Treatability Variance for Containerized Liquids in Mixed Debris Waste – 12101

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ABSTRACT

The TRU Waste Processing Center (TWPC) is a Department of Energy facility whose mission is to receive and process for appropriate disposal legacy Contact Handled (CH) and Remote Handled (RH) waste, including debris waste stored at various DOE Oak Ridge facilities.

Acceptable Knowledge (AK) prepared for the waste characterizes the waste as mixed waste, meaning it is both radioactive and regulated under the Resource Conservation and Recovery Act (RCRA)[1]. The AK also indicates that a number of the debris waste packages contain small amounts of containerized liquids. The documentation indicates liquid wastes generated in routine lab operations were typically collected for potential recovery of valuable isotopes. However, during activities associated with decontamination and decommissioning (D&D), some containers with small amounts of liquids were placed into the waste containers with debris waste. Many of these containers now hold from 2.5 milliliters (ml) to 237 ml of liquid; a few contain larger volumes. At least some of these containers were likely empty at the time of generation, but documentation of this condition is lacking. Since WIPP compliant AK is developed on a waste stream basis, rather than an individual container basis, and includes every potential RCRA hazardous constituent within the waste stream, it is insufficient for the purpose of characterizing individual containers of liquid.

Debris waste is defined in 40 CFR 268.2(g) [1] as “solid material exceeding a 60 mm particle size that is intended for disposal and that is: a manufactured object; or plant or animal matter; or natural geologic material.” The definition further states that intact containers of hazardous waste that are not ruptured and that retain at least 75% of their original volume are not debris. The prescribed treatment is removal of intact containers from the debris waste, and treatment of their contents to meet specific Land Disposal Restrictions (LDR) standards. This is true for containers with incidental amounts of liquids, even if the liquid is less than 50% of the total waste volume. Under the proposed variance, all free or containerized liquids (up to 3.8 liters(L)) found in the debris would be treated and returned in solid form to the debris waste stream from which they originated. The waste would then be macroencapsulated.

[1] Mixed waste contains radioactive waste regulated under the Atomic Energy Act and hazardous constituents regulated under the Resource Conservation and Recovery Act.

INTRODUCTION

Although the AK documentation indicates most liquids in the TWPC waste inventory are dilute acids or basic process solutions (non-RCRA), there is a slight risk of contamination with listed solvents. The AK documentation has applied the following Environmental Protection Agency (EPA) waste codes to the debris waste stream; F001, F002, F004, F005, D004-D011, D019, D022, and D028. There is also a small potential for the containerized liquids to be ignitable (D001) or corrosive (D002).

At the TWPC, the standard treatment for debris mixed LLW is macroencapsulation in accordance with 40 CFR 268.45 standards [1]. The LDR treatment standards for containerized liquids with the assigned listed waste codes and a portion of the characteristic D-codes are numerical standards. The standard for the other characteristic codes such as D001 and D002, is deactivation with treatment to meet any underlying hazardous constituents

A review of regulatory background information and guidance indicates these requirements were intended to apply to intact 208 L containers remediated during corrective action activities. The requirements were not evaluated for applicability to small quantities of containerized liquids generated with debris during D&D activities, especially in cases involving a radioactively contaminated waste stream.

The proposed variance request meets the intent of the Treatment Variance guidelines in that the constituents of concern are substantially treated and the threat to human health and the environment is minimized by safe disposal of the treatment residuals. Additionally, consistent with the guidelines, the proposed treatment would reduce risk from a release by minimizing the number of times the waste is transported and handled, and by treating this high alpha activity waste in a secure environment (e.g. glovebox or hotcell) at the time of repack at the TWPC. The amount of secondary waste generated would be decreased by eliminating the need to manage the liquids as a separate waste stream which requires separate packaging.

METHOD

On December 5, 1997, the EPA published in the Federal Register (Volume 62, Number 234) [2] a Clarification of Standard for Hazardous Waste Land Disposal Restriction Treatment Variances. The clarification stated, “The clarifying changes adopt EPA’s longstanding interpretation that a treatment variance may be granted when treatment of any given waste to the level or by the method specified in the regulations is not appropriate, whether or not it is technically possible to treat the waste to that level or by that method.”

The LDR treatment standards were promulgated to ensure hazardous waste is not land disposed of until its hazardous constituent concentration is at levels at which threats to

human health and the environment are minimized, and land disposal is otherwise protective of human health and the environment.
The EPA has interpreted that a treatment variance may be granted when treatment to meet the LDR standard is feasible, but is nevertheless "not appropriate." Agency rules require alternative standards approved through the variance result in substantial treatment of hazardous constituents in the waste so that threats posed by its land disposal are minimized. The EPA further states that an "… example of a situation where the otherwise applicable LDR treatment standard is technically inappropriate could be a case where BDAT [ed. note Best Demonstrated Available Technology] treatment could expose site workers to acute risks of fire or explosion and an alternative would not (62 FR 26060, May 12, 1997)" [3].

Finally, the EPA requires that all treatment variances must be consistent with the root requirements of RCRA section 3004 (m): that treatment be sufficient to minimize threats to human health and the environment posed by land disposal of the waste.
The proposed treatment method ensures that small quantities of liquid found in the debris waste stream are treated and then treated as part of the waste stream, using macroencapsulation. This method will ensure the waste is treated in a manner that is safe and consistent with the cited EPA guidelines. The macroencapsulated waste would be disposed of at NNSS-a RCRA-approved mixed waste landfill, or WIPP, which is EPA-regulated.

The existing RCRA LDR treatment standard for liquid wastes relevant to this petition is inappropriate due to the radioactive nature of the waste. The increased radiation exposure resulting from the required extra waste handling operations - including sampling, analysis, and transportation - is inconsistent with EPA guidelines related to minimization of risk to workers.

In response to a "Petition for Site Specific Variance from Treatment Standards at Sandia National Laboratories" dated April 16, 2004 [4], the New Mexico Environment Department (NMED) found that because the wastes contain radioactive materials they are physically different than those that were analyzed to develop the LDR treatment standard. The NMED further found that "treatment and verification of treatment by the usual methods would not be protective of workers".

Additional factors in favor of approval of the proposed variance include:

- The small amounts of liquids in the debris waste streams were not placed there to evade LDR requirements for liquids, which did not exist at the time of generation. Standard practice at ORNL has been separate management of liquid and debris waste streams, as evidenced by the fact that the vast majority of these waste streams are so segregated. Commingling of debris and liquid wastes discovered during AK investigations of certain waste streams involves a finite minority of containers and small amounts of liquid.
- By eliminating unnecessary handling operations, the proposed variance method also reduces the risk of an environmental release from the liquid waste. In order to manage the small amounts of liquids separately from the debris waste under

the current protocol, the liquid waste has to be moved to a separate, dedicated glovebox containment for screening and identification, or removed from the TWPC Waste Processing Facility for off-site analysis. It must then be transported for treatment, prior to final disposal. These steps and associated risks would be reduced through the proposed variance, under which all actions occur as steps within the on-site treatment process of the debris wastes. The first photograph below shows containers with small amounts of liquids. The second photograph shows the treated liquid being placed into a drum being utilized to collect such liquid wastes in preparation for shipment to an off-site treatment facility. Note the level of personnel protective equipment that is necessary to sleeve out the waste. Also, note the manpower requirements and the amount of secondary waste that is generated to manage this as a separate waste stream.

Fig. 1. Example of small containerized liquids

Fig. 2. Containers of treated liquid removed from Glovebox.

Worker exposure is further reduced under the proposed variance because small quantities of liquid waste (less than one gallon) would be managed in the same manner, whether TRU or MLLW. This eliminates the need for a pre-treatment radiological characterization. Identical treatment is allowed because TRU waste to be disposed of at WIPP is not required to meet LDRs, and needs only treatment of free liquids.

RESULTS

Figure 3, Current TWPC Liquids Treatment Process Flow, shows the steps required to manage small quantities of liquids separate from the mixed debris waste stream. Figure 4, TWPC Treatment Variance Process Flow, shows the improved processing flow if these liquids are treated and managed in the mixed debris waste stream. It emphasizes the reduced worker exposure and reduced risk of a spill due to the minimized handling requirements.

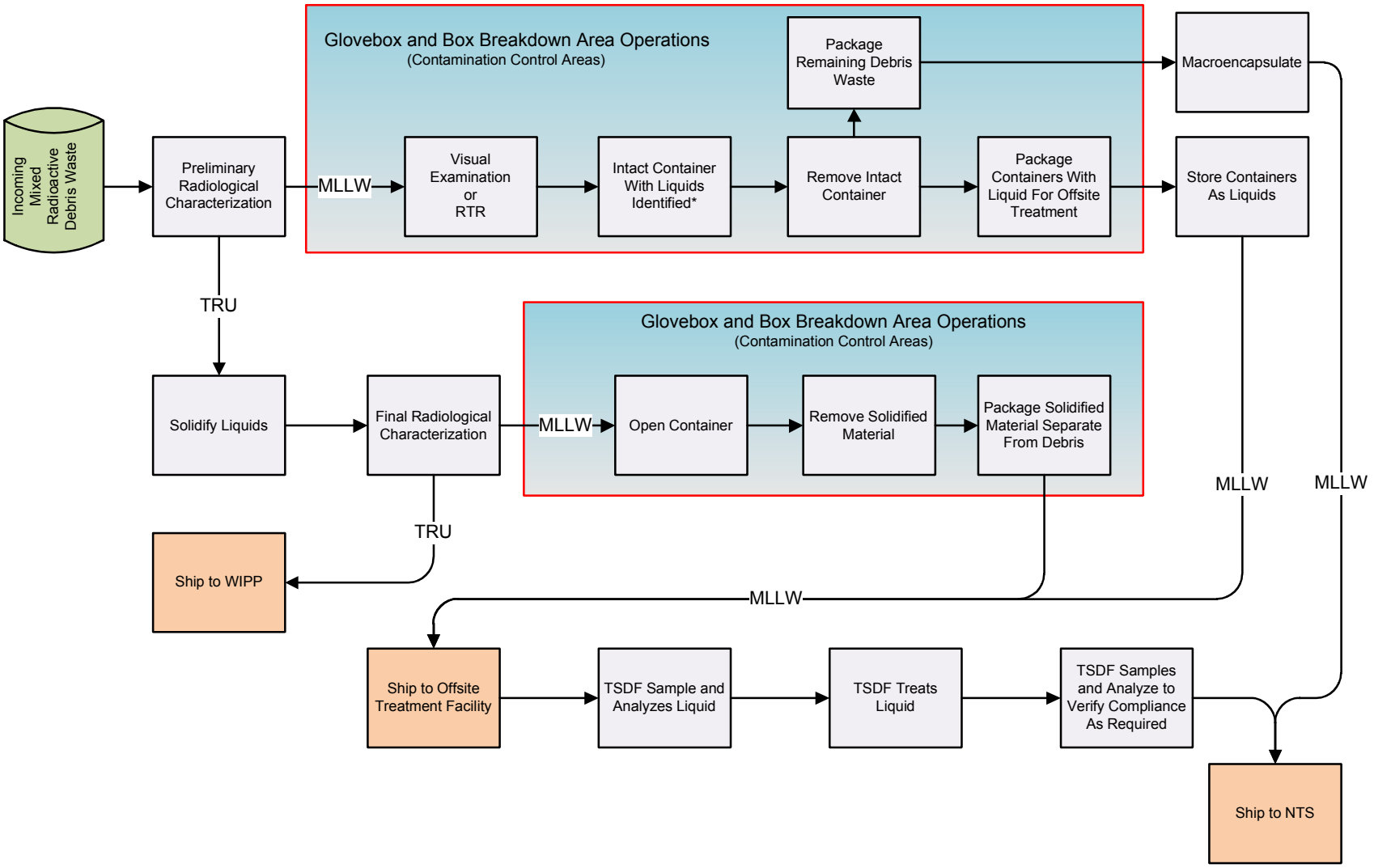
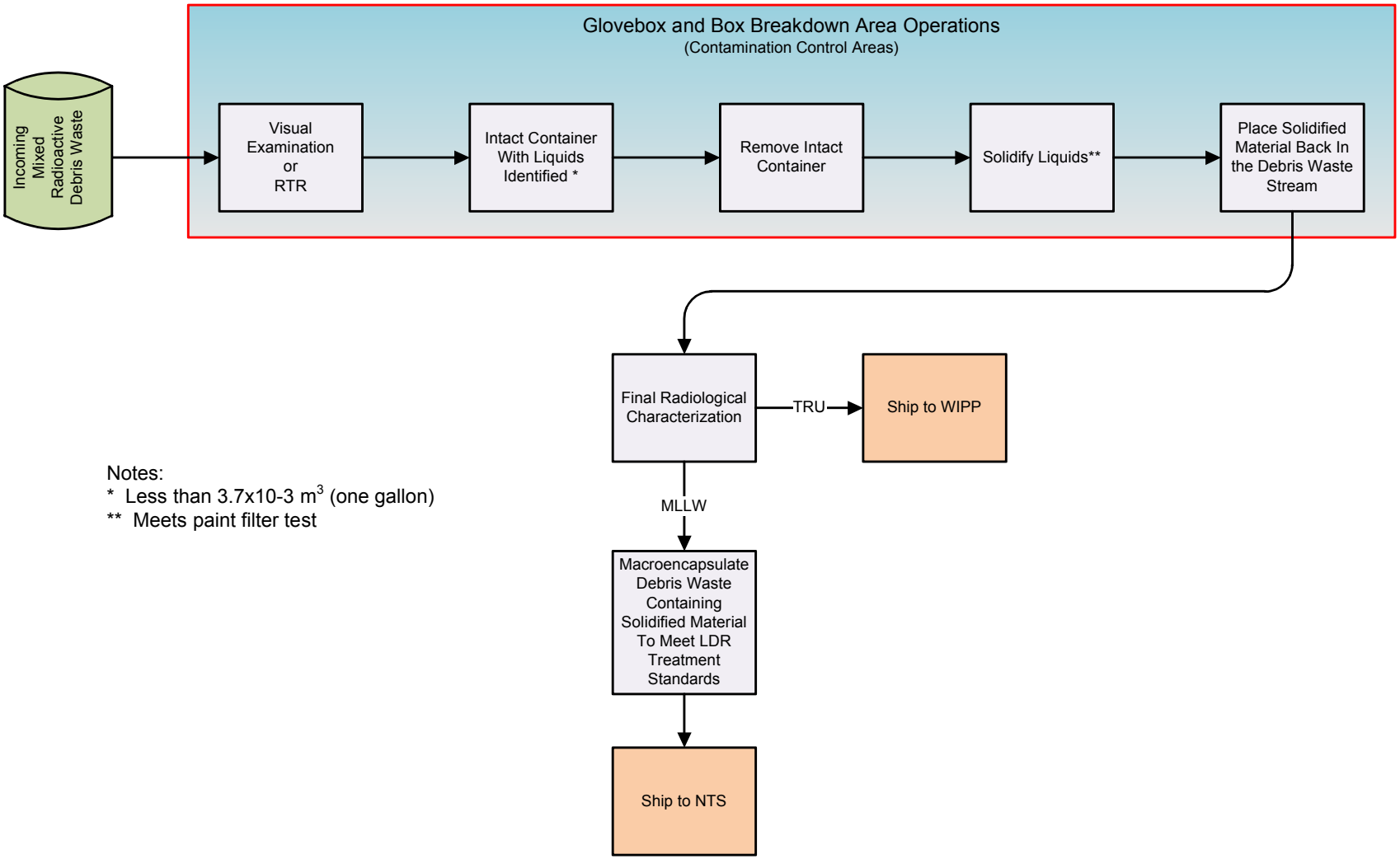


Fig. 3. Current TWPC Liquids Treatment Process Flow

TWPC Treatment Variance
Process Flow



Notes:
* Less than 3.7x10-3 m^3 (one gallon)
** Meets paint filter test

Fig. 4. TWPC Treatment Variance Process Flow

The proposed variance method minimizes the generation of secondary waste in accordance with accepted standards of responsible environmental stewardship. As noted above, the current protocol requires liquid waste to be bagged out – that is removed from its contained processing area and placed into a separate container in another area. The liquid must then be sampled and analyzed, treated and ultimately managed as hazardous non-debris waste. This process unnecessarily generates a considerable amount of secondary waste that must be disposed of as either radioactive or mixed waste.

DISCUSSION

Under the treatment variance proposed in this petition, small, liquid-bearing containers in debris waste undergoing processing at the TWPC would be treated with the NoChar process. NoChar utilizes specifically configured polymeric mixtures capable of neutralizing both acids and bases, and safely stabilizing/treating all liquids, including solvents. Further, the NoChar Process creates a solid polymeric matrix, which would immobilize RCRA characteristic metals (which, though theoretically characterized in the TWPC waste stream, are not considered a credibly documented constituent) and reduce any possible leaching if metals are present. The same is true for listed or ignitable solvents, which are also listed in the AK documentation, but the postulated presence of which is not based on any specific generator information. Additionally, the incorporation into a solid matrix of any ignitable solvents, if present, would eliminate the ignitable liquid phase form, in favor of a deactivated solid form.

The proposed variance meets the intent of the Treatment Variance guidelines in that the constituents of concern are substantially treated and the threat to human health and the environment is minimized by safe disposal of the treatment residuals. Additionally, consistent with the guidelines, risks to workers and the environment associated with extra handling and transportation of radioactive material are reduced.

Finally, significant amounts of secondary mixed waste, that would otherwise be generated, would be eliminated if the variance was approved.

In summary, after each individual liquid-bearing container is treated with the NoChar process, it is returned to the debris waste stream and the entire debris package is macroencapsulated using a process that meets the specifications found in 40 CFR 268, Land Disposal Restrictions. The unique properties of NoChar provide a combination of acid-base neutralization, immobilization of potential RCRA metals, and incorporation/deactivation of liquid organic wastes. The NoChar Process, followed by final macroencapsulation meets and exceeds the RCRA 3004 (m) standard regarding minimization of threats to human health and the environment. The proposed variance method, with its redundant protective features of an initial neutralization, immobilization, and deactivation, combined with a final macroencapsulation, is the best technology available to achieve substantial treatment of these wastes while minimizing radiological exposures from handling operations.

REFERENCES

1. Environmental Protection Agency, Land Disposal Restrictions, 40 CFR Part 268.

2. Environmental Protection Agency, Clarification of Standards for Hazardous Waste Land Disposal Restriction Treatment Variances, 62, FR @ 64504-64509, December 5, 1997.

3. Environmental Protection Agency, Land Disposal Restrictions Phase IV: Second Supplemental Proposal on Treatment Standards for Metal Wastes and Mineral Processing Wastes, Mineral Processing and Bevill Exclusion Issues, and the use of Hazardous Waste as Fill, 62 FR @ 26060, May 12, 1997

4. State of New Mexico Environment Department, Public Notice Number 04-05 Petition for Site-Specific Variance from Treatment Standards for Certain Mixed Wastes Generated at Sandia National Laboratories, April 16, 2004.