FY-2001: PAST, PRESENT, AND FUTURE OF DOE'S MLLW

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ABSTRACT

This paper presents a summary of an evaluation of the past, present, and future inventory of DOE's Mixed Low Level Waste (MLLW). The basis for the data is an evaluation conducted by the TRU and Mixed Waste Focus Area which reviewed the available data defining the inventory of DOE MLLW from 1994 through 2001. Data from the Mixed Waste Inventory Report first prepared in 1995 is presented along with more recent data from the Integrate Planning and Budgeting System (IPABS). Waste inventory by waste type is presented for the current inventory as well as waste generated and waste treated and disposed by DOE and commercial entities. Future projections of MLLW are presented along with a description of how those projections have changed over time. Lastly, the market for organic destruction is described.

INTRODUCTION

In 1992, when congress passed the Federal Facilities Compliance Act (FFCA), Mixed Waste was considered a major problem for DOE due to the limited information available on the existing inventory, the limited treatment capacity available, and the small disposal capacity. DOE was mandated by the FFCA to prepare an inventory of legacy waste and engage states containing DOE sites in establishing treatment plans for all mixed wastes. As a result, the first Mixed Waste Inventory Report (MWIR) was completed in 1995. The Mixed Waste Focus Area was created in fiscal year 1994, with the charter of providing technology solutions to the DOE complex for mixed low level and Transuranic waste. Initial funding was provided in fiscal year 1995. Much has changed since the FFCA was passed, and in 2001, the TRU and Mixed Waste Focus Area (TMFA) undertook a strategic evaluation to determine how significantly the inventory and treatment condition had changed since 1995. This paper evaluates those changes, considering the inventory as well as available treatment and disposal capacity.

As fundamental as it would seem, no single database has been used to historically track the complex-wide mixed waste inventory in the DOE. Since the initial MWIR was completed in 1995, three different systems have been used, the MWIR, the Analysis and Visualization System (AVS), and the Integrated Planning, Analysis, and Budgeting System (IPABS), each with different data reporting requirements. Due to the inconsistent tracking mechanisms, and the lack of a specific link to waste streams by the various databases, it is impossible to precisely trace, at the complex-wide level, disposition of waste streams from 1995 to the present.

However, there is considerable information available on the types and volumes of waste generated, treated, and disposed, including DOE inventories as well as treatment and disposal records from site and commercial providers. The analysis undertaken by the TMFA used all the available data in trying to piece together a cogent story to describe the overall inventory, generation, and disposition of mixed waste in the DOE complex from 1995 to the present.

Mixed Low Level Waste (MLLW) Past

The 1995 MWIR was the first comprehensive inventory of Mixed Waste in the DOE complex, and provided a fundamental understanding of what types of waste were located at what sites. Therefore, our starting point shown in Table I is the 1994 inventory, which was 138,141 m^3 of MLLW, and 47,329 m^3 of TRU waste. Although this paper is about MLLW, TRU is considered here because during 1995 a significant volume of MLLW was reclassified as TRU. Therefore, the TRU inventory jumped by about 47,500 m^3 in a single year to 94,851 m^3, which represents a number much closer to what we now know as TRU waste from the National TRU Waste Management Plan. In addition, considerable waste was transferred from the mixed waste inventory to the Formerly Utilized Sites Remedial Action Program (FUSRAP). Therefore, at the end of 1994 the MLLW inventory stood at 63,098 m^3.

Table I. Annual Transuranic and Low-Level Mixed Waste Inventories [cubic meter (m^3)] [a].
(The volumes in this table exclude large wastewater streams that are generated and disposed in the same reporting period.)

		1994	1995	1996	1997	1998	1999	2000	2001
1995 MWIR Initial Inventory	MLLW TRU	138,141 47,329							
Calculated Year-Beginning Inventory	MLLW	–	63,098	58,584	50,881	41,658	30,161	20,242	21,598
Site Reported Generation		–	1,703	4,393	na	3,451	4,237	12,759	–
Treated			-1,607 TSCAI	-1,784 TSCAI -65 WERF	-1,356 TSCAI -854 CIF -27 WERF	-953 TSCAI -2359 CIF -206 WERF	-1,242 TSCAI -73 CIF -114 WERF	-54 TSCAI -111 CIF -255 WERF	-22 TSCAI
Disposed			-4,609 EC	-10,247 EC	-6,986 EC	-11,424 EC -6 WCS	-12,527 EC -182 Han -18 WCS	-9,756 EC -668 Han -559 WCS	-2,400 EC (July) -159 Han -239 WCS (June)
Calculated Year-Ending Inventory	MLLW	-	58,584	50,881	41,658	30,161	20,242	21,598	18,778
Site Reported Inventory (Year-Ending)	MLLW	63,098	64,004	58,781	71,277	67,630	49,104	46,301	–
	TRU	94,851	104,012	106,035	108,222	109,193	108,918	111,176	–
Unaccounted Difference	MLLW	–	-5,420	-7,900	-29,619	-37,469	-28,862	-24,703	–

[a] From INEEL Report - Strategic Evaluation of the Transuranic and Mixed Waste Focus Area's Mixed Low-Level Waste Plans and Activities (INEEL/EXT-02-00082)

The inventory is balanced by adding new generation and subtracting treatment and disposal. Treatment can be accomplished at DOE facilities, like the Toxic Substance Control Act Incinerator (TSCAI) at Oak Ridge, the Waste Experimental Reduction Facility (WERF) at the Idaho National Engineering and Environmental Laboratory, and the Consolidated Incineration Facility (CIF) at the Savannah River Site, or at commercial sites. Of those facilities, only the TSCAI is still operating and available for future treatment of mixed wastes. Operations at CIF and WERF were suspended during 1999. Although the future of the TSCAI is uncertain, it is likely to continue operating through at least FY-2003. Operations at WERF have been permanently discontinued, and operations at CIF have been suspended, with restart being retained as a potential alternative. Combined DOE on-site treatment through 2001, totaled 11,082 m^3, with 7,018 m^3, 3,397 m^3, 667 m^3 at TSCAI, CIF, and WERF, respectively, based upon the individual incinerator burn records.

Commercial treatment and disposal, that has affected the inventory, has occurred at Envirocare of Utah, with a total waste disposal of about 57,949 m^3 disposed through 2001, based upon Envirocare's disposal record. Waste Control Specialists impact has been minimal to date.

Lastly, Hanford has reported waste disposal of 1,009 m^3 through 2001.

Site reported generation has been 26,563 m^3 from 1995 through 2000.

Therefore, if we start with 63,098 m^3 from our initial inventory, add 26,563 m^3 of generation, and subtract 12,710 m^3 from DOE treatment and disposal (through 2000 only), and 46,090 m^3 from commercial treatment (through 2000 only), we should have a 2001 balance of 30,861 m^3 of MLLW in the DOE inventory. However, we find that the reported DOE inventory in 2000 as reported in IPABS is 46,301 m^3, which leaves us with a considerable discrepancy in our inventory basis. This discrepancy is likely driven by underreporting of generated waste data due to a lack of a specific data call, or because the original MWIR data did not include projections from Environmental Restoration and D&D activities, which are now captured in IPABS. When the variation in accounting methods and databases is considered, the discrepancy, although puzzling, should not preclude our ability to make judgments about the changes in the MLLW condition in the DOE complex.

Since 1995, a considerable volume of MLLW has been treated and disposed, approximately 58,800 m^3, and one can conclude that considerable progress has been made in reducing the DOE inventory. It could also be concluded that there is adequate treatment and disposal capacity for MLLW since the inventory has been reduced, even considering newly generated waste. However, looking more specifically at the waste types that have been removed from the inventory, we find that Inorganic Homogeneous Solids (IHS) dominate the treatment and disposal figures. The IHS inventory in 1994 was about 51,300 m^3. Adding approximately 8,700 m^3 of newly generated waste and considering the IPABS inventory of 14,758 m^3 in 2000, indicates that approximately 45,245 m^3 of IHS material was treated and/or disposed. This figure corresponds very well to the commercial disposal figure, which was driven primarily by Oak Ridge and Rocky Flats disposal at Envirocare. It seems reasonable that the commercial capacity to treat the IHS waste in the DOE complex is adequate, however the same may not be clear for other waste types. Inventories of Combustible Organic and Debris type wastes have increased. From 1995 to 2000, Combustible Organic waste has risen from 1,997 m^3 to 4,107 m^3, while Debris has risen from 7,239 m^3 to 23,117 m^3. During that time, DOE incinerators treated approximately 11,046 m^3 of MLLW. Once again, it is not possible for us to track the waste treated in the incinerators on a waste stream basis because there was not a consistent inventory maintained, however, it is reasonable to assume that most of the material incinerated

would have been classified as combustible organic, while the balance would likely have been debris. The Waste Experimental Reduction Facility at the INEEL has been permanently shut down, and operations at the Consolidated Incineration Facility (CIF) at Savannah River Site have been suspended pending a future decision. That leaves the TSCA Incinerator at Oak Ridge as the only remaining operating incinerator in the DOE complex for Mixed Waste. Intuitively, with a reduction in capacity and an increase in inventory, it would appear that the treatment capacity is suspect.

MLLW Present:

Table II shows the current inventory of MLLW as described in IPABS, totaling about 46,301 m^3. Combustible organic treatment and disposal depends upon the continued operation of the TSCAI as well as additional capacity from Perma Fix, ATG, and other commercial providers. To date, debris waste treatment has primarily been provided by macroencapsulation at Envirocare and incineration by the WERF and TSCAI. However, due to limitations on TSCAI operations, other alternatives will be required to provide adequate debris waste treatment. Perma-Fix and ATG may be able to provide that capacity, but their capabilities have yet to be fully demonstrated, so there is some uncertainty about the adequacy of current treatment capacity. Stabilization and disposal for IHS will likely still be provided by Envirocare and WCS, and capacity for the current inventory appears to be adequate. Unique waste has been treated and disposed in limited capacity, and new unique waste problems are being identified. Treatment capacity will likely need to be expanded to provide currently unavailable treatments, but at relatively low throughput. Available waste water treatment capacity and capabilities are likely adequate for the existing inventory.

Table II. DOE MLLW Inventory in 2000 from IPABS

Waste Type		**Volume (m^3)**
Combustible Organic		4,107
Debris		23,117
Final Form		3,110
Inorganic Homogeneous Solids		14,758
Unique		623
Waste Water		586
Total		46,301

MLLW Future

The extended future of MLLW generation has been dominated by uncertainty over the entire time considered in this analysis, and seems to be only now starting to mature. Uncertainty is driven by the lack of Record of Decision at sites for Environmental Restoration activities and Deactivation and Decommissioning projects. The most solid data that we have has come from the IPABS data reports in FY-2000 and 2001. As can be seen in Figure 1, the projected generation through 2010 has grown considerably from 2000 to 2001, 290,041 m^3 and 513,451 m^3, respectively. That 77% increase could indicate a maturing of the ER programs and more emphasis on ER and D&D activities in general. Whether that growth is reflective of a single

event increase, or a trend in larger future waste generation isn't clear. Although there is a large increase in projected MLLW generation between the 2000 and 2001 data, it largely represents environmental restoration projects, that have yet to complete their investigations, so the amount of waste that will ultimately be excavated and require treatment is highly uncertain. Figure 2 indicates that the growth is dominated by Inorganic Homogeneous Solids (375,325 m^3), however, there is a significant debris component as well (121,684 m^3). If these data prove accurate, current treatment capacity may be inadequate for both the Inorganic Homogeneous Solids and Debris waste, although the Debris waste could be more problematic in increasing capacity. Much of the inorganic homogeneous solids waste can likely be disposed directly or with only stabilization treatment. Significant stabilization throughput can be provided by commercial interests using mobile equipment. Debris treatment could be provided by macroencapsulation or may require organic destruction. It's unclear how much of this projected volume would require organic destruction, but any significant increase would challenge the existing capacity, requiring a major investment to resolve.

Analysis conducted by Belencan, et al., Table III, in 2000, indicate that the DOE anticipates 106,528 m^3 of MLLW will require treatment before 2010, including both legacy and newly generated waste. Organic destruction will be specifically required for 9,050 m^3 of MLLW. However, about 68,700 m^3 of MLLW is relying on "To Be Determined" types of treatment. It is likely that the TSCAI and commercial providers can provide adequate treatment for the 9,050 m^3 of MLLW requiring organic destruction, however, if a significant portion of the To-Be-Determined waste also requires organic destruction, then the system capacity is likely inadequate.

Considering the two data sources, it is obvious that there is considerable uncertainty regarding how much waste will be generated, and what the treatment requirements will be in the next 10 years. However, there is a potential for tens of thousands of cubic meters of MLLW to be generated some of which would require treatment for organic destruction. If historical proportions of mixed waste requiring organic destruction treatment are also applicable to future generation, then existing DOE and commercial capacity may well be adequate. At this time there is no clear indication that a major DOE investment in mixed waste treatment capacity will be needed to satisfy legacy waste and future waste generation treatment requirements.

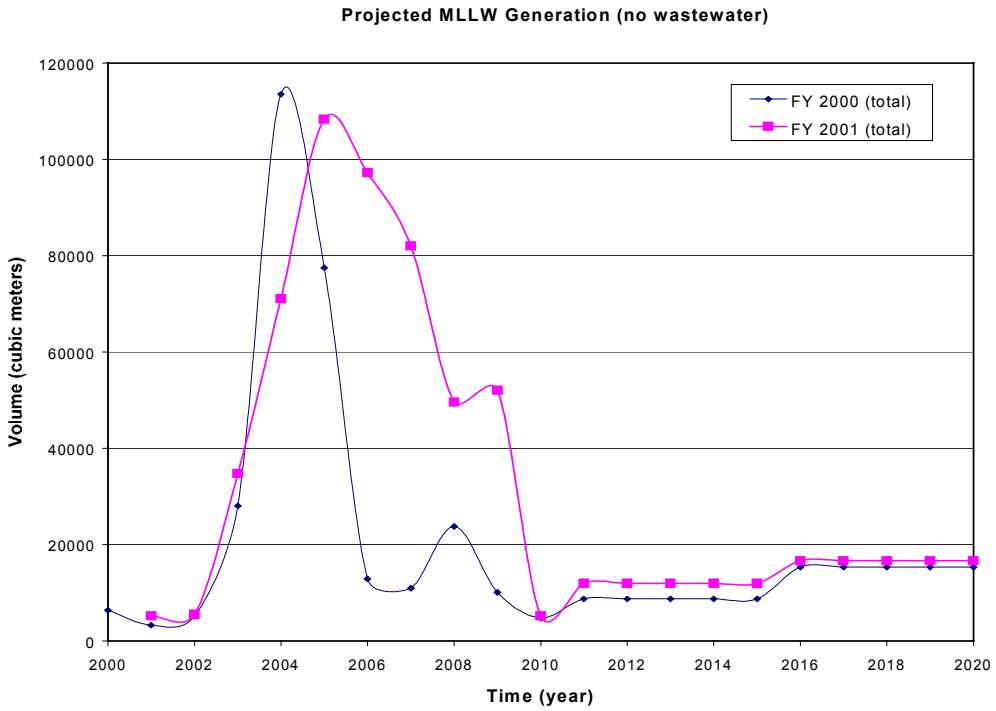


Fig. 1. Projected MLLW Generation in IPABS SDD FY 2000 and FY 2001. [a]

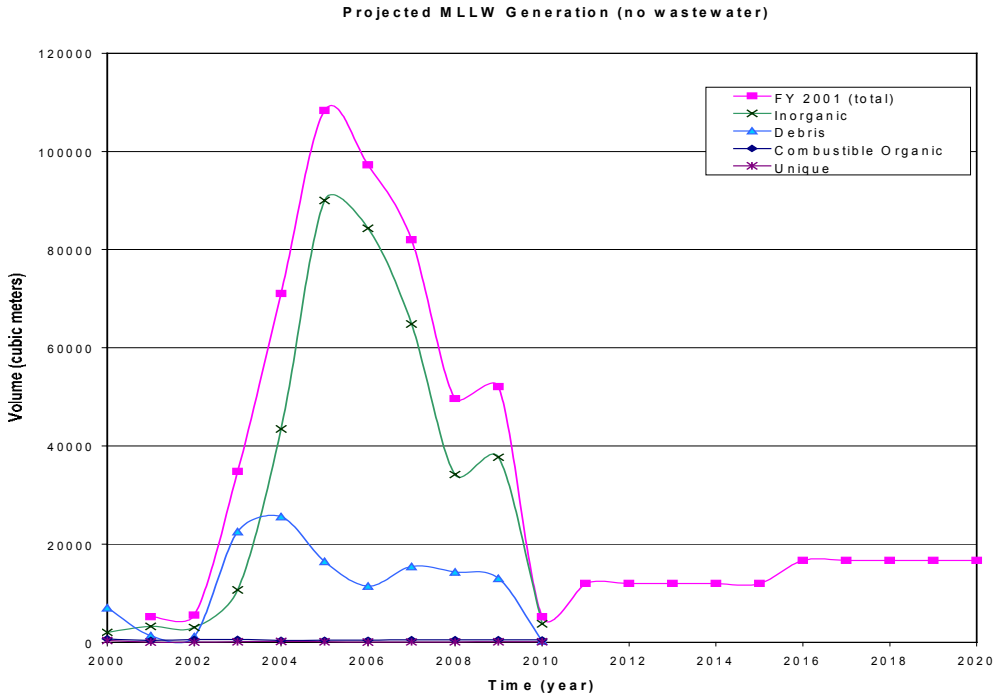
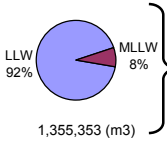


Fig. 2. Projected MLLW Generation in IPABS SDD FY 2001 by waste type. [a]

[a]From INEEL Report: Strategic Evaluation of the Transuranic and Mixed Waste Focus Area's Mixed Low-Level Waste Plans and Activities (INEEL/EXT-02-00082)

Table III. Total MLLW and LLW Treatment Planned for FY-2002 through FY-2010 - 1,355,353 (m3)

Waste Type	Treatment Type	Reporting Site	FY02-10 (m3)
LLW 1,248,826 m3 (92%)	TBD 856,235 m3 (63%)	Oak Ridge	739,225
		West Valley	89,110
		Fernald	23,143
		Nevada Test Site	3,226
		Paducah	1,194
		Others (4)	337
	Other 391,265 m3 (29%)	Fernald	268,489
		Oak Ridge	42,549
		Savannah	34,980
		Ashtabula	20,550
		Idaho	7,626
		Portsmouth	5,934
		Los Alamos	2,952
		Lawrence Livermore	2,682
		Argonne East	2,146
		Brookhaven	1,440
		Battelle WJ	934
		ITRI	540
		Others (2)	443
	Inc/OrgDest 1,326 m3 (0.1%)	Battelle WJ	407
		Savannah	403
		Lawrence Berkeley	270
		Portsmouth	162
		Oak Ridge	75
		Lawrence Livermore	9
MLLW 106,528 m3 (8%)	**Inc/OrgDest 9,050 m3 (0.7%)**	Hanford	5,111
		Oak Ridge	1,227
		Portsmouth	924
		Savannah	623
		Paducah	342
		Lawrence Livermore	317
		Rocky Flats	284
		Idaho	98
		Los Alamos	59
		Sandia NM	20
		Fernald	20
		Lawrence Berkeley	14
		Others (7)	13
	Other 28,805 m3 (2%)	Hanford	9,244
		Fernald	4,399
		Oak Ridge	4,296
		Idaho	3,111
		Portsmouth	2,574
		Ashtabula	1,157
		Rocky Flats	1,147
		Savannah	990
		Lawrence Livermore	690
		Sandia NM	430
		Paducah	294
		Argonne East	183
		Brookhaven	119
		Others (8)	173
	TBD 68,673 m3 (5%)	Paducah	40,130
		Oak Ridge	24,066
		Rocky Flats	3,510
		ETEC	537
		Fernald	146
		Idaho	132
		Sandia NM	90
		Others (7)	61



Demand by Year	FY02-10	2002	2003	2004	2005	2006	2007	2008	2009	2010
Hanford	5,111	264	717	717	717	310	600	600	600	586
Oak Ridge	1,302	319	321	430	36	39	37	43	43	34
Portsmouth	1,086	267	657		162					
Savannah	1,026				2		898	39	39	49
Battelle WJ	408	224	101	38	15	31				
Paducah	342	100	102	20	20	20	20	20	20	20
Lawrence Livermore	326	1	1	111	110	58	27	6	6	6
Lawrence Berkeley	284	30	30	35	31	31	31	31	31	31
Rocky Flats	284	284								
Idaho	98	19	13	16	5	5	10	10	10	10
Los Alamos	59	40	10	2	2	2	2			
Sandia NM	20	1	2	2	2	2	2	2	2	2
Fernald	20			15			5			
Others (6)	11	5	3	1	0.2	0.2	0.2	0.2	0.2	1
	10,377	1,555	1,958	1,387	1,103	499	1,634	751	751	740

Inc/OrgDest Facilities	M&LLW Inc & Org Dest FY02-10 (m3)	Hanford	Oak Ridge	Portsmouth	Savannah	Battelle WJ	Paducah	Livermore	Berkeley	Rocky Flats	Idaho	Los Alamos	Sandia NM	Fernald	Others (6)
Commercial - TBD	6,838	5,111	1,131	446						86	49	11		5	
TSCAI	**1,235**		**96**	**640**			**202**			**284**	**13**				**0.1**
CIF	1,203				1,015	2	140		26					20	
GTS Duratek	701		75			407			220						
AMWTP	325							317	8						
DSSI	58							9	30			10	9		1
ATG - Richland WA	16				11										5
	10,377	5,111	1,302	1,086	1,026	408	342	326	284	284	98	59	20	20	11

Demand by Year	FY02-10	2002	2003	2004	2005	2006	2007	2008	2009	2010
Commercial - TBD	6,839	585	1,251	1,131	924	358	650	654	654	632
TSCAI	**1,235**	**704**	**531**	**0.02**	**0.02**	**0.02**	**0.02**			
CIF	1,203	3	4	39	25	23	915	62	62	71
GTS Duratek	701	249	164	97	39	55	24	24	24	24
AMWTP	325			113	110	58	27	6	6	6
DSSI	58	12	8	6	5	5	5	5	5	5
ATG - Richland WA	16	2	1	0.2	0.2	0.2	11	0.2	0.2	1
	10,377	1,555	1,958	1,387	1,103	499	1,634	751	751	740