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TECHNICAL REPORT

Demonstration of Lead-Based Paint Removal and Chemical Stabilization Using Blastox®

by
Vincent F. Hock, Curt M. Gustafson, Donald M. Cropek and Susan A. Drozdz,
U.S. Army Construction Engineering Research Laboratories
Champaign, IL 61826-9005

U.S. Army Center Public Works
Alexandria, VA 22315-3862

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These test samples were very important because they demonstrated that Blastox® greatly affected the lead leachability, even during rigorous testing. The test conditions were designed for a "worst case" scenario. First, unbound white lead pigment powder ($PbCO_3.PB(OH)_2$) was used instead of white lead pigment bound in paint chips. Thus the lead compound had greater surface area exposed to the acid and did not have to diffuse through the organic binders in the paint. Second, acetic acid was continuously added to the test solutions until the buffering effect of Blastox® was overcome. Approximately 5 to 7 times more acetic acid was added than the standard test method requires. The hydration reactions need an alkaline environment to achieve maximum strength. Since the pH was adjusted often, the hydration reactions could not proceed as normal. The pH adjustment also limited the amount of silica in solution, as its solubility is dependent upon pH. Blastox® reduced the lead solubility during this test despite the lead pigment's higher exposure to the leaching solution and the acidic conditions of the test.

Durability

If the chemical stabilizer actually respeciates the lead carbonates and hydroxides to lead silicates, and if the lead silicates are as stable as reported in the literature, then a typical blasting waste containing the chemical additive should be able to pass the USEPA Method 1311(TCLP), back-to-back TCLP tests, and the Multiple Extraction Procedure (MEP), USEPA Method 1320. TCLP tests were performed on typical blasting waste containing the stabilizer. The two different extraction fluids were used to determine the performance in solutions of varying acidic contents. Table 3 shows the results of some of these tests.

Since the product was able to pass the TCLP test with both solutions, multiple TCLP extractions were performed back-to-back on the same set of samples. The multiple extraction tests would give information on the stability of the product in a simulated landfill over time, and after repeated additions of acid to the matrix. It would also give more information on the performance of the product after the pH buffering effect was overcome. Five back-to-back TCLP tests were performed, and the final pH of the leaching solution was recorded (Table 4 and Figure 10).

The results confirm that, even if the material is placed in a low pH environment, the lead leachability is controlled. The final two tests were performed in a solution with an initial pH of 4.9 and a final pH of 5.2 and 5.1 (i.e., there was no pH adjustment). The highest value of leachable lead in all 5 tests was 0.38 ppm, less than one-tenth the 5.0 ppm limit. These positive results prompted analysis of the waste using MEP, which is another stringent test (Figure 11).

Table 3. TCLP results of a blast media containing Blastox® and lead pigment.

Sample Number	Blastox® in Medium (Wt%)	Ca Leached (PPM)	Pb Leached (PPM)	TCLP Solution (Initial pH)	TCLP solution (Final pH)
1	15	2657	0.8	2.8	10.2
2	15	2737	0.5	2.8	8.6
3	15	877	0.5	4.8	11.2
4	25	1497	0.3	4.8	11.3
5	25	2055	0.6	2.8	10.3
6	25	2885	0.5	2.7	9.9

Table 4. Results of 5 back-to-back TCLP tests.

Test Number	TCLP Pb (ppm)	pH of Solution Prior to Additions of Waste	Final pH of Solution
1	0.105	2.83	10.7
2	0.064	4.89	9.47
3	0.127	4.89	8.26
4	0.380	4.89	5.26
5	0.163	4.89	5.11

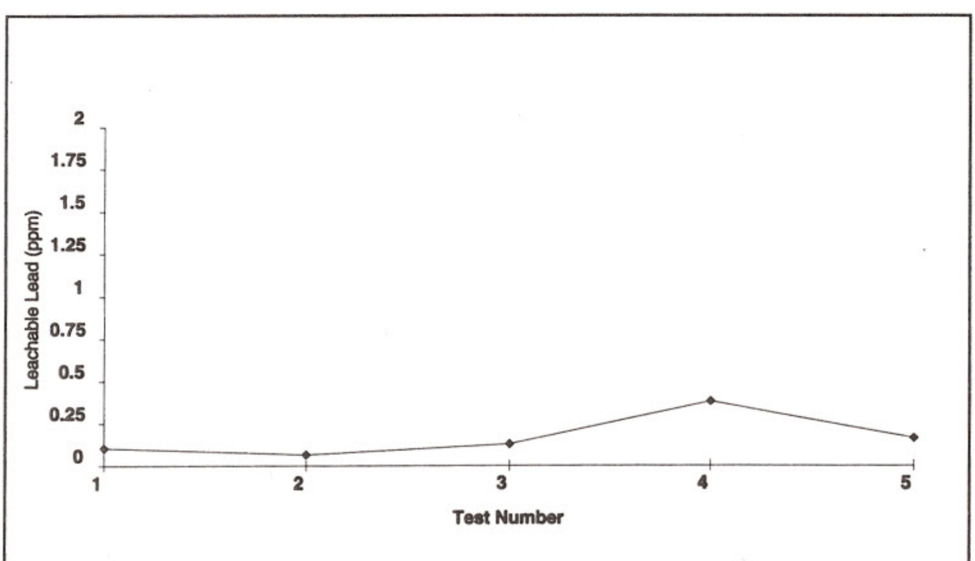

Figure 10. Back-to-back TCLP tests with additive.

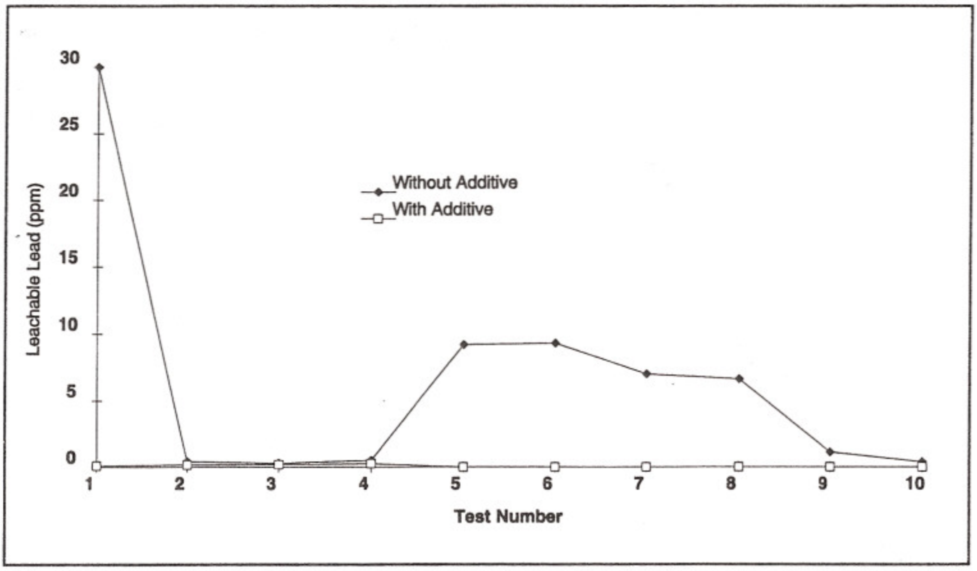

Figure 11. MEP results with and without additive

The waste with the additive passed all cycles, with a maximum lead leachability level of 0.2 ppm. On the last six cycles, the lead levels were below the detection limits of the apparatus. If a material has a potential to create a waste of questionable long-term stability, one would expect the leachable lead level to increase with the number of cycles. As explained, these results showed no lead leachability in the last six cycles.

These laboratory results, along with those given in Table 4 and Figure 10, give strong evidence that, as long as the materials (lead and calcium silicates) are able to react fully, there is no laboratory evidence of problems associated with their long-term stability. The pH buffering effects were eliminated, showing no dependence on a pH adjustment for stabilization.

Some preliminary screening tests were conducted to simulate effects of long term exposure in a landfill. The tests used do not necessarily represent a full range of landfill conditions. The waste from abrasive blasting operations was placed inside a filter placed over an Erlenmeyer flask. Then a vacuum was applied to the system such that when fluids were placed in the filter, the vacuum would draw the water through the waste and filter into the flask. By controlling the amount of vacuum, one could control the time that the fluid was in contact with the waste.

Samples with 15 and 25 weight percent Blastox® were tested in solutions varying from distilled water to a solution of distilled water and 5 percent acetic acid (a solution with a pH of approximately 2.0). The total amount of lead that leached from the waste by the various solutions was then measured.