LOW-LEVEL RADIOACTIVE WASTE REPORT

2016 - 2017

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EXECUTIVE SUMMARY

This report presents information and analysis of the volume and radioactivity of the low level radioactive waste (LLRW) reported to the Massachusetts Department of Public Health, Bureau of Environmental Health, Radiation Control Program (RCP) in the annual survey as generated in calendar years 2016-2017. The LLRW surveys are administered to RCP and Nuclear Regulatory Commission (NRC) licensees located in Massachusetts. The survey also provides information on the potential impact to licensees should access to out-of state LLRW disposal facilities be denied.

The four LLRW classes in this report (lowest to highest level) are: A, B, and C as described in 105 CMR 120.299, and High Volume, Low Activity (HVLA) waste as described in 345 CMR 1.13.

LLRW is further classified into five waste generator categories: (1) Academic, (2) Commercial, (3) Government, (4) Health, and (5) Utility; and,

six facility Types: (1) Federal Agency, (2) State Agency, (3) State Education, (4) Municipality, (5) Private, Profit, and (6) Private, Non-Profit.

LLRW VOLUME Generated from 2016-2017 (ft3)

Class	2016	2017
A	32,610	44,812
B	283	455
C	26	52
HVLA	3,809	15
TOTAL	**36,728**	**45,334**

LLRW ACTIVITY Generated from 2016-2017 (Ci)

Class	2016	2017
A	8,054	997
B	1,003	175
C	38	38
HVLA	17	.06
TOTAL	**9,113**	**1,210**

The total volume of LLRW generated in Massachusetts from 2016-2017 was 82,062 cubic feet (ft3), and the total LLRW activity was approximately 10,323 curies (Ci).

The volume and radioactivity generated annually varies due to events such as MA radioactive material licensee's decommissioning projects, source manufacturing projects or nuclear power plant maintenance projects.

In 2017, scheduled plant projects at the Entergy Pilgrim Nuclear Power Plant (PNPS) contributed to an increase in the LLRW VOLUME (ft3) figures. In 2016, unplanned shut-down outages contributed to the Class A LLRW ACTIVITY (Ci) generation increases.

Class A LLRW VOLUMES (ft3) have remained stable, except from academic facilities, which are generating lower volumes due to their decreasing use of radioactive material in research and development. Class A LLRW ACTIVITY generation (Ci) from utilities and commercial facilities has tripled due to the increased scope of maintenance and repair activities.

Low Level Radioactive Waste
Trend Report: Calendar Years 2016-2017

1. INTRODUCTION

Low-level radioactive waste (LLRW) is radioactive material that (1) is neither high-level radioactive waste, nor spent fuel, nor uranium mill tailings; and, (2) is classified by the U.S. Nuclear Regulatory Commission (NRC) as LLRW. This does not include waste owned or generated by the U.S. Department of Energy, the U.S. Navy (e.g., decommissioning Navy vessels), or by the federal government as a result of any research, development, testing, or production of any atomic weapon, all of which remain a federal responsibility.

LLRW typically consists of radioactively contaminated trash such as paper, rags, plastic, glassware, syringes, protective clothing (e.g. gloves, coveralls), cardboard, packaging material, organic material, spent pharmaceuticals, used (e.g. decayed) sealed radioactive sources, and water-treatment residues. The radioactivity of LLRW can range from just above background levels found in nature to highly radioactive in certain cases.

The maximum concentration for each class of LLRW can be found in 105 CMR 120.299 for Class A, B, and C wastes, and 345 CMR 1.13(B) for high volume low activity (HVLA) waste.

Typical applications of LLRW include:

- The production of contaminated ion-exchange resins and filters, tools, clothing, and irradiated metals and other hardware by a nuclear power plant;
- The production and end-use of radiopharmaceuticals for medical procedures such as cancer and thyroid dysfunction diagnosis and treatment, radioimmunoassay and diagnostic imaging examinations;
- Research and development in the life science and biotechnology industry for the treatment and prevention of various diseases and medical conditions, and in the environmental field to study the effects of chemicals on plant and aquatic life, and for ocean studies;
- Commercial uses such as within instruments that measure level, thickness, and density or that are used in moisture analysis and quality control; sealed sources that are used for industrial radiography of pressure vessels and other structural welds; smoke detectors and exit signs in buildings and commercial aircraft; and,
- University education and research in medicine, material science and biotechnology.

1.1. Overview

Annually each specific licensee that produces LLRW is surveyed to summarize the amount (e.g. volume and activity) of LLRW generated (e.g. transferred and in-storage) by waste classification, and the radioisotopes generated in each waste class. The LLRW data are evaluated by RCP to identify trends; significant generation and generators; and determine storage, treatment, and disposal solutions. This information supports the formulation of LLRW policy in the Commonwealth.

The data presented in this report summarizes LLRW generated in the calendar years 2016-2017. This report provides a review of the annual data for each waste classification, waste generator category, and facility type.

This report considers only volumes, activities, and waste class reported; the report does not directly account for external issues such as changes to regulatory requirements or changes in the number of licensees.

A database for tracking LLRW was developed by the Massachusetts Department of Public Health, Bureau of Environmental Health, Radiation Control Program (RCP) in 2002. This database contains records of LLRW reported to the RCP by their licensees, as well as from Nuclear Regulatory Commission (NRC) licensees located in Massachusetts. The database is maintained by the RCP and contains almost 8,000 surveys submitted from approximately 2000 to the present.

The four LLRW classes in this report (lowest to highest level) are: A, B, and C as described in 105 CMR 120.299, and High Volume, Low Activity (HVLA) waste as described in 345 CMR 1.13.

LLRW is further classified into five waste generator categories: (1) Academic, (2) Commercial, (3) Government, (4) Health, and (5) Utility; and,

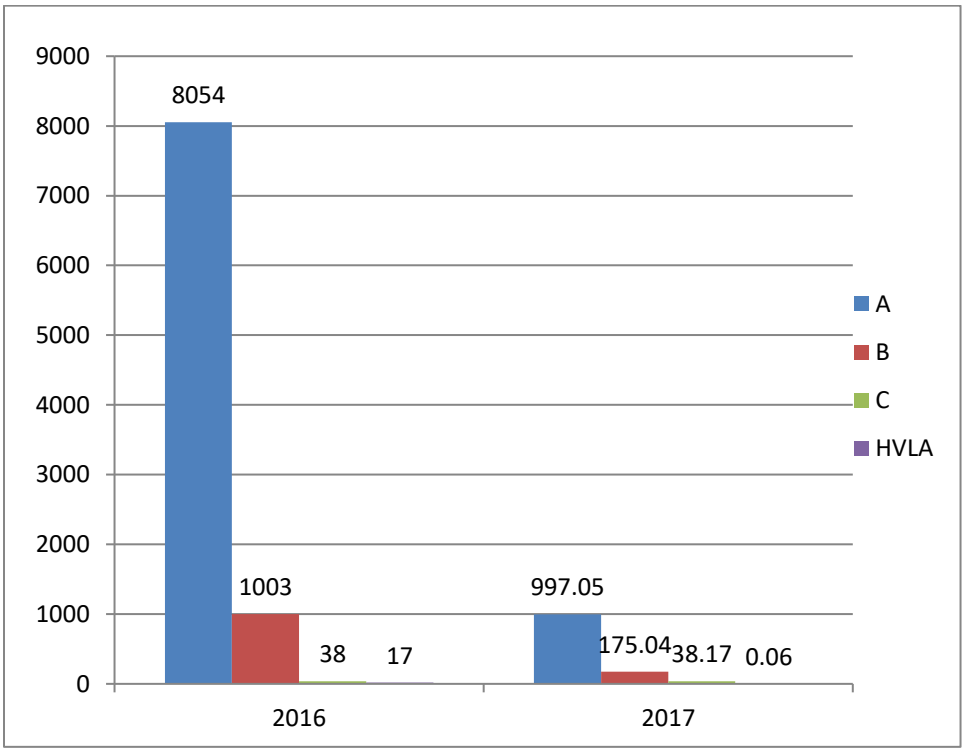
six facility Types: (1) Federal Agency, (2) State Agency, (3) State Education, (4) Municipality, (5) Private, Profit, and (6) Private, Non-Profit.

2. ANALYSIS of LLRW SURVEY DATA

2.1. LLRW by Radioactivity (Ci)

2.1.1. All LLRW Classes by Radioactivity

Figure 1 – All LLRW Classes by Radioactivity from 2016-2017



The following observations are made regarding the data in Figure 1.

- Beverly Microwave Div., generated the most Class A radioactivity for 2016 due to decommissioning 7,130 curries (Ci) of old product inventory (electron tubes).

- Entergy Pilgrim, Beverly Microwave Div. and PerkinElmer, Inc. were the top Class A radioactivity generators from 2016-2017.

2.1.2. LLRW Radioactivity by Waste Generator Category

Table 1. Radioactivity by Generator (Ci)

	2016	2017
Academic	64.95	27.3
Commercial	7835.6	901.8
Government	0	.07
Health	6.66	2.08
Utility	1205.6	279.1

2.1.3. LLRW Radioactivity by Waste Class

Table 2. Radioactivity by LLRW Waste Class (Ci)

	2016	2017
A	8054	997
B	1003	175
C	38	38
HVLA	17	.06

2.1.4. Top Radioactivity Generators in CY 2016-2017

Table 3. Top Activity Generators (Ci)

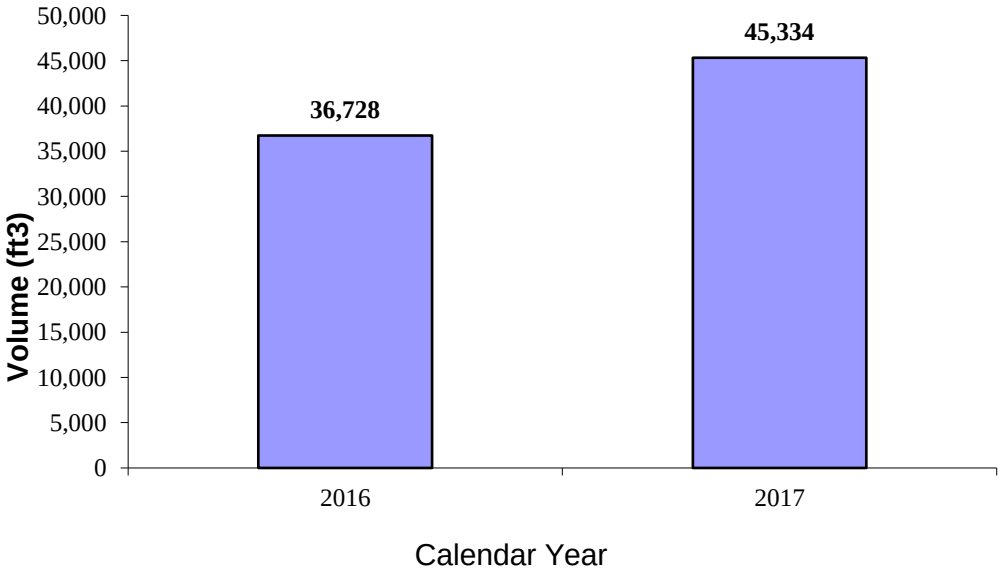
Facility Name	2016	2017
PERKINELMER, INC.	522	539
ENTERGY PNPS	1205	176
BEVERLY MICROWAVE DIVISION	7130	18

- Beverly Microwave Div. generated the most Class A radioactivity for 2016.
- Entergy PNPS and PerkinElmer, Inc. generated the most Class B radioactivity in any given year.
- Entergy Pilgrim generated the most Class C radioactivity
- Ariad Pharmaceuticals, Inc., Smiths Detection, LLC and Boston Heart Diagnostics generated the most HVLA radioactivity.

2.2. LLRW by Volume

2.2.1. All LLRW by Volume (ft3)

Figure 2 – LLRW by Volume from 2016-2017



- Consistent large volume generators include Entergy PNPS, PerkinElmer, Inc., and Bartlett Nuclear, Inc.
- In 2017, Entergy PNPS produced 76%, or 34,500 cubic feet of Class A waste.
- Entergy PNPS generated 42% of the total volume in calendar year 2016.

2.2.2. LLRW Volume by Waste Generator Category

Table 4. LLRW Volume by Waste Generator Category (ft^3)

	2016	2017
Academic	1,038	3,139
Commercial	19,569	6,640
Government	0	0
Health	730	774
Utility	15,368	34,781

- Entergy PNPS (Utility) generated the most volume from 2016-2017.

2.2.3. LLRW Volume by Facility Type

Table 5. LLRW Volume by Facility Type (ft^3)

	2016	2017
Federal Agency	56	9
Private, Non-Profit	1,578	3,769
Private, Profit	34,939	41,428
State Education Facility	133	128

- In 2017, Private, Profit facilities generated the largest volume of waste.

2.2.4. LLRW Volume by Waste Class

Table 6. Volume (ft^3) by Waste Class

Class	2016	2017
A	32,611	44,812
B	283	455
C	26	52
HVLA	3,809	15

- Entergy PNPS, Harvard University, Lantheus Medical Imaging, Inc., PerkinElmer, Inc., and Unitech Services Group were the largest generators of Class A volume from 2016-2017.

- Top HVLA waste volume generators in 2016 and 2017:

  1. Rapiscan Systems, Inc.;
  2. Infinity Pharmaceuticals, Inc.;
  3. Boston Heart Diagnostics;
  4. Health & Human Services, Dept.; and,
  5. Mass. General Hospital

- In 2016, Rapiscan Systems, Inc. reported 2,688 ft3 of HVLA. The 2,688 ft3 of HVLA waste was stored on the facility's premises.

2.2.5. Top Generators by Volume from CY 2016-2017

Table 7. Top Generators by Volume (ft^3) in Calendar Year 2016

Facility Name	Waste Volume (ft3)
ENTERGY PNPS	15,369
LANTHEUS MEDICAL IMAGING, INC.	8,658
MORPHO DETECTION, LLC	2,715

Table 8. Top Generators by Volume (ft^3) in Calendar Year 2017

Facility Name	Waste Volume (ft^3)
ENTERGY PNPS	34,500
HARVARD UNIVERSITY	2,680
PERKINELMER, INC.	1,375

Appendix A - Massachusetts LLRW Classes

The NRC has defined four classes of LLRW (e.g. Class A, B, C, and Greater Than Class C (GTCC)) each with specified disposal and waste requirements based on its potential hazard. These classes have progressively higher concentrations of radioactive material, with A having the lowest and C having the highest level. Class A waste accounts for more than 95% of the total volume of LLRW in the United States.

The fourth class of LLRW, GTCC, is not generally acceptable for near-surface, shallow-depth disposal, hence, the LLRW Policy Act of 1985 assigned the Federal Government (i.e. DOE) responsibility for the disposal of GTCC LLRW that results from NRC and Agreement State licensed activities. Thus, the volume and activity of GTCC generated in Massachusetts is not surveyed or tracked.

Massachusetts uses an additional class of LLRW called High Volume, Low Activity (HVLA) waste. It is anticipated that much of this waste will be produced by decommissioning nuclear licensed sites and will typically include soils & rubble with low concentrations (e.g. 100 pCi/g) of total activity that have the potential to be disposed in non-LLRW landfill sites, such as a Resource Conservation and Recovery Act (RCRA) Subtitle C or D site; else, this waste would be classified as Class A.

Thus, Massachusetts annual LLRW survey has four classes: HVLA, Class A, Class B, and Class C. The determination of the classification of waste is a complex process and has been codified in 345 CMR 1.12 (i.e., 105 CMR 120.299) for Class A, B, and C, and HVLA waste as described in 345 CMR 1.13.

Appendix B - Waste Generator Category Descriptions

Massachusetts uses essentially the same five waste generator categories as the DOE's MIMS database system: Academic, Commercial, Government, Health, and Utility (MIMS calls these categories: Academic, Industry, Government, Medical, and Utility, respectively). All entities that submit a LLRW survey is assigned just one waste generator category, as described below:

Academic	all institutions of learning (i.e., colleges, universities, etc.) are assigned this category, regardless if the entity is commercial or not.
Commercial	all for-profit entities not designated as a Health, Utility, or Academic generator category.
Government	all entities which are closely affiliated, generally by government ownership or control, with Federal, State and local governments.
Health	all entities supplying medical patient services regardless if it is for-profit or not. Generally this category will include all hospitals, medical clinics, etc.
Utility	all entities which supply electrical power regardless if it is for-profit or not. This includes any private, public, or government-owned nuclear power plant.

Appendix C - Facility Type Descriptions

To further analyze the submitted LLRW data, Massachusetts further classifies each entity with a facility type designation, as follows:

Federal Agency -	all entities which are closely affiliated, generally by government ownership or control, with the Federal government.
State Agency -	all entities which are closely affiliated, generally by government ownership or control, with the State government, excluding State Education facilities.
State Education -	all education (i.e., colleges, universities, etc.) entities which are closely affiliated, generally by government ownership or control, with the State government.
Municipality -	all entities which are closely affiliated, generally by government ownership or control, with local government (i.e., city, town, board of health, etc.).
Private, Profit -	any for-profit entity.
Private, Non-Profit -	any non-profit entity that is not government affiliated.

Appendix D - Acronyms

CFR	Code of Federal Regulations
CMR	Code of Massachusetts Regulations
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
GTCC	Greater than Class C
HVLA	High Volume, Low Activity (radioactive waste)
LLRW	Low Level Radioactive Waste
MDPH	Massachusetts Department of Public Health
MIMS	Manifest Information Management System
RCP	Massachusetts Radiation Control Program
NPP	Nuclear Power Plant
NRC	Nuclear Regulatory Commission
RCRA	Resource Conservation and Recovery Act
XRF	X-ray Fluorescence