Allen, Pam, NMENV

From: Maestas, Ricardo, NMENV
Sent: Thursday, December 18, 2014 9:54 AM
To: Allen, Pam, NMENV
Subject: FW: Draft Radioactive Tracer Decontamination Tests
Attachments: Americium Contaminated Salt Tests.docx

May

From: Kliphuis, Trais, NMENV
Sent: Thursday, May 29, 2014 4:33 PM
To: Maestas, Ricardo, NMENV; Smith, Coleman, NMENV; Holmes, Steve, NMENV
Subject: FW: Draft Radioactive Tracer Decontamination Tests

From: Oba Vincent [mailto:oba.vincent@cbfo.doe.gov]
Sent: Thursday, May 29, 2014 4:31 PM
To: Kliphuis, Trais, NMENV
Cc: Kouba, Steve - WRES (Steve.Kouba@wipp.ws)
Subject: FW: Draft Radioactive Tracer Decontamination Tests

Trais

Attached is the latest update on the decontamination studies.

Have a great night.

Oba

From: Demmer, Rick [mailto:rick.demmer@inl.gov]
Sent: Thursday, May 29, 2014 4:03 PM
To: Reynolds, Tammy - NWP; Philip J Breidenbach; Stevens, Jeffrey L; Cal D Christensen; Gretchen E Matthern; Stephen J Reese; Michael J Ancho; Steven B Aitken; Roger Nelson - WIPPNet; Joseph L Campbell; Berta Oates; Ray Daniels; Oba Vincent
Subject: Draft Radioactive Tracer Decontamination Tests

All,

Attached is my draft report on americium tracer tests on samples of WIPP salt. If you have any questions or suggestions (or just editorial comments) please direct them to me.

The results of these tests confirmed previous testing that indicate the effectiveness and ease of use for water washing. I am typically not a fan of water washing (soluble contaminants typically become more strongly entrenched in the surface when water is applied), but the data indicates it is a good answer for this problem. Please let me know if you have any comments on this that I should include in the final report.

We are still conducting some other tests on fixative alternatives and their durability on salt. Bartlette TLC, Bartlette PBS and Tekflex coatings have been successfully applied to the salt. While the Tekflex is more adherent (from a vertical application perspective), it seems to be a bit more brittle than the more flexible Bartlette coatings. We are trying some combinations that may give flexibility and the durabilitv of the Tekflex.

I think all this will be wrapped up within a couple of weeks and I can include any of your comments in the draft final report at that time.

Rick

Draft Report of Americium Contaminated Salt Tests

Radioactive tracer tests were conducted on WIPP halite, salt rock to determine the ability to decontaminate the salt material. Previous non-radioactive tests had identified that water washing and DeconGel 1108 Strippable Coating were effective at removing a U.V. sensitive powder (Glo Germ) from the surface of the salt, while other methods (brushing and vacuuming) were decidedly less capable. Thus, tracer tests were conducted with the two effective methods.

An americium tracer containing Am-241 at approximately 8 nCi/ml was applied to the surface of the salt in a "stippling" fashion. Stippling consists of placing small drops, in this case 0.025 ml each, of contaminant on the surface of the target material. This level of tracer gave approximately 21,000 disintegrations per minute (dpm) for the steel plate (essentially the "standard") and about 2,700 dpm for the salt samples. Stippling is a well-known technique for preparing standards to determine matrix effects with radiometric instruments. A stippled steel plate is shown in Figure 1. The stippling was confined to the area of the radiometric detector probe being used for these tests.

Figure 1, Americium Tracer Coated Stainless Steel Plate Showing Stippling.

The americium tracer was applied to two steel plates and six of the salt coupons. The salt coupons were the best, most regular, of the dozen 100 cm square (roughly), 3 cm thick coupons that were cut from the large core sample provided by WIPP. As the tracer was applied to the surface of the salt, it was observed that it did not "bead", like in Figure 1, but seemed to be "wicked" into the surface pores, cracks and imperfections. The structure of the salt appears to have about 1 cm "crystal like" grains, which allow solution to imbibe into the intergranular areas. This was confirmed somewhat when the "before" decontamination results, using the same amount of tracer, returned about 14% of the radiometric counts that were found on the steel plates. The tracer had likely penetrated and become attenuated within the salt surface.

Radiometric "count" analysis was provided by a Ludlum 2224 "scaler" handheld meter for a 60 second count. This meter had a 20% efficiency for both alpha and beta/gamma. Analysis showed typically 2500-3000 dpm/100 cm2 alpha before decontamination and results of 70-195 dpm/100 cm2 alpha post decon. This data is collected in Table 1. This data shows that the test results (for decontamination, quantifying with alpha) were fairly precise.

Table 1. Alpha Quantification For Salt Decontamination Tests.

Decon method	Sample #	Before Decon		After Decon		% Removal of Alpha
		Alpha (CPM)	Corrected Alpha (DPM)	Alpha (CPM)	Corrected Alpha (DPM)	
Water Wash	W103	579	2895	29	145	94.99
Water Wash	W101	526	2630	22	110	95.82
Water Wash	W102	658	3290	14	70	97.87
(none)	Steel Coupon #2	4322	21610			
Water Wash	WB201 Blank*	0	0	3	15	
Stripable Coating	W105	713	3565	20	100	97.19
Stripable Coating	W106	561	2805	39	195	93.05
Stripable Coating	W104	475	2375	23	115	95.16
(none)	Steel Coupon #1	4188	20940			
Stripable Coating	WB202 Blank*	0	0	11	55	

*Alpha background determined to be about 27.5 dpm

Two different methods of quantification were attempted unsuccessfully for the gamma radiation portion of the test, which could have provided an alternative method for quantifying the decontamination results. A portable, High Purity Germanium gamma scan unit, the ORTEC Detective, found insufficient radiation signature from these Am-241 spike levels to permit good quantification, although it did provide ready identification of the spike material as Am-241. Ultimately the Ludlum 2224 "scaler" unit used for the alpha detection (but in beta/gamma mode) was employed, but did not provide acceptable beta/gamma results. These Ludlum results were recorded for each coupon. They averaged 746 dpm before and 674 dpm after, with a background of about 640 dpm (general background in the hood). For these tests, that difference proved inadequate; essentially the error of the test was nearly as high as the difference between the high and low readings.

Water washing was by far the easiest method of decontaminating these coupons and was also highly effective. The conditions had been previously established during the non-radioactive testing, for a 15 second water rinse using a spray bottle. A photograph of this method is shown in Figure 2. The solution was collected and found to be about 20 ml from each coupon, which is essentially complete recovery of the solution (as measured in earlier experiments). If this volume scaled to practical use, it would be about 186 ml per square foot of surface. One ml of each 20 ml volume was counted using liquid scintillation to determine the amount of radioactivity recovered. It was found that about 6,533 dpm of alpha were recovered in each coupon's rinseate, which indicates that washing may have removed virtually everything from the surface, but only about 31% of the total applied (in relative terms of that found on the steel plates). Thus, it is expected that the remaining contamination is trapped in the body of the coupon.

While the DeconGel strippable coating was also highly effective, it was much more time consuming and difficult to remove than the water. It took (on average) 15 minutes to remove approximately 95% of the coating; complete removal was not able to be produced. We found that any strippable coating became somewhat incorporated into the salt surface and was very difficult to remove. A photograph of this portion of the test is seen in Figure 3. The surface of the coating was scored with a plastic knife to give a place to begin peeling the coating. Both the Bartlette

TLC and CBI DeconGel 1108 material were found to be better as "fixatives" rather than easy, strippable decontaminants. These strippable coatings were much more difficult to remove from the salt surface than from typical stainless steel or aluminum.

Figure 2, Washing Americium from Salt coupon

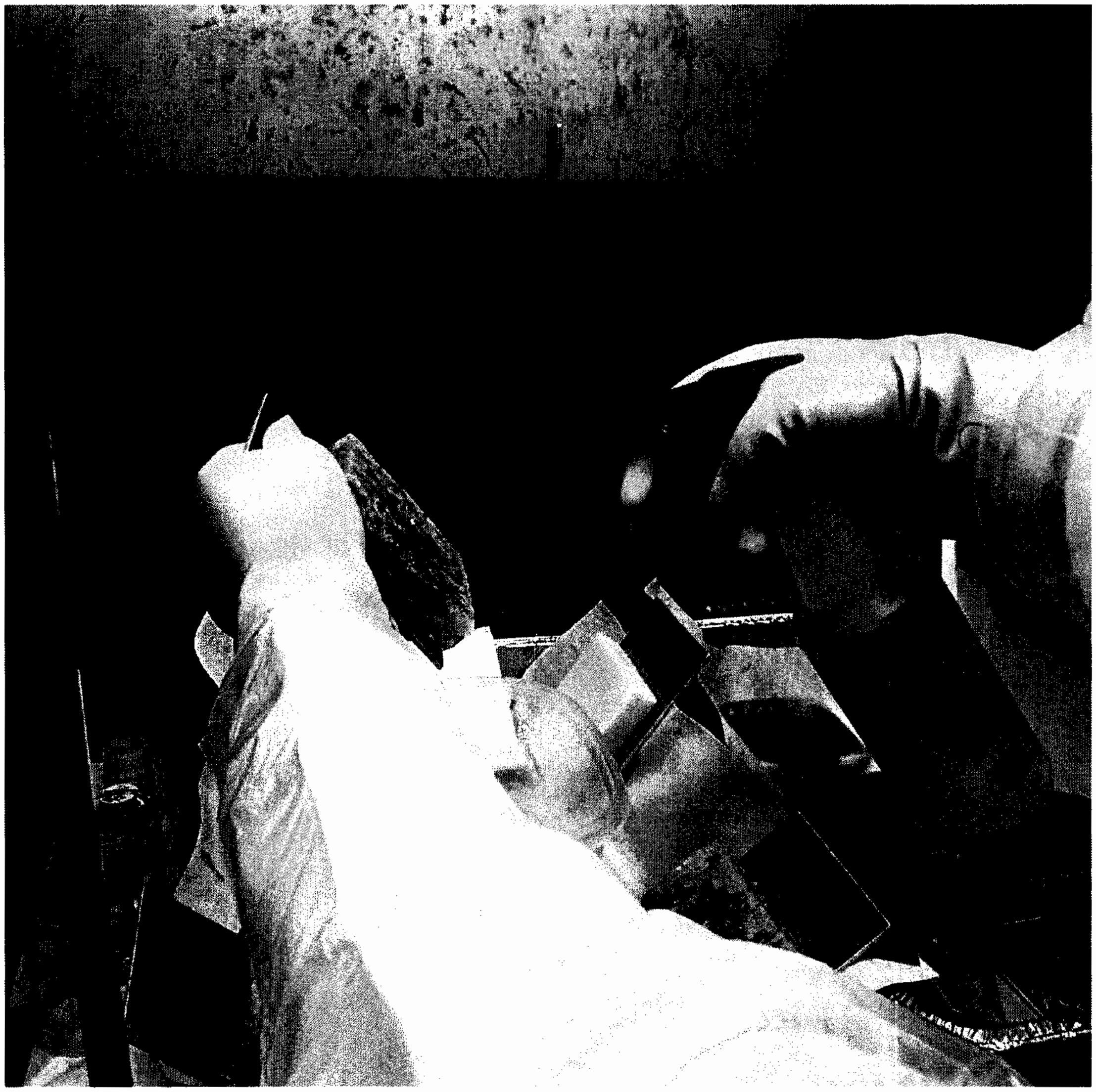
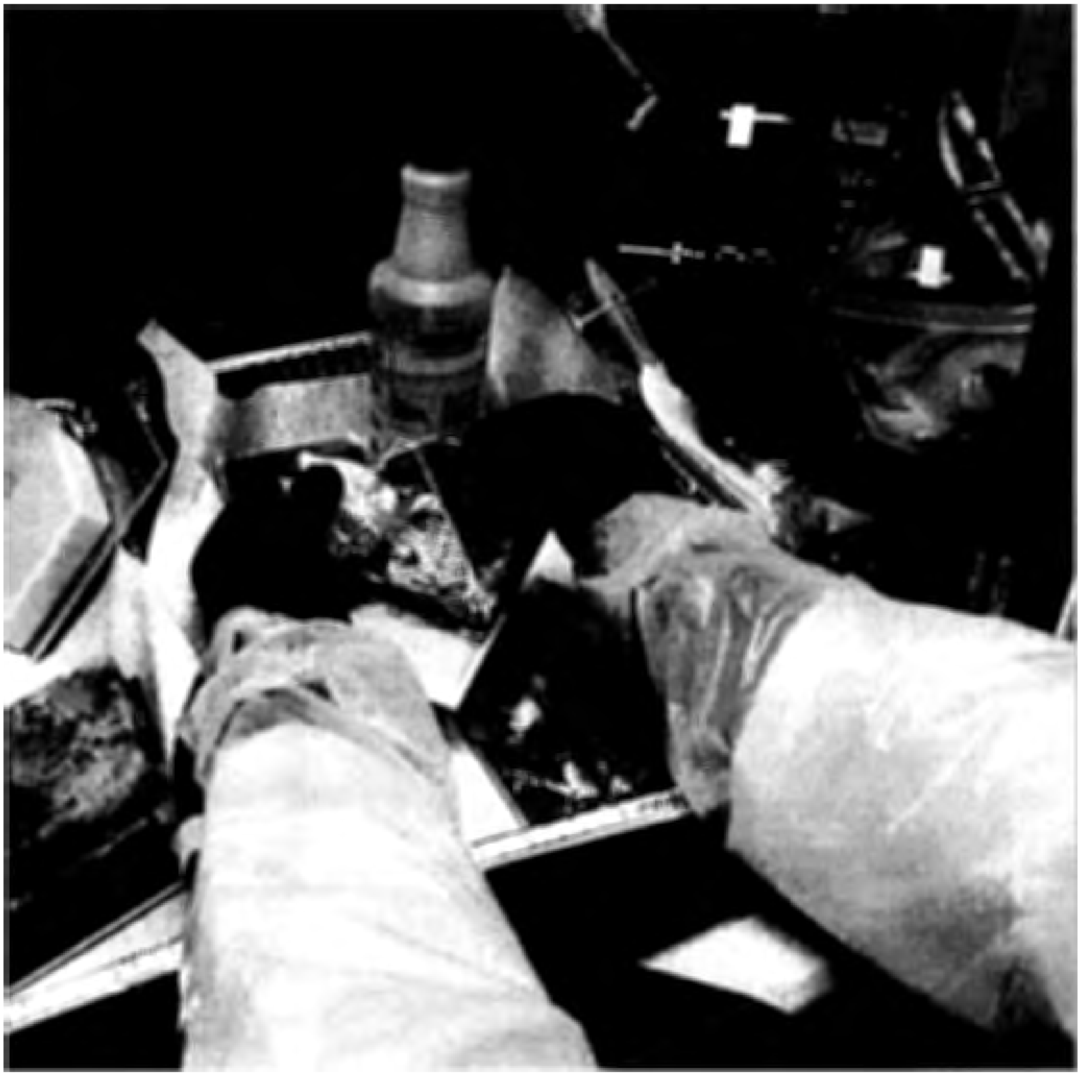


Figure 3, Removing the DeconGel Strippable Coating



Of the methods of decontaminating the WIPP Salt that we have tried (dry brushing, vacuum cleaning, water washing, strippable coatings and (recently) mechanical grinding) the most practical seems to be water washing. The effectiveness is very high and it is very easy and rapid to deploy. The amount of waste produced (some 186 ml/sq. ft.) would be substantial, and may not be easy to manage, but the method seems the clear winner from a usability perspective. Removable surface contamination levels (smear results) from the strippable coating and water washing coupons found no residual removable contamination. Thus, whatever is left is likely adhered to (or trapped in) the salt.