SHIPMENT OF LOW LEVEL WASTE FROM THE OAK RIDGE RESERVATION TO THE NEVADA TEST SITE

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ABSTRACT

The low-level waste form, commonly referred to as the 'Monoliths', originated as liquid low-level from the Oak Ridge National Laboratory (ORNL). The liquid low-level waste was generated from research and development facilities including radiochemical laboratories, radioisotope processing facilities, decontamination operations, and hot cell activities. The liquid was collected, made alkaline, and concentrated by evaporation, which was then stored in tanks. Once settling had occurred, the supernate in the tanks was solidified in metal containers using a mixture of cement, celite, blast furnace slag, and fly ash. After solidification of the supernate, the waste forms were transported to an area within the Oak Ridge Reservation (ORR) and placed in concrete storage casks. The storage casks were designed as radiation shields to maintain the external radiation dose levels as low as reasonably achievable (ALARA).

In 1994 and 1995, the Nevada Test Site (NTS) audited the ORNL NTS Certification Program. During this time, transporters and cask vendors were selected and final preparations for shipment were made. However, the shipments were placed on hold awaiting approval for a United States Department of Energy complex-wide Waste Management Programmatic Environmental Impact Statement (PEIS) or an amendment to the NTS Record of Decision (ROD) to allow ORR to ship to NTS. The PEIS was completed in 2nd quarter FY 2000 with shipments commencing in 3rd quarter FY 2000. This paper will discuss the waste matrix, characterization, handling, shipment, and final disposal of this unique waste form at NTS.

INTRODUCTION

A unique low level waste (LLW) stream, known as the "Monoliths," originated as liquid LLW from the Oak Ridge National Laboratory (ORNL) Research and Development Facilities. The facilities included: radiochemical laboratories, radioisotope processing facilities, decontamination operations, and hot cells. The liquid waste was collected, made basic, then concentrated by evaporation. The resulting concentrates were stored in tanks near the evaporator facility and also the Melton Valley Storage Tanks (MVST). The supernate in the tanks was solidified into high integrity containers (HICs) using a mixture of Portland cement, celite, blast furnace slag, and fly ash. Each HIC is a right circular cylinder approximately 1.8 meters tall and 1.8 meters in diameter and weighs approximately 8,600 kilograms (Fig. 1). Dose rate readings on the external surface of the most heavily contaminated liners are estimated to be 4.5 R/hr. The surface dose for most of the containers is a little less than 1 R/hr.

Fig. 1. Metal Liner (HIC) Containing LLW

After solidification of the supernate into metal liners, the waste forms were transported to Solid Waste Storage Area No. 6 (SWSA 6) where they have been stored on the 7842A yard in concrete storage casks. The storage casks are cylindrical in shape with outside dimensions of 2.6 meters in diameter and 2.4 meters in height with a lid that is 30 centimeters thick (Fig. 2). Each storage cask weighs approximately 23.4 metric tons. The casks were designed as radiation shields, in order to maintain external levels As Low As Reasonably Achievable (ALARA). Dose rates at the exterior surface of the storage casks are generally less than 5 mrem/hr.

includes monolith shipments to the disposal site, was audited by NTS. Transporters and cask vendors were selected, and final preparations to ship were made. However, shipments were put on hold since that time, while waiting for approval of the complex-wide waste management Programmatic Environmental Impact Statement (PEIS) or amendment to the NTS Record of Decision (ROD), which would allow Oak Ridge to be recognized as an approved shipper to NTS.

Anticipating that either the PEIS would be approved or the NTS ROD would be amended, preparations to ship to NTS were initiated in FY1998 resulting in an audit of the program by NTS in November 1998. The audit resulted in three Corrective Action Requests (CARs) and five observations. The NTS audit team returned in April of 1999 and conditional approval to ship was given on May 28, 1999, pending the PEIS or NTS ROD amendment.

On February 25, 2000, the PEIS ROD was published in the Federal Register and on March 9, 2000, NTS removed the conditional approval for shipment of monoliths. At that time, Bechtel Jacobs Company LLC restarted the program and made their first shipment of monoliths on April 11, 2000.

Fig. 2. Monolith Storage

WASTE MATRIX

The waste sent to the MVST came from various sources throughout the ORNL site. Table I identifies, by year and percent contribution, where the waste came from. Each of the locations performed various activities as shown in Table II, which shows the descriptions and the types of waste received were diverse (1).

Table I. Sources of Liquid LLW (%)

Facility	FY 1985	FY 1986	FY 1987	FY 1988	FY 1989
PWTP	30.1				
PWTP Spent Acid		5	2	3	2
Tank WC-8 pump pit		1		2	3
Isotope Area	11	17	14	16	17
TRU	2.9				
3019	4.6	3	8	4	1
3026	4.3				
3039	4.0	8	13	14	13
3517	8.6	11	12	13	4
3525	4.2	9	7	8	10
4500 Complex	4.8	12	9	7	4
7920		4	4	7	3
ORR, BSR	10.7	13	13	6	8
HFIR	12.5	12	10	12	15
Tank W-1A		4	4	5	18
Other	2.3	2	2	3	3

Table II. Facilities Generating Liquid Low Level Wastes

Facility	Function
PWTP	Process Waste Treatment Plant liquid
TRU	Bldg. 7920 and 7930 Transuranic processing facilities
3019	Pilot Chemical Reprocessing Facility (location where PUREX process was developed)
3039 Stack Area	The majority of the liquid LLW that came from the stack area was from the scrubber. These stacks serviced all hot cells and glove boxes throughout the ORNL.
3525	Hot cell where various activated metallography experiments occurred
ORR	Oak Ridge Research Reactor
BSR	Bulk Shield Reactor
HFIR	High Flux Isotope Reactor

The liquid waste was pumped from the MVSTs to either Tank W-29 or Tank W-30. There the pH was adjusted to precipitate out the majority of the heavier isotopic particles (i.e., Plutonium, Uranium, etc.). This selective precipitation created a sludge layer and a supernate layer. The supernate layer had a density of ~1.4 g/cm^3 and was yellowish in color. The supernate was then alternately pumped from Tank W-29 and Tank W-30 into liners within Bldg. 7877. Tank W-30 produced the even liners and Tank W-29 produced the odd liners. Treatment was accomplished by pumping approximately 3,860 kgs. of liquid supernate out of either Tank W-29 or W-30 into a carbon steel liner.

The liner then received a chemical stabilization addition of Portland cement, celite, blast furnace slag, or fly ash of approximately 3,860 kgs. The waste was then mixed in the liner. The mixer blades were left in the liner and solidified with the waste. The waste set for three days prior to movement to storage. The waste has continued to cure within the liners at ORNL, in some cases, for over ten years.

CHARACTERIZATION (2, 3)

The characterization of this waste is broken into two parts, Chemical and Radiological. Each part utilized process knowledge and sampling and analysis.

Chemical Characterization

Determination of the RCRA status of the Liquid LLW system, which feeds the MVST, is based on a combination of process knowledge (including knowledge of the sources of wastes) and the administrative controls in place at ORNL and laboratory analyses. For listed constituents, a combination of administrative controls which limit discharges of RCRA wastes to the waste water treatment system and also use of the exemptions found in 40CFR261.3 were used. Laboratory analysis was used to demonstrate the waste was not characteristic.

Other NTS Waste Acceptance Criteria (WAC) limiting chemical constituents were also demonstrated through the characterization package to not be present within the waste.

Radiological Determination

The radiological determination was based upon historical sampling and analysis and process knowledge. This section discusses the specific methodology utilized for the determination of the isotopic distribution for each liner. The following key points are covered in this memorandum:

- Utilization of analytical data for specific monolith liners
- Utilization of scaling factors for determination of isotopic distribution in other monolith liners
- Determination of plutonium isotopic distribution using "Total Pu" analytical results from liner data and historical data from referenced documents
- Determination of uranium isotopic distribution using historical data from referenced documents
- Determination of concentration of other isotopes listed on the NTS waste profile, but not included in the specific analytical data package for each liner from historical data.

There were four solidification campaigns from the MVST tanks. The Emergency Avoidance Solidification Campaign (EASC) was the first solidification campaign and was started in 1988. The name was aptly given because ORNL was running out of space to store their liquid waste. The other three solidification campaigns were identified as Liquid Waste Solidification Projects (LWSP) 1, 2, and 3. The operation was accomplished by using two tanks, W-29 and W-30, as blend tanks. Other tanks would pump their supernate into these two tanks where the liquid was blended and allowed to settle. The liquid portion of these tanks was then pumped into a Liner where it was blended with Portland cement, celite, blast furnace slag, and fly ash. The W-29 or W-30 sequence in the liner number indicates from which MVST tank waste was solidified for the specific liner (the last number in the liner numbering sequence). For both the EASC and LWSP-1 campaigns, even-numbered liners (i.e., W-30-2, 4, 6, etc.) contain solidified waste from MVST W-30 and vice versa for the odd-numbered liners with waste solidified from Tank W-29 (i.e., W-29-3).

The analytical results contained a number of results, which showed a value of "less than". For these analytical results, the less than "value" was utilized as the activity for the specific isotope. For other isotopes (e.g. Cs-134 and Cs-137), the result plus the positive analytical error indicated on the analysis were utilized as the value for NTS WAC and U.S. Department of Transportation (DOT) calculations.

Utilization of Scaling Factors

The results denoted above were based on the specific date of each analytical result. Dose rates were also taken on each liner of waste prior to the liner being transferred to the concrete storage casks for storage. For the EASC campaign, the dose rate was taken as a contact reading (1/2 inch) from the actual monolith solidified waste surface. For the LWSP-1 campaign, the dose rates were taken on contact with the liner surface. The liner is a carbon steel cylindrical container with a wall thickness of 1/8" (Fig. 1.). The results for each liner denoted above were back decayed to the date the dose rate was taken for the specific liner. To determine the activity of another liner of waste solidified from the same MVST tank, a dose rate to activity (curie) conversion was made between the two liners.

The first liner of waste to be shipped to NTS as part of this campaign was EASC Liner #W-30-58. This liner corresponds to the analytical results from EASC Liner W-30-42. The on-contact solidified dose rate for EASC Liner #42 was 1,100 mRem/hr and the dose rate for Liner #58 was 300 mRem/hr. To convert activity levels from the Liner #42 analytical data to Liner #58, each activity for a specific isotope was multiplied by a factor of 300/1100 (corresponding to the dose rates of each liner). The date basis for EASC Liner #58 would be the date the dose rate was taken and recorded for the liner following solidification.

The activity for these liners is then decayed to the estimated shipping date. The final NTS WAC and DOT parameters are calculated utilizing the activity decayed to the shipping date.

DETERMINATION OF ISOTOPIC DISTRIBUTION (2, 3)

Plutonium (Pu Total)

The plutonium data reported in the NTS Waste Characterization Project Radiochemical Summary & Raw Data – Data Package, Lab Batch ID: IPA 7720, July 1996 (Reference 4 under Section 3 above), reported the plutonium value as a total using alpha spectroscopy.

Historical sampling and analysis reported an isotopic breakdown for plutonium results for the supernate liquid samples for six of the eight MVST tanks. The values from these analytical results (in Bq/ml) were averaged and the resultant isotopic breakdown for these results is denoted below:

- 61% Pu-238
- 39% Pu-239/240

Pu-239 and Pu-240 were reported as Pu-239/240 in the supernate samples since the concentration of each isotope was not sufficient to discern the separate peaks for each isotope. Pu-239 and Pu-240 have relatively the same alpha energies. Since Pu-239 has a more conservative specific activity, which would equate to a higher number of grams of this isotope, the Pu-239/240 result was reported as Pu-239 on the NTS WAC and DOT documentation.

Please note this analysis is being used to defend the plutonium distribution for all generated monolith liners. It has been assumed that Tanks W-29 and W-30 have the same plutonium isotopic distribution as the other MVST tanks. Prior to solidification operations for both the EASC and LWSP-1 solidification campaigns, supernate liquids from the other six MVST tanks were pumped into W-29 and W-30.

Uranium

There are at least three issues associated with the need to determine the U-235 enrichment and uranium isotopic distribution of the monolith waste stream for the EASC and LWSP-1 solidification campaigns. The issues are as follows:

- Nevada Test Site Waste Acceptance Criteria Compliance

- Department of Transportation Shipping Documentation
- Materials Control and Accountability Determination

The uranium is considered "enriched" when the U-235 enrichment is greater than 0.711wt percent of the total uranium weight. The following discussion will demonstrate why the solidified monolith waste is less than 0.711 wt percent or is considered depleted. This section of this memorandum also provides the methodology utilized to determine the uranium isotopic distribution in each monolith liner.

There were four references used to determine the uranium enrichment and isotopic distribution of the monoliths:

- Sampling and Analysis of Radioactive Liquid Wastes and Sludges in the Melton Valley and Evaporator Facility Storage Tanks at ORNL (Sears – September 1990), sampled waste from six of the MVST tanks and two storage tanks from the Bethel Valley Evaporator Storage Tanks. Samples were taken from both the liquid and also the sludge bottoms. U-235 was not analyzed in the liquid samples. All sludge results were reported at less than the detection limit.
- Characterization of Selected Waste Tanks from the Active LLLW System (Keller - August 1996), sampled waste from six MVST tanks and other tanks at ORNL. For the purposes of this discussion, only the MVST tanks were evaluated relative to uranium enrichment and isotopic distribution. samples were taken from both the liquid supernate and sludge. The U-235 enrichment for the liquid samples ranged from 0.27 to 0.35 wt. percent for the six MVST tanks. One sludge sample from the MVST tank was analyzed for uranium enrichment; the result was 0.548 wt. percent U-235. *All laboratory analytical results demonstrated that the waste was depleted.*
- Characterization of the MVST Waste Tanks Located at ORNL (Keller – December 1996), sampled waste from six MVST tanks. Samples were taken from both the liquid and sludge bottoms. The U-235 enrichment for the liquid samples ranged from 0.29 to 0.35 wt. percent U-235 for the six MVST tanks. The U-235 enrichment for the sludge samples ranged from 0.253 to 0.621 wt. percent U-235 for the six MVST tanks. *All laboratory analytical results demonstrated that the waste was depleted.*
- NTS Waste Characterization Project Radiochemical Summary & Raw Data – Data Package, analyzed solidified waste from MVST Tanks W-29 and W-30 from the EASC and LWSP-1 solidification campaigns. The results from Tank W-30 reported the U-235 as less than detectable. It is assumed that liners generated from Tank W-30 are depleted and have an enrichment of 0.283 wt. percent which is the average enrichment found in the liquid samples from the second and third sets of information identified above. Although the average result for the solidified waste from Tank W-29 indicated that the waste is enriched, the analytical is suspect because of the extremely low uranium concentration. The supervisor from the laboratory that reported these results indicated that the isotope was at a concentration less than the detectable limits since the error was greater than the result

Please note, the laboratory analysis reported negative values for U-235 for Tank W-30 (from the EASC campaign) and greater than the value reported for Tank W-29. Also note, the analytical error for the U-235 from the solidified waste from Tank W-29 was greater than the reported U-235 result. Therefore, the enrichment reported on the laboratory analysis for Tank W-29 is not considered accurate. *Therefore, this waste is also considered depleted.*

Characterization provided atomic isotopic (weight) percentages from U-233, U-234, U-235, U-236, and U-238 for the supernate samples (3). This data was averaged together to determine the uranium isotopic weight distribution in the supernate waste. The weight percentages for each uranium isotope are delineated in Table III.

Table III. Averaged Supernate Distribution

Isotope	Uranium wt %
U-233	0.115%
U-234	0.010%
U-235	0.283%
U-236	0.010%
U-238	99.583%

The U-233 results (reported in Bq/ml) for the six MVST supernate samples were converted to $gm_{U\text{-}233}$/ml using the specific activity of U-233. Values (in $gm_{U\text{-}Isotope}$/ml units) were calculated for each Uranium isotope using the average atomic weight percentages delineated in the table above. This methodology was utilized since the sample results for a few of the uranium isotopes reported results as less than a specific value. The gm/ml units for each Uranium isotope were then converted back to Bq/ml units to correspond to similar units for Cs-137. The analytical results for Cs-137 were also averaged together for these six samples. Using this Cs-137 average value, a ratio of each Uranium isotope to Cs-137 was calculated. This ratio was utilized to determine the specific uranium isotope concentration for each sample under Reference 4 of Section 3 above for the EASC and LWSP-1 solidification campaigns. This methodology was utilized versus the "suspect" analytical data reported for the solidified waste samples. The resultant U-238 values were within the range of the analytical results from these same samples; therefore, this calculation has been validated with actual analytical results. Table IV provides the resultant uranium isotopic concentration from the December 1996 Keller report based on the uranium weight percentages of each isotopes as compared to the average U-233 concentrations delineated in the report. Table IV also provides the ratio of each isotope to the average concentration of Cs-137 in the waste.

Table IV. Uranium Isotopic Concentration of the Supernate

Isotope	Concentration (Bq/ml)	Ratio to Cs-137
U-233	1.54E+01	1.89E-05
U-234	8.54E-01	1.05E-06
U-235	8.59E-03	1.06E-08
U-236	8.95E-03	1.10E-08
U-238	4.66E-01	5.74E-07
Cs-137	8.13E+05	1.00E+00

Please note this analysis is being used to defend the enrichment and isotopic distribution for all generated monolith liners. Monoliths generated from EASC and LWSP-1 solidification campaigns contained supernate liquid from Tanks W-29 and W-30. It is assumed that Tanks W-29 and W-30 have the same U-235 enrichment and isotopic distribution as the other tanks analyzed because the results were similar. As part of the MVST operations, supernate from six of the MVSTs was pumped to Tanks W-29 and W-30. From the latter two tanks, supernate was removed and solidified as part of the solidification operations.

Other Isotopes Listed on NTS Waste Profile Martin Marietta Energy Systems ORNL00002 (4)

Other isotopes listed on the subject NTS waste profile include C-14, Cm-244, I-129, and Tc-99. Cm-244 was ruled out since Cm-244 was only detected in the Bethel Valley Evaporator Storage Tanks (BVESTs) and not the MVSTs. Waste is transferred from the BVESTs to the MVSTs. Following transfer to the MVSTs, the waste undergoes a pH adjustment, which results in the heavier isotopes (e.g., Cm, Pu, U, etc.) precipitating and settling into the sludge layer in the tanks. Also, following transfer of the supernate into MVST Tanks W-29 and W-30 for eventual solidification, the solids in the supernate were allowed to settle into the sludge layer. This settling process further reduced the concentration of these heavier isotopes in the supernate that was solidified as part of the EASC and LWSP-1 solidification campaigns. Since the Cm-244 was not detected in the supernate, samples from the MVSTs in any of the reports delineated as References 1, 2, and 3, under Section 3 above, will not be reported on the shipping documentation or the Package, Storage, & Disposal Request for monoliths shipped to NTS.

For isotopes, I-129 and Tc-99, information was utilized to determine the average isotopic concentration in the supernate (3). A ratio was established between each of these isotopes and the average Cs-137 concentration in the samples under this reference. To determine the specific isotopic concentration of each of these isotopes in the monolith liners, this ratio was then multiplied by the Cs-137 analytical result in each sample. The date for the resultant isotopic concentration utilized for the monolith liner was assumed to be the same as the analytical date for Cs-137. The concentration of each isotope was then converted to determine the total activity of the liner. This activity of each isotope is then "back-decayed" to the date when the dose rate was taken on the liner following solidification cure and prior to transfer to the concrete storage cask.

As discussed earlier, a dose rate to activity (curie) conversion was then performed on liners solidified from the same MVST tank during solidification operations. The activity is then decayed to the present day shipping date for the particular monolith. Table V provides the average I-129, Tc-99, and Cs-137 concentrations from the December 1996 Keller report (Reference 3 under Section 3 above).

Table V. Average Other Isotopic Concentrations In Supernate

Isotope	Concentration (Bq/ml)	Ratio to Cs-137
I-129	1.19E-01	1.47E-07
Tc-99	7.70E+02	9.47E-04
Cs-137	8.13E+05	1.00E+00

Analytical data for the concentration of C-14 is only available from 1 reference (1). On this basis, the values delineated in the report were averaged together and compared to the average of all Cs-137 values from other references. Like I-129 and Tc-99, this ratio was utilized to determine the C-14 concentration and activity in each sample (4). The ratio was multiplied by the Cs-137 concentration denoted for each sample and the result was the C-14 concentration. The date for the C-14 concentration in the sample is assumed to be the same sample date Table VI provides the C-14 average concentration from the September 1990 Sears report along with the Cs-137 average concentration from both the September 1990 Sears report and the December 1996 Keller report.

Table VI. C-14 Average Concentration

Isotope	Concentration (Bq/ml)	Ratio to Cs-137
C-14	1.64E+02	3.13E-04
Cs-137	5.24E+05	1.00E+00

These analytical concentrations are then multiplied by the product weight in each monolith liner. Product weight includes the supernate weight plus all other additives including water, Portland cement, blast furnace slag, Type F fly ash, etc. This resultant calculation provides the activity of each isotope in the monolith liner. The activity of each isotope is then "back-decayed" to the dose rate date for each monolith liner (the date when the liner completed the solidification curing process and was transferred to the concrete storage cask). Using a dose rate to curie (activity) scaling factor, the activity is then determined for corresponding liners solidified from supernate from the same MVST (i.e., W-29 or W-30). This activity is then decayed to the shipping date for each monolith liner.

SHIPMENT

As part of the startup activity requirements for the shipment of the monolith waste from the ORNL to the NTS, an Internal Field Evaluation was required prior to the start of operation activities. The Internal Field Evaluation was completed by Bechtel Jacobs LLC waste management subcontractor, WESKEM. DOE Oak Ridge also provided oversight of the Internal Field Evaluation. After the Internal Field Evaluation was completed, the project was ready to begin shipping monoliths.

The first step in shipping monoliths was preparation of the facility. This was accomplished by first determining which monolith was to be shipped, then positioning the crane in the appropriate location. The shipping cask was then inspected and made ready for receipt of the monolith for transportation. After the crane was set into place, the primary 10,000 lb. lid of the monolith storage cask was lifted and surveyed (no lids were found with contamination for the first 60 monoliths loaded). After the primary lid was removed, a 15' long shepherd's hook was used to hook the rigging on the inner plastic lid to the crane. This was accomplished by having a person stand upon an adjacent railed storage cask and then reach into the storage cask with the shepherd's hook and hook the lid onto the crane. The inner plastic lid was then removed and surveyed (no inner plastic lids were found with contamination). After the inner plastic lid was removed, the rigging crew inspected the slings and rigging hardware on the monolith with binoculars. Using the same shepherd's hook, the rigging crew hooked the slings onto the crane's hook.

The monolith was raised about 6" and allowed to rest for ten minutes. The riggers inspected the rigging hardware to ensure the rigging was still in acceptable condition (Per the solidification project manager who generated the liners, all 60 monoliths shipped appeared to be in the same condition as they were placed in the storage cask over 10 years ago). The monolith was then lifted above the storage cask where the liner was surveyed with a muslin wipe on a long pole. (No liner was found to exceed the Health Physics required loose contamination limits.) After the survey results were returned, the liner was swung over to the shipping cask and lowered. The lid was placed upon the shipping cask and then the load was surveyed for DOT.

The loading operation was a huge success. No person was hurt during the entire operation and the total dose received by the crew was 242 mrem. The crew consisted of approximately 6 people. This is a rather low number for handling approximately 1,000,000 pounds of remote-handled waste.

After the waste was loaded onto the truck, a local trucking firm came and picked the trailer up for transport to NTS (see Fig. 3). The load was overweight so the trucking firm obtained overweight permits in most of the states they crossed. The only other off-normal activity regarding the shipping of this waste was that DOE/HQ required that the waste did not go over the Hoover Dam or through the Spaghetti Bowl in Las Vegas. This forced the shipment to take the northern route coming in on Interstate 80 to US-93 to US-6 to US-95.

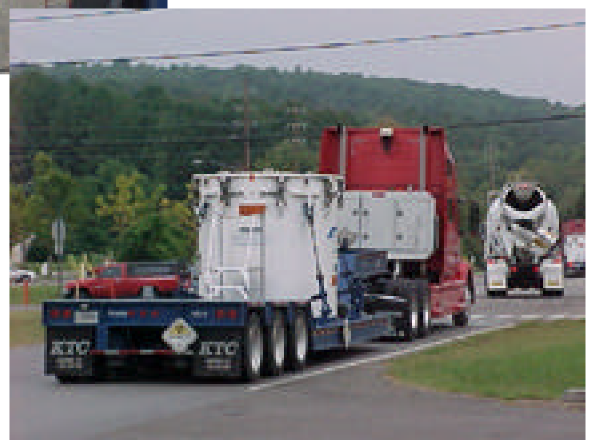

Fig. 3. Transport to NTS

FINAL DISPOSAL AT NTS

The shipments were required to arrive at NTS from 7:00 a.m. to 1:00 p.m. Monday – Thursday barring any holidays. After they arrived at NTS, the drivers went through security and drove to Area 3 for off-loading. NTS had prepared their disposal cell for receipt of this waste by creating nests with Sea Land containers to receive this waste. The off-loading was accomplished by driving the trailer into the waste storage cell then removing the shipping cask lid. NTS personnel stood upon a ladder and used a 15' shepherd's hook to hook the liner slings onto the crane.

Fig. 4. Disposal at NTS

The personnel then vacated the area while the crane operator removed the monolith from the cask and lowered the monolith into the nest. After the monolith was unloaded, a bulldozer pushed approximately six feet of soil on top of the liner (Fig. 4).

CONCLUSION

A unique low level waste (LLW) stream, known as the "Monoliths," originated as liquid LLW from the Oak Ridge National Laboratory (ORNL) Research and Development Facilities. The liquid waste was collected, made basic, then concentrated by evaporation. The supernate stored in tanks was solidified into high integrity containers using a mixture of Portland cement, celite, blast furnace slag, and fly ash. After solidification of the supernate in metal liners, the waste forms were transported to SWSA 6 where they have been stored in concrete storage casks.

Prior to shipment, an Internal Field Evaluation was conducted. Activities included:

- The primary 10,000 lb. lid of the monolith storage cask was lifted and surveyed.
- The inner plastic lid was then removed and surveyed.
- The monolith was then lifted above the storage cask where the liner was surveyed with a muslin wipe on a long pole.
- After the survey results were returned, the liner was swung over to the shipping cask and lowered.
- The lid was placed upon the shipping cask and then the load was surveyed for DOT.
- After the waste arrived at NTS, the drivers went through security and drove to Area 3 for off-loading. The off-loading was accomplished by driving the trailer into the waste storage cell then removing the shipping cask lid. After the monolith was unloaded, a bulldozer pushed approximately six feet of soil on top of the liner. A total of 60 monoliths were successfully shipped and disposed at NTS in FY 2000.

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