WM2008 Conference, February 24 -28, 2008, Phoenix, AZ
Abstract #8495

Post Barnwell Class B/C Waste – Crisis Avoidance

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ABSTRACT

The Barnwell Waste Management Facility (BWMF) is scheduled to restrict access to waste generators outside of the Atlantic Compact (SC, CT, NJ) on July 1, 2008. South Carolina, authorized under the Low-Level Waste Policy Act of 1980 and Amendments Act of 1985, and in agreement with the other Atlantic Compact states, will only accept Class A, B, and C low-level radioactive waste (LLRW) generated within compact. For many years, the BWMF has been the only LLRW disposal facility to accept Class B and C waste from LLRW generators throughout the country, except those that have access to the Northwest Compact Site. Many Class B/C waste generators consider this to be a national crisis situation requiring interim or possible permanent storage, changes in operation, significant cost impacts, and/or elimination of services, especially in the health care and non-power generation industries. With proper in-house waste management practices and utilization of commercial processor services, a national crisis can be avoided, although some generators with specific waste forms or radionuclides will remain without options.

INTRODUCTION

The Barnwell Waste Management Facility (BWMF) is scheduled to restrict access to waste generators outside of the Atlantic Compact (SC, CT, NJ) on July 1, 2008. South Carolina, authorized under the Low-Level Waste Policy Act of 1980 and Amendments Act of 1985, and in agreement with the other Atlantic Compact states, will only accept Class A, B, and C low-level radioactive waste (LLRW) generated within compact. For many years the BWMF has been the only LLRW disposal facility to accept Class B and C waste from LLRW generators throughout the country, except those that have access to the Northwest Compact Site. Many Class B/C waste generators consider this to be a national crisis situation requiring interim or possible permanent storage, changes in operation, significant cost impacts, and/or elimination of services, especially in the health care and non-power generation industries.

Since 2000 when the State of South Carolina and the Atlantic Compact announced a systematic reduction and ultimate restriction, waste generators have been analyzing their current waste generation practices and developing plans and processes to minimize waste generation and identify waste management solutions. The primary Class B/C waste forms, which include resins/filter media, irradiated hardware, mechanical filters, and sealed sources, have management options that could result in future risk and liabilities that must be considered prior to implementation or utilization. Regulatory revisions to the Nuclear Regulatory Commission's (NRC) 10 CFR 61 and/or Branch Technical Position (BTP) guidance must also be considered as a possible method of relief.

WASTE CLASS AND VOLUMES

In SC Fiscal Year 2007/2008 (July 1 – June 30), the BWMF is authorized to accept 35,000 ft^3 of Class A, B, or C LLRW. Although the BWMF is commonly considered only a Class B/C disposal site, a significant percentage of the waste falls within the Class A concentrations as indicated in Table I illustrating waste classes in previous years by compact affiliation.

Table I – Annual Waste Volumes By Class And Compact Affiliation[a]

	CY 2004 Class A (ft^3)	CY 2004 Class B/C (ft^3)	CY 2005 Class A (ft^3)	CY 2005 Class B/C (ft^3)	CY 2006 Class A (ft^3)	CY 2006 Class B/C (ft^3)
Atlantic Compact (3)	10,301	11,319[b]	7,409	3,839	5,681	4,092
Texas Compact (2)	331	976	701	397	550	253
Non-Sited States (34)	14,675	19,161	16,994	13,673	11,648	15,905
Totals	**25,307**	**31,456**	**25,104**	**17,909**	**17,879**	**20,250**
Totals w/o RPVs	25,307	23,949	25,104	17,909	17,879	20,250

[a] Excludes volumes being disposed at the Northwest Compact Site
[b] High volume due to CY RPV

The Class A waste generated in the Atlantic Compact may still be disposed at the BWMF, but it is assumed that all of the non-Atlantic Compact Class A waste will be disposed at the Energy*Solutions* site in Clive, Utah (Clive) after June 30, 2008. Although the national Class B/C waste volume generated is approximately 20,000 ft^3/year, the non-Atlantic Class B/C waste volume is approximately 16,000 ft^3/year. Temporary or permanent storage of 16,000 ft^3/year is definitely not desired by generators, regulators, or the public and may even be considered a national LLRW crisis.

The largest majority of the Non-Atlantic Class B/C waste generated and disposed at the BWMF in 2006 is generated by the utility industry as illustrated in Table II.

Table II – Non-Atlantic Class B/C Volumes by Type in 2006

Generator Segment	**Class B (ft^3)**	**Class C (ft^3)**	**Total (ft^3)**
Utility	8,260	7,248	15,508
Non-Utility	149	484	633
Medical	1	15	16
Projected Total	**8,410**	**7,747**	**16,157**

In general, the nuclear power utilities have greater resources available to manage their Class B/C waste without significantly affecting its final product or service, electricity. The same cannot be said for the financial or operational impact on the non-utility industries or public health, especially if the medical industry ceased using nuclear material for diagnostics or treatment.

WASTE TYPES AND WASTE MANAGEMENT OPTIONS

Generators and processors have considered all waste types in order to identify or develop management options for stranded Class B/C waste. Table III illustrates the waste forms disposed at the BWMF over a three-year period.

Table III - Waste Types Disposed At BWMF

	CY 2004 Volume		**CY 2005 Volume**		**CY 2006 Volume**	
Waste Types	**ft^3**	**%**	**ft^3**	**%**	**ft^3**	**%**
Dewatered Resins/Filters	27,358	48	23,419	54	18,149	48
Dry Active Waste	12,358	22	8,861	21	10,867	28
Reformed Residue	4,225	7	6,685	16	5,534	15
Equipment & Components[a]	10,398	18	1,624	4	1,493	3
Irradiated Hardware	920	2	1,498	3	1,379	4
Solidified Liquids	519	1	493	1	285	1
Sealed Sources, Devices and Gauges	985	2	433	1	422	1
Totals	**56,763**	**100**	**43,013**	**100**	**38,129**	**100**

[a] CY 2004 volume includes 7,507 ft^3 for the CY RPV large component

Although all of the dry active waste and portions of the other waste form volumes were Class A, the Class B/C waste can be condensed into four waste type categories:

- Ion Exchange and Filter Media
- Irradiated Hardware
- Mechanical Filters
- Sealed Sources

Ion exchange (bead or powder) resins and bulk forms of filter media (activated carbon) make up the largest volume of Class B/C waste. They are problematic to store, but have the greatest opportunities for minimization and processing. Some of the problems associated with storage of dewatered resins and filter media in high integrity containers (HICs) include; explosive gas generation due to biological growth, degradation of dewatering internals, and maintaining or confirming 10 CFR 61 compliance. Removing resins and filter media from service prior to exceeding the Class A limits may increase waste volumes, employee dose, and the number of shipments on road, but disposal is still a better option versus storage. Although currently not a common practice, commingling and concentration averaging within the authorized guidelines of the NRC Branch Technical Position on Waste Classification and Characterization can provide significant relief from having to store large volumes of resins or filter media.

Irradiated hardware from nuclear plants, such as control rods, in-core detectors, or guide tubes, are generated in moderate volumes, but pose the greatest management challenge due to their high radiation levels routinely exceed 10,000 R/hr. New hardware designs and materials have and will continue to reduce the generation of hardware. Techniques currently exist that have been used for years that reduce the waste volumes. But, once generated, there is little to no processing option that eliminates the need for temporary or permanent storage. Storage can continue in the spent fuel pools or at dry storage locations. In-pool storage impacts spent fuel storage capacity and contributes to employee dose when stored on hanger around the perimeter of the spent fuel pool. Processing for volume reduction and loading in fuel bundle size containers for storage in fuel rack locations helps reduce these impacts. Dry storage in shielded containers, Figure 1, away from the spent fuel pool can be performed on-site similar to spent fuel dry storage on an ISFSI pad or off-site at a contracted, third party storage facility. Storage off-site poses a loss of control and risks stranded or orphaned waste.

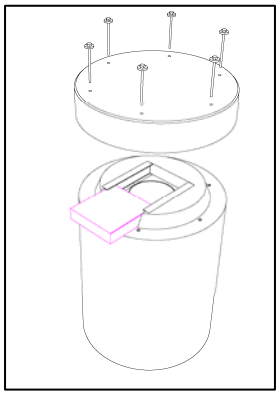

Figure 1 – Shielded Dry Storage Container

Mechanical filters are also generated in moderate volumes. They pose similar storage problems to resins from explosive gas generation due to biological growth, degradation of dewatering internals, and maintaining or confirming 10 CFR 61 compliance. Processing for disposal is restrictive due to NRC guidance on waste characterization. Processing for storage by means of encapsulation in a stabilizing media is possible, but poses a risk of acceptance by future disposal sites. Management techniques to minimize Class B/C generation may be the best option, yet will increase waste volumes and may increase employee dose. Regulatory revisions could open up new process options, such as shredding and/or commingling for Class A concentration averaging.

Sealed sources contribute the lowest volume but, similar to mechanical filters, processing for disposal is restrictive due to NRC guidance on waste characterization. Although the NRC BTP guidance suggests concentration averaging over some encapsulation media, this is not commonly accepted by the State-regulated disposal sites. Regulatory revisions and acceptance at State-regulated sites would eliminate the need to store many sealed Class B/C sources. Some sealed sources can be managed through recycling, return to manufacturer, or DOE source recovery program.

CRISIS AVOIDANCE

Since 2000, there has been increasing concern, analysis of the problem, and development of solutions by waste generators, regulators, and commercial processors. Examples include:

- NRC meeting on LLRW – Dec. 6, 2006
- NRC NUREG-1614, 5-Year Strategic Plan program identification
- NEI LLRW Committee activity
- EPRI LLRW Committee activity
- ASME LLRW Committee activity
- Commercial Processor research and development
- Generator's specific problem identification and waste generation modifications

The NRC is evaluating, not only the need for changes to the BTP on Waste Classification and Characterization, but revisions to 10 CFR 61. Generators and industry organizations are providing input to the NRC in order to facilitate and influence these changes and revisions. Regulators and generators alike are revisiting the base assumptions and analyses that were used to support the promulgation of 10 CFR 61 and the BTP guidelines. Specific radionuclides, radionuclide concentrations, and performance basis are being validated or discredited. The impact of certain radionuclides in the long-term intruder scenario is being questioned. The result may be regulatory changes that minimize the impact of Class B/C storage due to the BWMF restrictions after June 30, 2008. Unfortunately, a rulemaking change will take many years. Even modifications to the BTPs will take too long to provide waste generator relief in a timely manner.

Timely relief and crisis avoidance will need to be a combination of waste generator management changes and commercial processor solutions. When evaluating waste management options, waste generators are applying the following key goals:

- Maintain disposal availability for all classes of waste

If not achievable:

- No change in plant operations or resin processing equipment
- No change in transport methods
- Single process for all resins generated
- Eliminate on-site or off-site storage and associated risks and liability
- Stable and predictable disposal costs

If storage is necessary**:**

- Optimize waste form for storage
- Optimize waste container for storage
- Meet all new site WAC conditions, currently an unknown
- Ensure regulatory approval or acceptance
- Optimize storage facility design and operations
- Decide on on-site versus off-site storage based on costs, risks, and liability

Some options being considered by generators and/or processors to eliminate or minimize the impact of a Class B/C crisis:

- Changes in process management techniques

- Removal from service prior to exceeding Class A
- Resins/filter media that limits the collection of radionuclides to no more than Class A
- Removal of radionuclides from liquid radwaste streams without using resins or media
- Commingling resins and filter media to maximize the Class A volumes still capable of being disposed
- Using binders and/or solidification agents that only produce Class A waste forms
- Plant waste systems modifications
- Recycling
- On-site storage

Table IV illustrated the author's estimate of waste volume reduction by waste type either solely due to generator and/or commercial waste processor management methods versus NRC regulatory changes and the management methods of the waste generators and commercial processors.

Table IV – Reduced Volumes Through Waste Management and/or Regulatory Revisions

Compact & Non-Compact **Waste Types**	**Management within the Current BTP Guidelines (ft^3)**	**Volume after NRC Regulatory Revisions to BTP Guidelines (ft^3)**
Dewatered Resins & Filter Media	1,914	797
Reformed Residue	Included in above	Included in above
Mechanical Filters	1,208	483
Irradiated Hardware	276	276
Solidified Liquids	143	57
Sealed Sources, Devices and Gauges	178	111
Totals	**3,719**	**1,724**

Reduced waste volumes in the 2,000 to 4,000 ft^3 range for storage do not constitute a national crisis.

SUMMARY

It is unknown what the future will bring for commercial LLRW disposal. Could the anticipated post Barnwell Class B/C crisis be avoided by any of the following?

- Barnwell Site remains open for the nation's commercial Class B/C waste
- Richland Site opens back up to the nation for commercial Class B/C waste
- Texas Site opens up to the nation for commercial Class B/C waste
- Federal Government intervenes by keeping a commercial Class B/C site open for the nation's commercial Class B/C waste
- Federal Government makes a DOE site available for commercial Class B/C waste
- Federal Government revisits the LLRW Policy Act of 1980 and Amendments Act of 1985

Without a future LLRW site capable of accepting Class B/C currently on the horizon, commercial LLRW generators are faced with waste volume elimination, reduction, or storage. With proper in-house waste management practices, utilization of commercial processor services and regulatory relief, a national crisis can be avoided. Waste volumes for storage can be reduced to as little as 10% of the current Class B/C volume. Although a national LLRW crisis can be avoided, some generators with specific waste forms or radionuclides will have a significant financial and/or operational impact due to a lack of commercial LLRW management options.