Ohio Department of Health

Bureau of Radiation Protection

Annual Low-level Radioactive Waste Management Report for 2004

The Ohio Department of Health (ODH) Bureau of Radiation Protection (BRP) is releasing this report titled "Annual low-Level Radioactive Waste Management Report for 2004." The report is designed to keep ODH management informed of low-level radioactive waste in the State of Ohio. The final report is designed and intended for distribution to interested members of the public. Copies of this report may be obtained by contacting ODH, BRP.

Ohio Department of Health

Bureau of Radiation Protection

Annual Low-level Radioactive Waste Management Report

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Ohio Department of Health

Bureau of Radiation Protection

Table of Contents

Ohio Department of Health

Bureau of Radiation

List of Tables

Introduction

The Ohio Department of Health (ODH) Bureau of Radiation Protection (BRP) collects low-level waste generation information from both Ohio and the U.S. Nuclear Regulatory Commission (NRC) licensees in accordance with rule 3701:1-54-02 of the Ohio Administrative Code (OAC). The purpose of this rule is to provide ODH with information relating to the amount of low-level radioactive waste generated, treated, stored and/or disposed of by generators within the state.

This report presents a summary of information on the generation and management of low-level radioactive waste (LLRW) in Ohio during 2004. The definition of LLRW does not include naturally occurring or accelerator-produced radioactive material (NARM) waste. This information is compiled from the annual reports submitted by the LLRW generators to ODH.

Ohio's responsibility as Host State for the Midwest Interstate Low-level Waste Compact was terminated by the Compact Commission in 1997. The compact is no longer involved in siting its own repository.

Radioactive waste generators use either the Barnwell, South Carolina or Envirocare of Utah disposal facilities for land disposal of radioactive waste. The Barnwell facility has decreased the disposal volume available for out-of-compact radioactive waste generators, which includes Ohio generators. As indicated by the data, land disposal volumes are being shifted to the Envirocare facility for Class A low-level radioactive waste they accept.

The Ohio Department of Health, Bureau of Radiation Protection

ODH is authorized by Ohio Revised Code (ORC) 3748 to be the radiation control agency for the state. The BRP performs the radiation control functions in behalf of the director of ODH.

Ohio became an agreement state with the NRC for the regulation of byproduct, source and special nuclear materials effective Aug. 31, 1999. Being an agreement state means the NRC has relinquished control and regulation of certain byproduct, source and special nuclear materials within Ohio to ODH.

The director of ODH, through the BRP, collects and analyzes information on LLRW generators within Ohio. These activities are performed in response to the responsibilities given to the states in the Low Level Radioactive Waste Policy Act (LLRWPA) (1980) as amended in 1985 and codified in Title 42 Section 2021 of the United States Code (USC). The reports submitted by waste generators provide information on the management, storage, transportation and disposal of radioactive wastes. Fees are collected from the LLRW generators to help fund this activity.

After Ohio became a member of the Midwest Compact, Ohio rules promulgated in OAC Chapter 3701-77 (effective Dec. 23, 1987) required annual reporting of low-level radioactive waste generated in Ohio to the director of ODH. In the process of becoming an agreement state, the rules were inadvertently rescinded in 1997. In February 1999, the rules were reinstated under OAC Chapter 3701:1-54. The reporting requirements under the old 3701-77-02 and current 3701:1-54-02 rules are the same; the principal rule differences are in the fee structure associated with the waste generated and an added reporting exemption. Effective Sept. 14, 2003, licensees that continue to hold only their own radioactive waste beyond a five-year period must comply with OAC 3701:1-54-03, the Assured Isolation Facility (AIF) rule.

Low- Level Radioactive Waste

Low-level radioactive waste is defined in ORC 3748.01 and rule 3701:1-54-01 of the OAC. For the purpose of this report, the definition of LLRW does not include NARM, transuranic waste, high-level radioactive waste, U.S. Department of Energy generated, or uranium mining and milling waste. LLRW is waste containing radioactive material that meets the definition contained in Chapter 3748 and OAC rule 3701:1-54-01. OAC rule 3701:1-54-01 defines low-level radioactive waste as follows:

"Low-level radioactive waste means, with regard to the disposal of low-level radioactive waste, radioactive waste that is not classified as high-level radioactive waste and that is class A, B, or C low-level radioactive waste as defined in 10 C.F.R. 61.55, as that section existed on January 26, 1983. In regard to regulatory control at locations for purposes other than disposal, low-level radioactive waste has the same meaning as in 42 U.S.C.A. 2021 (b). Low-level radioactive waste does not include any such waste that is owned or generated by the United States Department of Energy; by the United States navy as a result of the decommissioning of its vessels; or as a result of any research, development, testing, or production of any atomic weapon."

LLRW includes a variety of materials that have a wide range of levels of radioactivity. LLRW includes items contaminated with radioactive material, for example protective clothing, paper towels and laboratory equipment. Included are some highly radioactive items, such as sealed sources, materials used to purify coolant in nuclear power plants, and from equipment associated with nuclear reactors. LLRW is generated in the operation and maintenance of nuclear power plants as well as hospitals, universities, private research firms, industrial facilities and the military.

The classification system for LLRW, defined in OAC rule 3701-39-02.1 Appendix C (analogous to section 10 CFR 61.55), is designed to take into account the potential hazards of LLRW. The system is based on the concentration of the particular radionuclides in the waste and their half-life and is part of an overall regulatory system designed to control the potential human exposure to disposed radioactive waste. The classes of radioactive waste are:

Class A waste, generally consisting of short-lived radionuclides. (less than 30 years) but also including low concentrations of some long-lived radionuclides. Disposed Class A waste must be isolated for 100 years.

Class B waste, including waste with higher concentrations of short-lived radionuclides than Class A waste and concentrations of long-lived radionuclides similar to Class A waste. Class B waste must be in structurally stable physical form for disposal or in a structurally stable container that will last for 300 years.

Class C waste, including waste with the highest concentrations of short and long-lived radionuclides that states are responsible for managing. Disposal units for Class C LLRW must have barriers capable of preventing people in future years from accidentally encountering the waste for at least 500 years.

As previously noted, federal law makes each state responsible for providing disposal capacity for LLRW generated in the state. These federal laws, however, do not make the states responsible for all LLRW generated within their borders. The federal government, specifically the DOE, is responsible for LLRW from the following sources and types:

LLRW owned or generated by the DOE;

LLRW owned or generated by the U.S. Navy as the result of decommissioning Navy vessels;

LLRW owned or generated by the federal government as the result of any research, development, testing or production of nuclear weapons.

The primary source of "greater than Class C waste" is from the decommissioning of nuclear power plants and high-activity sealed sources. This class waste is generally not suited for shallow land burial for disposal.

Additional forms of radioactive waste that require regulatory management and oversight are:

"Mixed Waste," which satisfies the definition of both low-level radioactive waste and hazardous waste in federal law;

NARM and technologically enhanced naturally occurring radioactive materials (TENORM), which is a subset of NARM. While not considered by definition as LLRW, these materials require disposal in a controlled manner due to the radiation hazards that exists with this waste.

The federal LLRWPA, ORC 3748 and Ohio rules do not address the collection of information on the activity and volume of NARM waste produced, although it is regulated to the same degree as LLRW. NARM waste is typically generated from medical, consumer and industrial sources. TENORM waste is typically generated as a byproduct from industrial processes and nonindustrial consumers, such as pipe scale and water treatment sludges.

LLRW Generation and Management

Inventory of generators

A LLRW generator report form is sent annually to all Ohio licensees and NRC licensees within Ohio. The inventory of generators is based on analysis of the 2003 annual generator reports that completed and returned to the BRP. The BRP received 597 responses from licensees, of which 137 generated waste. Only those licensees that generated, continued to store or disposed of LLRW in 2004 were required to submit a report.

ODH has provided seven separate classifications for generators instead of the standard five mentioned in national waste report statistics. The additional classifications are Uranium Enrichment and Academic/Medical. Uranium Enrichment was added because United States Enrichment Corporation (USEC) is regulated by the NRC as a private enterprise and has a unique waste stream. The blend of Academic/Medical was added because the facilities under this category are both medical institutions and universities,

and as such produce the activity typical of medical institutions and the volume typical of academic/research institutions.

The waste generator descriptions are:

Utilities – Public or private utilities that provide basic services within the state borders. The volume and activity in this category is almost exclusively from nuclear power plants. Other utilities use licensed radioactive material in the form of sealed sources for process measurements, typically for level and fill measurements in coal-fired utilities.

Medical Facilities – Hospitals, physicians and clinics licensed to use radioactive materials as part of their service.

Academic and Research Facilities – Licensed colleges, universities and research facilities within the state borders, including research reactors that use radioactive materials in the course of teaching or research.

Academic/Medical – A joint medical facility within an academic and research institution where the combined facility generates waste with activities and volumes characteristic of each.

Government – NRC-licensed and state-licensed government agencies within Ohio.

Industrial – NRC-licensed and Ohio-licensed sources within the state of Ohio. These licenses may include sealed sources and radioactive devices as well as commercial nuclear pharmacies or other service providers licensed by the NRC or Ohio to conduct radioactive material distribution activities that generate LLRW.

Uranium Enrichment – NRC-regulated activities for the processing of uranium and uranium ores for use as nuclear reactor fuel.

The assignment of generator classification is based on the generator's self-identification. Commercial entities submitted under other classifications were entered under the "industrial" classification.

Volume and Activity of LLRW generated in 2004

For calendar year (CY) 2004, the BRP received 682 responses to the LLRW generator report form, a 71 percent response rate. Reciprocity licensees were mailed the report form for the first time in CY 2004. Of the respondents, 137 generated LLRW that required reporting. The remainder were either exempt or did not generate any LLRW.

The LLRW generator report form sent to licensees (copy in appendix A) requested information regarding the volume and activity of the LLRW generated. Additional information regarding the amount of LLRW stored at the end of the calendar year, the amount of LLRW shipped for disposal and the treatment of LLRW during the calendar year were also requested.

The results of the responses were entered into a computer database. The computer program handled MBq and mCi activity conversions. Due to the wide range of data values for activity and volume, the data was manipulated in scientific notation with three significant digits. The implicit error introduced by using data in this format ranges from 0.1 percent up to a 1 percent error, which is likely far less than the error in the activity and volume estimates provided by LLRW generators.

For general readability of the report, the volume terms were reported in cubic feet number formats, and radionuclide activities are converted back to Curie units. Therefore, some rounding errors may be found.

In accordance with OAC rule 3701:1-54-02, certain generators of LLRW were exempted from having to submit a LLRW generator report. A reporting exemption was granted to users of byproduct radioactive material provided the only byproduct materials used had a half-life of one day or less. This exemption provides regulatory relief from filing by small clinics and physicians using short half-life radioactive materials for medical diagnosis and imaging even though they did generate LLRW.

Generators of NARM waste are not designated as LLRW generators since NARM is not included in the definition of LLRW. Examples of these radionuclides include, but are not limited to, Germanium/Gallium-68, Cobalt-57 and 58, Thallium-201, Sodium-22, Iodine-123, Radium-226 and Indium-111. Often the distinction must be traced to a manufacturer as numerous radionuclides may also be produced in a reactor.

The decision of declaring radioactive material or contaminated items as radioactive waste is often a subjective call by individual generators. The greatest impact of the variability is noticed in the decay-in-storage (DIS) waste volumes and activities. However, regardless of when the specific material is declared waste, all must be reported in one reporting period or the next.

The volume and activity of the waste generated by each organization classification is listed in Table 1 “Waste Generator Classification.”

Table 1 – Waste Generator Classification

Waste Generator Classification	Activity in MBq (Ci)	% of total activity	Volume generated In ft³	% of total volume generated
Academic	440,629 (11.9)	0.07	2,096.04	1.36
Academic/medical	205,767 (5.6)	0.03	1,412.7	0.92
Government office	327.3 (0.008)	<0.01	247	0.16
Industrial	71,919,538 (1,943.8)	11.46	87,035	56.6
Medical	483,220,328 (13,060)	77.02	22,116	14.4
Uranium enrichment	72,549.6 (1.96)	0.01	21,099	13.74
Utility	71,518,743 (1,932.9)	11.4	19,599.3	12.76
TOTAL	627,377,881 (16,956)	---	153,605.04	-

The volume and activity of the waste generated by waste class is listed in Table 2 “Waste Generated by Waste Class.” Class A waste constitutes the majority of the volume and activity of waste generated.

Table 2 – Waste Generated by Waste Class

Class	Activity in MBq (Ci)	% of Activity	Volume In ft³	% of volume
A	555,967,807 (15,026)	88.6	152,860.04	99.5
B	69,952,200 (1,890.6)	11.2	586	0.4
C	1,457,874 (39.4)	0.2	159	0.1
Total	627,377,881 (16,956)	___	153,605.04	___

Trends of Generated LLRW

In 1998, a low-level radioactive waste generator's report to report 1997 waste generation was not sent to generators. Factors included: The Midwest Compact Commission discontinuance of LLRW disposal siting in Ohio for which Ohio was to be host state; the reassignment of LLRW staff; and the replacement of LLRW rules as described earlier.

Table 3 – Activity Trend (in Ci) of Waste Generated

Classification/Year	1995	1996	1998	1999	2000	2001	2002	2003	2004
Academic	2.2	2.97	1.81	1.62	1.77	1.18	1.14	30.6	11.9
Academic/Medical	-	-	7.0	7.38	1.76	2.39	2.08	1.39	5.6
Government Office	0.39	-	0.36	0.07	0.15	0.12	0.03	-	0.01
Industrial	15.3	3.24	31.9	61.4	3,644	1,122	1,611	2,840	1,943.8
Medical	25.6	22.4	976	1,103	1,650	972	667	1,831	13,060
Uranium Enrichment	-	-	0.59	0.47	0.45	0.19	0.16	1.16	1.96
Utility	551	1,540	132	368	442	791	976	396	1,933
TOTAL	595	1,569	1,150	1,153	5,740	2,888	3,258	5,100	16,956

Table 4 – Volume Trend (in ft^3) of Waste Generated

Class/Year	1995	1996	1998	1999	2000	2001	2002	2003	2004
Academic	2,682	1,371	3,340	859	1,893	1,732	2,153	2,017	2,096
Acad/Medical	-	-	4,200	3,897	3,189	1,885	1,216	1,319	1,413
Govern Office	59	10	76	91	24	134	31	5	247
Industrial	11,055	2,792	7,640	35,308	510,664	21,311	7,310	23,291	87,035
Medical	26,082	22,351	25,300	80,921	8,853	8,638	8,524	21,393	22,116
Uranium Enrichment	-	-	62,400	41,521	42,388	18,013	15,400	6,001	21,099
Utility	11,244	14,641	17,000	30,140	29,259	73,255	66,581	86,793	19,599
TOTAL	51,122	41,165	120,000	192,736	596,271	124,969	101,216	140,820	121,544

The volume and activity of LLRW produced by USEC has declined significantly since 2000 as the Ohio facility has been on standby mode. It is expected to return to full operation in the future, thus waste volumes will increase. In addition, a Depleted Uranium Hexafluoride (DF6) facility being constructed is scheduled to commence conversion of large quantities of waste DF6. This will also generate additional waste streams.

Changes in the volume generated or shipped do not translate into a proportional change in the volume disposed in a licensed land disposal facility. One reason is some generators are using commercial service providers to segregate and decontaminate radioactive waste prior to disposal, therefore reducing the volume disposed. Several kinds of waste, especially in the medical arena, are held for decay in storage on site prior to disposal, which is a common form of waste treatment to dispose of or eliminate the radioactive component of the waste.

Treatment of LLRW

LLRW may be treated to reduce the waste volume, radionuclide activity or make the waste safer. As defined in rule 3701:1-54-01 of the OAC, "Treatment means any method, technique, or process, including storage for decay, that changes the physical, chemical, or biological characteristics of any low level waste in order to render the waste safer for transport or management, amenable to recovery, convertible to another usable material, or reducible in volume."

DIS is the most commonly used method for treating LLRW. To use DIS, the radioactive waste is held in a segregated container from other waste and stored for 10 half-lives or until the radioactivity from the waste is no longer distinguishable from background, whichever is longer. After the radioactive material has decayed, the remaining waste can be disposed of appropriately such as biohazardous, sharps, pathological, chemical or normal trash.

LLRW is frequently processed off site to reduce the volume prior to disposal and/or achieve a more stable waste form for disposal. Waste volume reduction can be accomplished in a number of ways including:

- Decontamination;
- Compaction;
- Supercompaction;
- Incineration;
- Commercial decay-in-storage;
- Thermal reduction.

Commercial LLRW processors used by Ohio generators are located outside of Ohio. The vast majority of processors disposed of the processed waste at a licensed facility on behalf of the generator in lieu of returning the processed waste.

For nuclear power plants, there has been a shift from treating the waste on site, to having a commercial firm segregate the waste, then treat the remaining waste by incineration or other means. The processor, not the generator, is primarily responsible for the final volume reduction.

Use of Decay-in-Storage (DIS)

Medical and academic facilities are avid users of DIS because it is simple to implement and does not have any direct costs. Indirect costs include the use of secured space and personnel time for logging, tracking and surveying waste.

Unless identified otherwise, the volume and activities listed are for the waste generated, not the volume and activity for the LLRW after treatment.

The LLRW generated is broken down into two categories DIS or non-DIS waste. By splitting the waste streams in this manner, not only can the volume and activity of the waste be differentiated, but also the constituent waste streams for the LLRW can be identified. This differentiation is of particular importance because LLRW held for DIS does not leave the site of the generator as a radioactive waste.

The “final volume” is the generator-identified volume after treatment, either by the generator or a commercial processor. The radioactive waste generation fee can be reduced by declaring the reduced volume after treatment. The final volume after treatment for DIS waste is the volume of waste that remains in storage at the end of the calendar year. Ultimately, the final volume of all DIS waste is zero.

The final volume and activity after treatment is in Table 11. This statistic is the volume and activity disposed at the two low–level radioactive waste land disposal facilities.

Table 5 – DIS vs. non-DIS vs. USEC Waste Generated

Decay in Storage	Activity in MBq (Ci)	% of activity	Volume generated ft^3	% of volume generated	Final volume ft^3	% of final volume
Yes	553,935,113. (14,971)	88.2	29,455.2	16.8	19,165.5	13.5
No*	73,442,767 (1,985)	11.7	124,150.3	71.1	102,378.	71.8
USEC	72,549.6 (1.96)	0.01	21,099	12.1	21,020	14.7
Total	627,450,430 (16,958.6)	-	174,704.6	-	142,563.	-

* USEC waste was segregated from the non–DIS waste for this table only

The waste type “Dry Waste” may combine several subcategories of solid waste into a single category. Examples of subcategories combined in the “Dry Solid” waste type include incinerator ash, sludges, filter media, contaminated equipment, stock vials and other solid waste containing trace quantities of free-standing liquids. Resins/beads are separated out from the “Dry Solid” waste stream as they constitute the majority proportion of the non-DIS activity. Most of this waste stream results from the filtration of water in the nuclear power industry.

Table 6 – DIS vs. non-DIS Waste Activity Generated by Waste Type

Waste Type	DIS activity MBq (Ci)	% of DIS activity	Non–DIS activity MBq (Ci)	% of non-DIS activity
Animal Carcass	-	-	146.9 (0.004)	<0.01
Aqueous Liquid	295,779,248 (7,994)	53.4	5,395 (0.14)	0.01
Biohazard/ Pathological	3,260 (0.088)	<0.01	39,109.4 (1.05	0.05
Debris (HV-LLRW)	-	-	718.2 (0.02)	<0.01
Dry Solid	258,132,927 (6,977)	46.6	1,700,956 (46)	2.3
Gas (Xe-133, Kr-85)	17,353 (0.47)	<0.01	-	-
Generator Columns	7.4 (0.0002)	<0.01	-	-
Liquid Mixed Waste	-	-	137,542.9 (3.7)	0.19
Resin/Beads (ion exchange)	-	-	69,952,200 (1,890.6)	95.3
Scintillation Vials	259 (0.007)	<0.01	1,229.7 (0.03)	<0.01
Scintillation Fluid-bulk	-	-	609.2 (0.16)	<0.01
Sealed Sources	-	-	1,383,394.8 (37.4)	1.9
Sewer	1,687.9 (0.045)	<0.01	221,464.7 (6)	0.3
Total	553,935.114 (14,971.2)	-	73,442,767 (1,985)	-

Table 7 – DIS vs. non DIS Waste Volume Generated by Type

Waste Type	DIS volume ft^3	% of DIS volume	Non DIS volume ft^3	% of non-DIS volume
Animal Carcass	30.0	0.1	5.5	<0.01
Aqueous Liquid	5,396.9	18.32	98.3	0.08
Biohazard/Pathological	-	-	51.0	0.04
Debris (HV-LLRW)	-	-	3,660	2.95
Dry Solid	24,006	81.5	118,939.4	95.8
Gas (Xe-133, Kr-85)	13.44	0.05	-	-
Generator Columns	0.5	<0.01	-	-
Liquid Mixed Waste	-	-	40	0.03
Resin/Beads (ion exchange)	-	-	586	0.47
Scintillation Vials	6.0	0.02	505.3	0.41
Scintillation Fluid-bulk	370	<0.01	120.2	0.1
Sealed Sources	-	-	49	0.04
Sewer	1.0	<0.01	95.6	0.08
TOTAL	29,455.2	-	124,150.3	-

LLRW Shipments

The generalized flow of radioactive waste from generation to disposal can be simplified into the following sequence of events. (1) The waste is generated and recognized as a radioactive waste. (2) The radioactive waste is treated on site and packaged for shipment as appropriate for the waste stream. (3) The radioactive waste is shipped to a treatment, storage or disposal facility (TSDF). (4) The waste is treated to reduce volume and activity as appropriate by the TSDF. (5) The remaining radioactive waste is sent by the TSDF back to the generator or a licensed facility for burial on behalf of the generator.

For the purposes of the waste generator report, the return of contaminated syringes to a radiopharmacy was not considered either a waste shipment or disposal. Syringes and needles are used to inject patients with short-lived radionuclides. The syringe volumes and activities are incorporated in the nuclear pharmacy waste reports.

A total of 26 licensees reported shipping LLRW waste in 2004.

Table 8 – LLRW Shipments by Waste Class

Waste Class	Activity MBq (Ci)	% of activity	Volume (ft^3)	% of volume
A	331,105.05 (7.0)	1.52	36,197.25	99.02
B	20,002,200 (540.6)	91.47	330.0	0.9
C	1,533,282.64 (41.4)	7.01	28.7	0.08
TOTAL	21,868,587.7 (591.04)	-	36,555.95	-

The waste shipped was also broken down by the disposal destination of the waste.

Table 9 – LLRW Shipments by Disposal Destination

Destination	Activity MBq (Ci)	% of activity	Volume (ft^3)	% of volume
ADCO for DIS	559.81 (0.015)	<0.01	71	0.19
Barnwell	21,539,417.92 (582.15)	98.49	601.45	1.65
DSSI (TN)	94,366.82 (2.55)	0.43	99.34	0.27
Envirocare (UT)	169,288.7 (4.57)	0.77	35,483.44	97.07
Flanders NJ	377.4 (0.01)	<0.01	45	0.12
Permafix	63,171.03 (1.7)	0.29	248.22	0.68
NSSI(TX)	1,406 (0.038)	0.01	7.5	0.02
TOTAL	21,868,587.69 (591.04)	-	36,555.95	-

Barnwell is a LLRW disposal site in South Carolina that accepts class A, B and C radioactive wastes. It is in the process of phasing out acceptance from outside the Atlantic Compact. Ohio LLRW generators may lose access by July 2008.

The Envirocare site currently accepts class A radioactive waste. As evidenced by the data in Table 11, this facility is the site of choice for disposal of LLRW, including large volume decommissioning waste.

Table 10 – Total LLRW Shipments by Year

Calendar Year	Activity in MBq (Ci)	Volume in ft^3
1998	5,840,000 (158)	27,518
1999	15,900.000 (430)	92,310
2000	22,021,265 (595)	74,484
2001	30,323,124 (820)	105,899
2002	14,807,530 (400)	69,880
2003	3,005,880.1 (81.24)	62,253
2004	21,868,587.69 (591.04)	36,556

LLRW Land Disposal

Table 11 is a list of the activity and volume of radioactive waste received from Ohio licensees and disposed at the Barnwell and the Envirocare facilities. The data are values reported by the respective land disposal facilities.

Table 11 – Land Disposal – Barnwell Disposal Site Reports

Year	Activity in MBq (Ci)	Volume (ft^3)
1998	3,626,000 (98)	1,544
1999	1,480,000 (40)	1,577
2000	12,617,000 (341)	2,230
2001	5,069,000 (137)	1,358
2002	44,881,000 (1,213)	729.9
2003	11,928,430 (322)	245.9
2004	406,223,000 (10,979)	857

Table 11 – Land Disposal - Envirocare Site Reports

Year	Activity in MBq (Ci)	Volume (ft^3)
1998	24,383 (0.659)	4,240
1999	-	73,905
2000	72,520 (1.96)	62,091
2001	258,260 (6.98)	48,764
2002	202,760 (5.48)	14,329
2003	96,200 (2.6)	5,005
2004	781,762 (21.13)	215,883

The volumes and activities of the radioactive waste presented here is what remains after the generated radioactive waste has been treated, segregated and reduced in volume prior to final disposal. There are some lag times between waste generation, to shipment and/or treatment and eventually disposal at a land disposal facility when appropriate.

The activity and volume of radioactive waste disposed at Barnwell will continue to decrease over time as access to that facility is phased out for Ohio generators. For year 2004 however, the NASA Plumbrook reactor decommissioning contributed approximately 90 percent of the activity going to Barnwell and 80 percent of the volume going to Envirocare. The activity and volume of LLRW going to Envirocare will likely increase, at least in the short term. Disposal availability, however, may increase in the future as legislative initiatives across the country point to the development of new disposal sites.

LLRW Storage

Currently, few locations in Ohio store LLRW for extended periods. LLRW is stored on site for decay in storage, awaiting treatment options or accumulating for shipment. The NRC, by policy and license conditions, did not allow licensees to store LLRW for extended periods on site, other than decay in storage, if there were readily available treatment or disposal options. As Ohio is now an NRC agreement state, the current policy and requirements for licensees storing LLRW beyond a five-year period may be found in OAC rule 3701:1-54-03, titled "Assured Isolation Facility."

Medical facilities commonly use DIS or transfer their material back to the pharmaceutical vendor as the preferred method of waste management. The radionuclides in the LLRW held for DIS generally have short half-lives, six hours or less in many cases. These facilities plan to continue to use DIS and thus are able to avoid the costs associated with other disposal methods.

The following tables provide information on waste storage as of Dec. 31, 2004, placed into storage prior to 2004

Table 12 – Pre-2004 LLRW Remaining in Storage by Year Generated

Year Generated	Activity MBq (Ci)	% of total activity	Volume in ft^3	% of total volume
1991	25,900 (0.70)	2.05	0.05	<0.01
1993	44.77 (<0.01)	<0.01	116	<0.01
1994	137.64 (<0.01)	<0.01	288	1.7
1995	11.10 (<0.01)	<0.01	37	<0.01
1996	223.89 (<0.01)	<0.01	1,014.33	6.03
1997	420.02 (0.01)	0.03	671	3.9
1998	2580.79 (0.7)	2.05	736.19	4.37
1999	1,110.01 (0.03)	0.08	1433.5	8.5
2000	337,937.32 (9.13)	26.8	3,649.9	21.7
2001	545,982.47 (14.75)	43.38	2,651.7	15.7
2002	343,433.14 (9.28)	27.3	6,208.13	37
2003	49,623.22 (1.3)	5.5	3,014	19.7
TOTAL	894,121.69 (24.16)	-	15,272.13	-

Table 13 breaks down the waste held in storage for more than one year by the waste type. Dry solid waste is the overwhelming majority of the waste volume and activity.

Table 13 – Pre-2004 LLRW Remaining in Storage by Waste Type

Waste Type	Activity MBq (Ci)	% of activity	Volume ft^3	% of volume
Biohazard/pathological	1.14 (<0.01)	<0.01	20.18	0.13
Dry solid waste	676,211 (18.3)	75.63	14,438.1	94.54
Gas in container	185,518 (5.01)	20.75	3	0.02
Debris /HVLLRW	2.52 (<0.01)	<0.01	528	3.46
Liquid-aqueous	2,337.16 (0.06)	0.26	264.2	1.73
Mixed waste / non-scintilation fluid	-	-	-	-
Scintilation fluid /bulk	-	-	-	-
Scintilation vials	-	-	-	-
Sealed sources/special form	26,299.56 (0.71)	2.94	1.75	0.01
Generator columns	11.1 (<0.01)	<0.01	1.5	0.01
Animal carcass/tissue	3,741.3 (0.1)	0.42	15.4	0.1
TOTAL	894,121.69 (24.16)	-	15,272.13	-