the nuclear power plants. The increase in disposal volume in 2021 can be attributed largely to decommissioning of a nuclear power plant site.

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

Table 1. Generators Reporting and Disposing Waste⁶

Generator Type	Number Reporting	Number Disposing
Medical		
Government	7	0
Private	137	12
College	14	11
Other	10	3
Total Medical	168	26
Industrial		
Manufacturing	6	6
Research and Development	2	2
Other	1	1
Total Industrial	9	9
Academic (nonmedical)		
College or University	22	9
Other	2	0
Total Academic	24	9
Government (nonmedical)		
New York State	3	1
Other	3	2
Total Government	6	3
Total Nonpower Plant	207	47
Nuclear Power Plant	6	6
Total	213	53

⁶ 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 of waste are either storing waste for future disposal or storing waste for decay and subsequent disposal as nonradioactive waste. Section 3 addresses storage in detail.

Table 2. Volume and Radioactivity of Waste Disposed⁷

Generator Type	Volume ⁸ (m ³)	% of Total	Radioactivity ⁸ (GBq)	% of Total
Medical				
Government	0.0		0.0000	
Private	4.0		4.5217	
College	6.9		14.1634	
Other	0.7		1.2051	
Total Medical	11.6	0.4	19.8902	0.3
Industrial				
Manufacturing	4.3		0.2970	
Research and Development	1.9		0.0084	
Other	*		77.8890	
Total Industrial	6.2	0.2	78.1944	1.1
Academic (nonmedical)				
College or University	7.8		4.9977	
Other	0.0		0.0000	
Total Academic	7.8	0.3	4.9977	*
Government (nonmedical)				
New York State	0.2		19.2421	
Other	295.7		0.0028	
Total Government	295.9	10.4	19.2449	0.3
Total Nonpower Plant	321.5	11.3	122.3272	1.7
Nuclear Power Plant	2,517.7	88.7	7,227.5545	98.3
Total	2,839.2	100.0	7,349.8817	100.0
	(100,252 ft³)		(199 curies)	

⁷ Refers to all classes of LLRW transferred either directly or via broker or processor to one of the available licensed LLRW disposal facilities.

⁸ 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% or 0.1 cubic meters.

Table 3. Waste Disposed⁹ by Class¹⁰ and Generator Type

Generator Type	Class A		Class B		Class C	
	Volume ¹¹ (m ³)	Radioactivity ¹¹ (GBq)	Volume ¹¹ (m ³)	Radioactivity ¹¹ (GBq)	Volume ¹¹ (m ³)	Radioactivity ¹¹ (GBq)
Medical	11.6	19.8902	0.0	0.0000	0.0	0.0000
Industrial	6.2	78.1944	0.0	0.0000	0.0	0.0000
Academic	7.8	4.9977	0.0	0.0000	0.0	0.0000
Government	295.9	19.2449	0.0	0.0000	0.0	0.0000
Nuclear Power Plant	2,507.5	4,809.5834	10.2	2,417.9710	0.0	0.0000
Total	2,829.0	4,931.9106	10.2	2,417.9710	0.0	0.0000
	(99,892 ft³)	(133 curies)	(360 ft³)	(65 curies)	(0 ft³)	(0 curies)

⁹ Refers to LLRW transferred either directly, via brokers, or processors to one of the available licensed LLRW disposal facilities.

¹⁰ 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."

¹¹ 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 meters, 0.0001 gigabecquerels, 0.1 curies, or 0.1%.

Table 4. Distribution of Waste Among Disposal Facilities¹²

Disposal Facility	Volume¹³ (m³)	% of Total	Radioactivity¹³ (GBq)	% of Total
Andrews, Texas	945.1	33.3	1,733.7198	23.6
Clive, Utah	1,894.1	66.7	5,616.1617	76.4
Richland, Washington	0.0	0.0	0.0000	0.0
Total	2,839.2 (100,252 ft³)	100.0	7,349.8815 (199 curies)	100.0

¹² Refers to all classes of LLRW transferred either directly or via a broker or processor to the respective disposal facility.

¹³ 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% or 0.1 cubic meters.

Table 5. Waste Disposed by County of Origin

County	Number of Generators Reporting	Number of Generators Disposing LLRW ¹⁴	Volume ¹⁵ (m ³)	% of Total	Radioactivity ¹⁵ (GBq)	% of Total
Albany	12	3	295.9	10.4	19.2614	0.3
Allegany	0	0	0.0	0.0	0.0000	0.0
Bronx	6	3	0.7	*	0.8800	*
Broome	4	1	0.1	*	0.0185	*
Cattaraugus	2	0	0.0	0.0	0.0000	0.0
Cayuga	0	0	0.0	0.0	0.0000	0.0
Chautauqua	0	0	0.0	0.0	0.0000	0.0
Chemung	2	1	0.8	*	0.0625	*
Chenango	1	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	2	1	0.1	*	0.0185	*
Delaware	1	0	0.0	0.0	0.0000	0.0
Dutchess	7	3	1.4	*	1.2396	*
Erie	18	4	0.9	*	0.2964	*
Essex	0	0	0.0	0.0	0.0000	0.0
Franklin	1	0	0.0	0.0	0.0000	0.0
Fulton	1	0	0.0	0.0	0.0000	0.0
Genesee	1	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	3	0	0.0	0.0	0.0000	0.0
Kings	7	1	*	*	11.0556	0.2
Lewis	0	0	0.0	0.0	0.0000	0.0
Livingston	3	0	0.0	0.0	0.0000	0.0
Madison	0	0	0.0	0.0	0.0000	0.0
Monroe	7	3	3.2	0.1	0.5927	*
Montgomery	1	0	0.0	0.0	0.0000	0.0
Nassau	21	2	0.2	*	0.0055	*
New York	18	9	7.8	0.3	7.1040	0.1
Niagara	2	0	0.0	0.0	0.0000	0.0
Oneida	1	0	0.0	0.0	0.0000	0.0
Onondaga	12	3	0.1	*	0.0312	*

Table 5 continued

County	Number of Generators Reporting	Number of Generators Disposing LLRW ¹⁴	Volume ¹⁵ (m ³)	% of Total	Radioactivity ¹⁵ (GBq)	% of Total
Ontario	2	1	1.0	*	2.2570	*
Orange	9	0	0.0	0.0	0.0000	0.0
Orleans	1	0	0.0	0.0	0.0000	0.0
Oswego	4	3	1,064.6	37.5	5,125.9680	69.7
Otsego	0	0	0.0	0.0	0.0000	0.0
Putnam	2	0	0.0	0.0	0.0000	0.0
Queens	7	2	0.2	*	77.8983	1.1
Rensselaer	3	0	0.0	0.0	0.0000	0.0
Richmond	0	0	0.0	0.0	0.0000	0.0
Rockland	4	1	0.1	*	0.0024	*
St. Lawrence	2	1	0.5	*	0.0003	*
Saratoga	3	0	0.0	0.0	0.0000	0.0
Schenectady	3	1	0.9	*	0.0082	*
Schoharie	0	0	0.0	0.0	0.0000	0.0
Schuyler	0	0	0.0	0.0	0.0000	0.0
Seneca	0	0	0.0	0.0	0.0000	0.0
Steuben	2	1	1.8	*	0.1851	*
Suffolk	15	1	0.9	*	0.5080	*
Sullivan	0	0	0.0	0.0	0.0000	0.0
Tioga	0	0	0.0	0.0	0.0000	0.0
Tompkins	3	2	0.9	*	0.6830	*
Ulster	0	0	0.0	0.0	0.0000	0.0
Warren	3	0	0.0	0.0	0.0000	0.0
Washington	0	0	0.0	0.0	0.0000	0.0
Wayne	2	1	368.5	13.0	973.1452	13.2
Westchester	14	5	1,088.6	38.3	1,128.6603	15.4
Wyoming	1	0	0.0	0.0	0.0000	0.0
Yates	0	0	0.0	0.0	0.0000	0.0
Totals	213	53	2,839.2		7,349.8817	
			(100,252 ft³)		(199 curies)	

¹⁴ 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.

¹⁵ 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, 0.1%, or 0.0001 GBq.

Table 6. Radionuclide Content of Waste Disposed^{16,17} (MBq)

Radionuclide	Half-Life ¹⁸	Academic	Government	Industrial	Medical	Nuclear Power Plants	Total
Ag-110m	249.8 d					4,731.930	4.7 E3
Al-26	7.2 E5 y			0.370			3.7 E-1
Am-241	432.7 y	3.465	0.061	0.080		21.774	2.5 E1
Ba-133	12.8 d	0.257			0.308		5.6 E-1
C-14	5.7 E3 y	267.122	209.228		403.104	66,767.035	6.8 E4
Ca-45	162.7 d	37.407					3.7 E1
Cd-109	461.0 d	1.221		6.475			7.7 E1
Ce-144	284.6 d					1,887.161	1.9 E3
Cl-36	3.0 E5 y	0.370	0.001		1.070		1.4 E0
Cm-242	162.8 d					2.123	2.1 E0
Cm-243	29.1 y					25.917	2.6 E1
Cm-244	29.1 y					20.534	2.0 E1
Co-56	77.3 d	47.430		33.855			8.1 E1
Co-57	271.8 d	35.910		74.518	553.403	2,708.177	3.4 E3
Co-58	70.9 d	90.287		10.305		66,259.534	6.6 E4
Co-60	5.3 y	4.215	0.370		6.733	3,807,079.435	3.8 E6
Cr-51	27.7 d	41.707		52.170		3,624.618	3.7 E3
Cs-134	2.1 y					40,510.404	4.1 E4
Cs-137	30.1 y	1.138	3,258.142	24.055	12,562.162	309,004.127	3.3 E5
Eu-152	13.5 y				0.162		1.6 E-1
Eu-154	8.6 y				0.024		2.4 E-2
Eu-155	4.8 y				0.004		4.0 E-3
F-18	1.8 H			4.071			4.0 E0
Fe-55	2.7 y	100.011		0.010	0.026	692,301.165	6.9 E5
Fe-59	44.5 d					459.607	4.6 E2
Gd-153	241.6 d				82.400		8.3 E1
Ge-68	270.8 d				26.685		2.7 E1
H-3	12.3 y	2,973.054	15,732.338	77,890.553	2,803.835	15,032.490	1.2 E5
Hg-203	46.6 d					69.560	7.0 E1
I-125	59.4 d	4.928			28.528	67,071.230	6.7 E4
I-129	1.6 E7 y		0.858			13.024	1.4 E1
I-131	8.0 d				5.099		5.1 E0
Lu-177	6.7 d				1.003		1.0 E0
Lu-177m	160.7 d				3.016		3.0 E0
Mn 54	312.1 d	7.075		8.069	3.579	203,895.044	2.0 E5
Na-22	2.6 y	0.011			3.716		3.7 E0
Nb-94	2.0 E4 y			0.740		211.173	2.1 E2
Nb-95	35.0 d					2,516.181	2.5 E3
Ni-59	7.6 E4 y					10,804.000	1.1 E4

Table 6 continued

Radionuclide	Half-Life ¹⁸	Academic	Government	Industrial	Medical	Nuclear Power Plants	Total
Ni-63	101 y	1.110	2.410			1,523,826.071	1.5 E6
Pb-210	22.3 y	2.611	12.543	0.062			1.5 E1
Po-210	138.4 d	18.500					1.8 E1
Pu-238	87.7 y					22.366	2.2 E1
Pu-239	2.4 E4 y		0.144			4.406	4.6 E0
Pu-240	2.4 E4 y					4.207	4.2 E0
Pu-241	14.4 y					2,156.689	2.2 E3
Ra-226	1.6 E3 y	0.074	0.385		1.406		1.9 E0
Ra-228	5.8 y	0.004					4.0 E-3
Re-183	70.0 d	1.667					1.7 E0
Re-184	38.0 d	0.022					2.2 E-2
S-35	87.2 d	1,309.011			3.700		1.3 E3
Sb-124	60.2 d					3,916.311	3.9 E3
Sb-125	2.8 y					34,447.420	3.4 E4
Sn-113	115.1 d					1,148.428	1.1 E3
Sn-117 m	13.6 d					63.599	6.4 E1
Sr-89	50.5 d					32.338	3.2 E1
Sr-90	28.8 y		26.664		1,101.294	2,941.484	4.1 E3
Ta-182	114.4 d			0.740			7.4 E-1
Tc-99m	6.0 h	14.800	0.010		0.433	282.462	3.0 E2
Te-123m	119.7 d					60.692	6.1 E1
Th-230	7.5 E4y	0.002					2.0 E-3
Th-232	1.4 E10 y	2.461		23.950			2.6 E1
U-233	1.6 E5 y			0.186			1.9 E-1
U-234	2.4 E5 y			60.064	0.004		6.0 E1
U-235	7.0 E8 y			1.939			1.9 E0
U-236	2.3 E7 y			0.246			2.5 E-1
U-238	4.5 E9 y	31.837	1.767	1.202	2,305.870		2.3 E3
Y-88	106.7 d				0.001		1.0 E-3
Zn-65	243.8 d			0.740		361,897.462	3.8 E5
Zr-85	7.9 m				0.047		4.7 E-3
Zr-95	64 d					818.658	8.2 E2
Zr-96	2.8 y					15.725	1.6 E1
Others ¹⁹	---	---	---	---	---	---	---
	Total	4,997.704	19,244.922	78,194.400	19,890.209	7,227,554.561	9.0 E6

¹⁶ 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.

¹⁷ To obtain radioactivity in curies, divide the number of megabecquerels (MBq) by 37,000.

¹⁸ Source: Chart of the Nuclides, General Electric Company under the direction of Naval Reactors, DOE; 16th edition, revised to 2002. NB: y=years, m=months, d=days, h=hours.

¹⁹ 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 Types²⁰

Waste Type ²¹	Medical	Industrial	Academic	Government	Nuclear Power Plants	Total
Activated Material	0	1	1	0	0	2
Aqueous Liquids	3	3	1	0	1	8
Animal Carcasses	2	0	1	0	0	3
Anion Exchange Media	0	0	0	0	0	0
Biological Material (except animal carcasses)	2	0	2	0	0	4
Cation Exchange Medias	0	0	0	0	0	0
Charcoal	0	0	0	0	0	0
Compacted Trash	7	3	3	1	2	16
Contaminated Equipment	2	0	0	0	2	4
Demolition Rubble	0	0	0	0	0	0
Evaporator Bottoms/Sludges/Concentrates	0	0	0	0	0	0
Filter Media	0	1	0	0	0	1
Filter (Mechanical)	0	0	0	0	1	1
Glassware/Labware	6	0	1	0	0	7
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	3	1	1	0	2	7
Oil	0	0	1	0	1	2
Organic Liquids (excluding oil)	2	1	2	0	0	5
Paint or Plating	0	1	0	0	0	1
Sealed Source/Device	7	0	1	2	0	10
Soil	0	0	0	0	0	0
Other ²²	2	0	2	1	1	6

²⁰ 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.

²¹ 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.

²² 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, 2021)

This section provides information on LLRW stored by generators.

Many generators store LLRW to allow its radioactivity to diminish to levels that permit disposal as nonradioactive waste (i.e., storage for decay). In general, the regulatory agencies with jurisdiction over LLRW in the 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 no longer accepted waste from generators in New York State from June 30, 1994 to June 30, 1995. The Barnwell facility again closed to New York State as of July 1, 2008, increasing storage needs until the Andrews, Texas facility opened in 2012. 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 are rounded using standard procedures as described. The totals shown represent the sum of the rounded entries; therefore, they may vary slightly from one table to another and not always equal 100%. Waste volumes are rounded to the nearest tenth of a cubic meter. In most cases, radioactivity is rounded to the nearest 10,000th of a GBq. Percentages are rounded to the nearest tenth of a percent in the tables and figures.

Table 8. Generators Reporting and Storing Waste Pending Disposal²³

Generator Type	Number Reporting	Number Storing
Medical		
Government	7	1
Private	137	9
College	14	5
Other	10	1
Total Medical	168	16
Industrial		
Manufacturing	6	3
Research and Development	2	1
Other	1	1
Total Industrial	9	5
Academic (nonmedical)		
College or University	22	10
Other	2	1
Total Academic	24	11
Government (nonmedical)		
New York State	3	1
Other	3	0
Total Government	6	1
Total Nonpower Plant	207	33
Nuclear Power Plant	6	1
Total	213	34

²³ 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, 2021. Does not include LLRW held in storage for decay.

Table 9. Volume and Radioactivity of Waste Stored Pending Disposal²⁴

Generator Type	Volume ²⁵ (m ³)	% of Total	Radioactivity ²⁵ (GBq)	% of Total
Medical				
Government	0.3		0.0279	
Private	2.4		0.2287	
College	8.0		3.3824	
Other	0.5		0.0130	
Total Medical	11.2	42.4	3.6520	*
Industrial				
Manufacturing	45.0		393.8000	
Research and Development	*		*	
Other	*		32.9060	
Total Industrial	45.1	19.3	426.7060	91.7
Academic (nonmedical)				
College or University	3.6		4.8999	
Other	0.1		0.0995	
Total Academic	3.7	14.0	4.9994	0.1
Government (nonmedical)				
New York State	1.4		0.0208	
Other	0.0		0.0000	
Total Government	1.4	5.3	0.0208	*
Total Nonpower Plant	61.4	81.0	435.3782	91.8
Nuclear Power Plant	5.0	19.0	368.5908	8.2
Total	66.4	100.0	803.9690	100.0
	(2,345 ft³)		(22 curies)	

²⁴ 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, 2021. Does not include LLRW held in storage for decay.

²⁵ 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% or 0.1 cubic meters.

Table 10. Waste in Storage Pending Disposal by Class and Generator Type^{26, 27}

Generator Type	Class A		Class B		Class C	
	Volume ²⁸ (m ³)	Radioactivity ²⁸ (GBq)	Volume ²⁸ (m ³)	Radioactivity ²⁸ (GBq)	Volume ²⁸ (m ³)	Radioactivity ²⁸ (GBq)
Medical	11.2	3.6520	0.0	0.0000	0.0	0.0000
Industrial	45.1	426.7060	0.0	0.0000	0.0	0.0000
Academic	3.7	4.9994	0.0	0.0000	0.0	0.0000
Government	1.4	0.0208	0.0	0.0000	0.0	0.0000
Nuclear Power Plant	0.0	0.0000	5.0	368.5908	0.0	0.0000
Total	61.4	435.5654	5.0	368.5908	0.0	0.0000
	(2,168 ft³)	(12 curies)	(176 ft³)	(10 curies)	(0.0 ft³)	(0.0000 curies)

²⁶ 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."

²⁷ 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, 2021. Does not include LLRW held in storage for decay.

²⁸ 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% or 0.1 cubic meters.

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

Waste Type ²⁹	Medical	Industrial	Academic	Government	Nuclear Power Plants	Total
Activated Material	1	1	0	0	0	2
Animal Carcasses	0	0	0	0	0	0
Anion Exchange Media	0	1	0	0	0	1
Aqueous Liquids	2	0	1	0	0	3
Biological Material (Except Animal Carcasses)	1	0	0	0	0	1
Cation Exchange Media	0	0	0	0	0	0
Contaminated Equipment	0	0	0	0	0	0
Compacted Trash	6	2	3	0	0	11
Demolition Rubble	0	0	0	0	0	0
Evaporator Bottoms/Sludge	0	0	0	0	0	0
Filter Media	0	1	0	0	0	1
Filter Media (Mechanical)	0	0	0	0	0	0
Glassware/Labware	1	2	2	0	0	5
Incinerator Ash	0	0	0	0	0	0
Material that will be Incinerated	1	0	0	0	0	1
Mixed Bed Ion-Exchange Media	0	0	0	0	1	1
Non-Compactible Trash	1	3	1	1	0	6
Organic Liquids (excluding oil)	0	0	1	0	0	1
Paint or Plating	0	0	0	0	0	0
Sealed Source/Device	0	1	2	0	0	3
Soil	0	0	0	0	0	0
Other ³⁰	0	0	1	0	0	1

²⁹ 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.

³⁰ 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 Storage³¹ Pending Disposal by County of Origin

County	Number of Generators Reporting	Number of Generators Storing LLRW ³²	Volume ³³ (m ³)	% of Total	Radioactivity ³³ (GBq)	% of Total
Albany	12	4	0.8	1.2	0.1318	*
Allegany	0	0	0.0	0.0	0.0000	0.0
Bronx	6	2	0.3	0.4	0.0279	*
Broome	4	0	0.0	0.0	0.0000	0.0
Cattaraugus	2	1	1.4	2.1	0.0299	*
Cayuga	0	0	0.0	0.0	0.0000	0.0
Chautauqua	0	0	0.0	0.0	0.0000	0.0
Chemung	2	0	0.0	0.0	0.0000	0.0
Chenango	1	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	2	0	0.0	0.0	0.0000	0.0
Delaware	1	0	0.0	0.0	0.0000	0.0
Dutchess	7	0	0.0	0.0	0.0000	0.0
Erie	18	4	45.0	67.8	394.2216	49.0
Essex	0	0	0.0	0.0	0.0000	0.0
Franklin	1	1	0.1	0.2	0.0100	*
Fulton	1	0	0.0	0.0	0.0000	0.0
Genesee	1	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	3	0	0.0	0.0	0.0000	0.0
Kings	7	1	3.4	5.1	2.1918	0.3
Lewis	0	0	0.0	0.0	0.0000	0.0
Livingston	3	1	0.2	0.3	0.0008	*
Madison	0	0	0.0	0.0	0.0000	0.0
Monroe	7	1	*	*	0.0273	*
Montgomery	1	0	0.0	0.0	0.0000	0.0
Nassau	21	3	1.9	2.9	0.1858	*
New York	18	4	1.2	1.8	1.1666	0.1
Niagara	2	0	0.0	0.0	0.0000	0.0
Oneida	1	0	0.0	0.0	0.0000	0.0
Onondaga	12	1	*	*	0.0001	*
Ontario	2	0	0.0	0.0	0.0000	0.0

Table 12 continued

County	Number of Generators Reporting	Number of Generators Storing LLRW ³²	Volume ³³ (m ³)	% of Total	Radioactivity ³³ (GBq)	% of Total
Orange	9	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	7.5	368.5908	45.8
Otsego	0	0	0.0	0.0	0.0000	0.0
Putnam	2	0	0.0	0.0	0.0000	*
Queens	7	2	1.3	1.9	34.5673	4.3
Rensselaer	3	1	1.0	1.5	2.3380	0.3
Richmond	0	0	0.0	0.0	0.0000	0.0
Rockland	4	1	*	*	0.0001	*
St. Lawrence	2	0	0.0	0.0	0.0000	0.0
Saratoga	3	0	0.0	0.0	0.0000	0.0
Schenectady	3	0	0.0	0.0	0.0000	0.0
Schoharie	0	0	0.0	0.0	0.0000	0.0
Schuyler	0	0	0.0	0.0	0.0000	0.0
Seneca	0	0	0.0	0.0	0.0000	0.0
Steuben	2	1	0.3	0.5	0.0594	*
Suffolk	15	1	4.0	6.0	0.3100	*
Sullivan	0	0	0.0	0.0	0.0000	0.0
Tioga	0	0	0.0	0.0	0.0000	0.0
Tompkins	3	1	0.5	0.8	0.0130	*
Ulster	0	0	0.0	0.0	0.0000	0.0
Warren	3	0	0.0	0.0	0.0000	0.0
Washington	0	0	0.0	0.0	0.0000	0.0
Wayne	2	0	0.0	0.0	0.0000	0.0
Westchester	14	3	*	*	0.0968	*
Wyoming	1	0	0.0	0.0	0.0000	0.0
Yates	0	0	0.0	0.0	0.0000	0.0
Totals	213	34	66.4 (2,345 ft³)		803.9690 (22 curies)	

³¹ Includes LLRW in storage at generator sites or an approved off-site location pending transfer to a licensed LLRW facility, as of December 31, 2021. Does not include LLRW held in storage for decay.

³² Refers to the number of generators that reported LLRW in storage pending disposal as of December 31, 2021.

³³ 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%, or 0.0001 GBq.

Table 13. Radionuclide Content of Waste³⁴ in Storage Pending Disposal³⁵ (MBq)

Radionuclide	Half-Life ³⁶	Academic	Government	Industrial	Medical	Nuclear Power Plants	Total
Ag-110	249.8 d			0.0278			2.8 E-2
Al-26	7.1 E5y			0.1451			1.5 E-1
Am-241	432.7 y			428.138		0.640	4.3 E2
Ba-133	10.5 y	0.010					1.1 E-2
Be-7	53.3 d			0.909			9.1 E-1
C-14	5.7 E3 y	882.455	0.344		1,253.479		2.1 E3
Cd-109	461 d			3.559			3.6 E0
Cl-36	3.0 E5 y				0.555		5.0 E-1
Cm-243	29.1 y					2.979	3.0 E0
Cm-244	18.1 y	14.049					1.4 E1
Co-56	77.3 d			19.147	0.544		2.0 E1
Co-57	271.8 d	0.002		1.715	373.592		3.8 E2
Co-58	70.9 d			0.250	1.153		1.4 E0
Co-60	5.3 y	0.019		0.110	4.163	126,910.000	1.3 E5
Cr-51	27.7 d			29.37	5.700		3.5 E1
Cs-134	2.1 y					193.880	1.9 E2
Cs-137	30.1 y	3.620	0.011			59,940.000	6.0 E4
Eu-152	13.5 y				0.232		2.3 E-1
Eu-154	8.6 y				0.005		5.0 E-3
Eu-155	4.8 y				0.001		1.0 E-3
Fe-55	2.7 y	0.003				90,650.000	9.0 E4
Ge-68	1.1 h				74.221		7.4 E-1
H-3	12.3 y	2,592.254	20.519	32,906.050	1,730.358	495.800	3.8 E4
I-125	59.4 d				138.258		1.4 E2
Lu-177	6.6 d				2.035		2.0 E0
Mn-54	312.1 d	1.650		1.763	2.726	0.810	6.9 E0

Table 13 continued

Radionuclide	Half-Life ³⁶	Academic	Government	Industrial	Medical	Nuclear Power Plants	Total
Na-22	2.6 y	15,334		0.087	0.166		1.6 E1
Nb-94	2.0 E4y			0.668			6.7 E-1
Ni-63	101 y	1,483,170		393,105.0568		84,360,000	4.8 E5
P-32	14.3 d				7,001		7.0 E0
Po-210	138.4 d y			205.102			2.1 E2
Pu-238	87.7 y					4,107	4.1 E0
Pu-239	2.4 E4 y					1,528	1.5 E0
Ra-226	1.6 E3 y	0.037					3.7 E-1
S-35	87.2 d				54,160		5.5 E1
Sr-90	28.8 y		0.003		0.983	6,031,000	6.0 E3
Ta-182	114.4 d			0.855			8.5 E-1
Tc-99m	6.0 h		0.087				8.7 E-2
Th-230	7.5 E4 y			1,006			1.0 E0
Th-232	1.4 E10 y	0.181		0.648			8.3 E-1
U-238	4.5 E9 y	7,046		0.648			7.7 E0
Zn-65	243.8 d				2,672	0,011	2.7 E0
Zr-95	64 d			0.776			7.8 E-1
Others ³⁷	---	---	---	---	---	---	---
	Total	4,999,400	20,882	426,706,040	3,652,002	368,590,755	8.0 E5

³⁴ 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.

³⁵ To obtain radioactivity in curies, divide the number of megabecquerels (MBq) by 37,000.

³⁶ 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.

³⁷ 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 Decay³⁸ by Generator Type

Generator Type	Number of Generators Reporting	Number of Generators Reporting Storage for Decay³⁹	Number of Generators Reporting Only Storage for Decay	Estimated Maximum Volume in Storage for Decay at Any Time⁴⁰ (m³)
Medical	168	161	131	1,611
Industrial	9	2	0	2
Academic	24	16	3	199
Government	6	3	2	299
Nuclear Power Plant	6	0	0	0
Total	213	182	136	2,111 (74,539 ft³)

³⁸ Storage for decay means holding the LLRW until the level of radioactivity has diminished to the point where it can be disposed of as nonradioactive waste. Normally, such LLRW is held for 10 half-lives, or until the radioactivity is at 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 (59.4 days), Iodine-131 (8.0 days), Technetium-99m (6.0 hours), Phosphorous-32 (14.3 days), Gallium-67 (3.3 days), and Sulfur-35 (87.2 days).

³⁹ 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.

⁴⁰ To obtain volume in cubic feet (ft³), multiply the number of cubic meters (m³) 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 2012 through 2021.

This section also provides a summary, based on information supplied in the 2021 generator reports, of generator projections of the volume and radioactivity of LLRW that require disposal in a licensed LLRW facility for the years 2022 through 2026.

Volume projections are rounded to the nearest tenth of a cubic meter, and radioactivity projections to the nearest gigabecquerels (GBq).

Table 15. Historic Overview of Waste Disposal by Volume^{41, 42} (in m³)

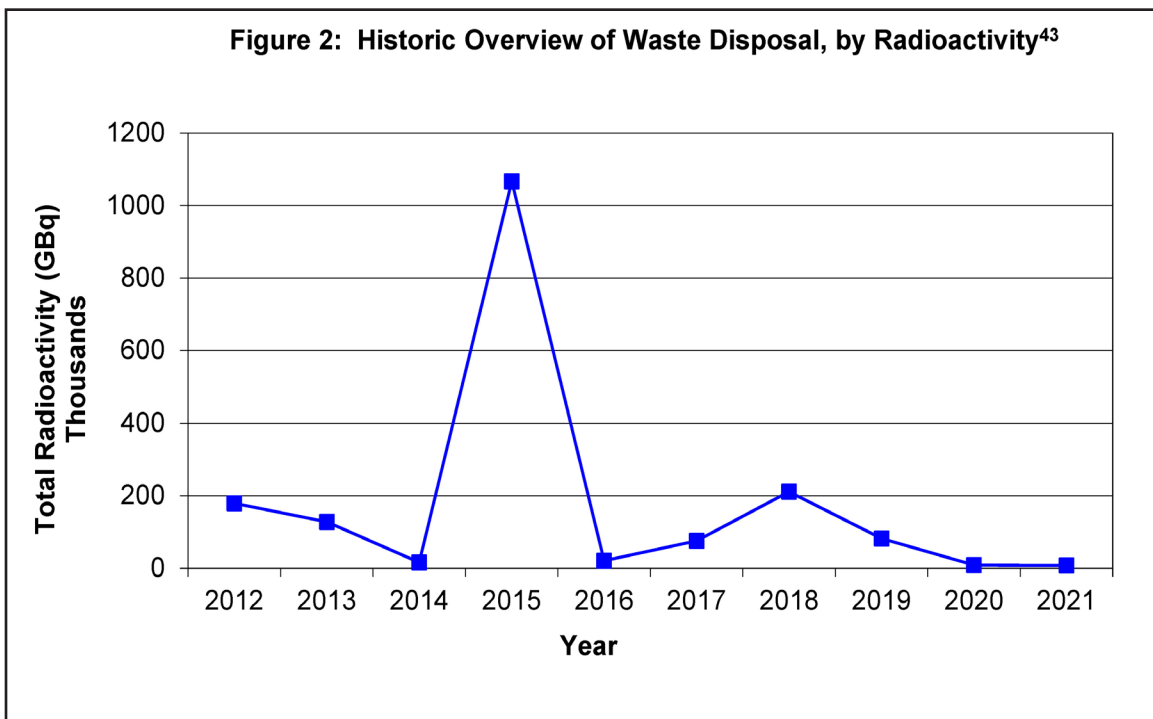
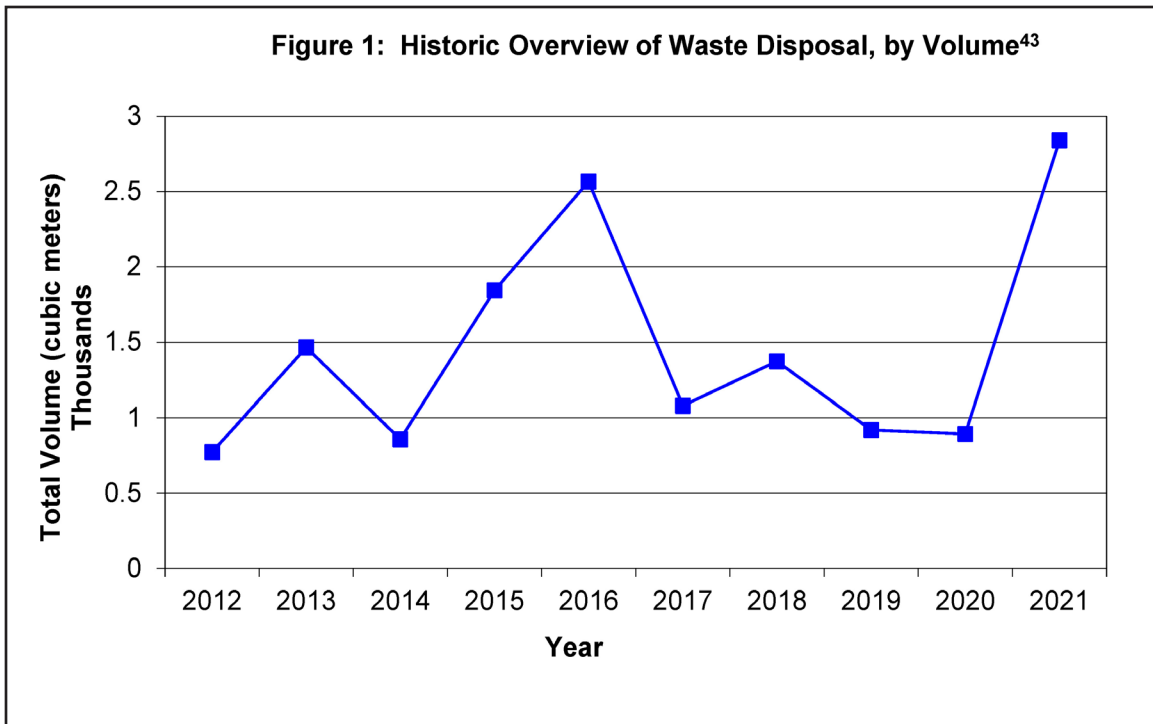
Generator Type	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Nonpower Plant	60	46	40	380	79	15	20	51	22	321
Nuclear Power Plant	713	1,420	818	1,464	2,487	1,065	1,353	868	870	2,518
Total	773	1,466	858	1,844	2,566	1,080	1,373	919	892	2,839

Table 16. Historic overview of Waste Disposal by Radioactivity^{41, 42} (in GBq)

Generator Type	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Nonpower Plant	196	33	524	41	126	34	974	315	200	122
Nuclear Power Plant	178,962	128,112	15,533	1,066,628	20,432	75,602	210,454	81,602	8,846	7,228
Total	179,158	128,145	16,057	1,066,669	20,558	75,636	211,428	81,917	9,046	7,350

⁴¹ Data are based on reports that must be filed annually with NYSERDA.

⁴² 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.



⁴³ In general, the radioactive content of the LLRW disposed continues to be a function of refueling and maintenance activities at New York State's six nuclear power plants, and shows little or no correlation to overall volume. The increase in disposal in 2015 and 2016 can be attributed to three separate disposal actions: decommissioning of a university research reactor, disposal of both irradiated hardware and a large volume of resin from one of the nuclear power plants. The increase in disposal volume in 2021 can be largely attributed to decommissioning of a nuclear power plant site.

Table 17. Generators' Five-Year Projections of Waste by Volume (m³)^{44, 45}

Generator Type	2022	2023	2024	2025	2026
Medical	67.0	58.3	58.5	58.5	58.5
Industrial	18.1	17.8	17.0	16.8	16.8
Academic	31.6	31.1	21.3	21.3	22.2
Government	0.3	0.3	0.3	0.3	0.3
Total Nonpower Plant	117.0	107.5	97.1	96.9	97.8
Nuclear Power Plant	2,780.0	2,690.0	2,690.0	2,080.0	2,080.0
Total	2,897.0	2,797.5	2,787.1	2,176.9	2,177.8

Table 18. Generators' Five-Year Projections of Waste^{44, 45} by Radioactivity (GBq)

Generator Type	2022	2023	2024	2025	2026
Medical	26.9	24.5	24.3	24.3	24.3
Industrial	2.0	1.3	1.2	1.2	1.2
Academic	14.9	4.8	107,002.3 ⁴⁶	2.3	12.3
Government	0.1	0.1	0.1	0.1	0.1
Total Nonpower Plant	43.9	30.5	107,027.8	27.8	37.8
Nuclear Power Plant	19,850.0	19,850.0	18,850.0	18,850.0	18,850.0
Total	19,893.9	19,880.5	125,877.8	18,877.8	18,887.8

⁴⁴ Refers to all classes of LLRW projected by generators to require disposal in a licensed LLRW facility.

⁴⁵ 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.

⁴⁶ The increase in activity for the academic sector in 2024 can be attributed to projected disposal of a number of sealed sources used for teaching, research & calibration.

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 (Système International d'Unités) units have been incorporated into the U.S. Nuclear Regulatory Commission's 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	$Ci \times 37 = GBq$ $Ci \times 37,000 = MBq$ $GBq / 37 = Ci$ $MBq / 37,000 = Ci$
Volume	cubic meters (m ³)	cubic feet (ft ³)	1 ft ³ = 0.028 m ³	$ft^3 \times 0.028 = m^3$ $m^3 \times 35.31 = ft^3$

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 support 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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