Publication No. FHWA-RD-94-100
February 1995

Lead-Containing Paint Removal, Containment, and Disposal

U.S. Department of Transportation
Federal Highway Administration

Research and Development
Turner-Fairbank Highway Research Center
6300 Georgetown Pike
McLean, Virginia 22101-2296

4- to 6-percent addition level except for the G-40 shot. There was a rough correlation between particle size and efficacy, though other abrasive specific factors appear to be operating.

The explanation for the efficacy of iron in reducing leachable lead content appears to be an oxidation-reduction reaction similar to the electrochemical reaction that causes corrosion. Lead plates out on the iron surface from solution. The reaction is dependent upon surface area of the iron particles, hence, smaller particles are more effective as they contain a larger surface area on an equal weight basis. Similarly, steel shot, as round particles, have less surface area than an equivalent-sized particle with a rough surface.

Some States have already begun specifying the addition of 10-percent iron grit to slag or mineral sand abrasives. The choice of 10 percent by weight addition comes from the results presented above with a safety factor included. It should be noted that a proprietary blast abrasive additive is available that will generate a non-hazardous waste according to the data presented by the manufacturer.[34] The use of abrasive additives to slag or mineral sand abrasives does not solve the problem of minimizing the total amount of waste generated, which is a problem in some States where landfill space is limited. The use of blast additives is not without controversy about long-term stability of the debris.

Long-Term Stability

The addition of iron to the abrasive has been questioned based on the known chemistry of the stabilization. The plating reaction will only occur when the elemental iron and lead compounds are present together in solution. Therefore, a freshly generated waste placed in the TCLP leaching solution will have the constituents needed for the plating to occur. The question arises that if the material is placed in a landfill and the iron grit particles rust prior to the lead compounds being in intimate contact with the iron surface, the plating reaction will not occur. Therefore, the addition of iron may not be effective for long-term stability. This point is very important to State highway agencies, as they will be responsible for the waste *in memorium.*

The EPA has been questioned on this point and the EPA Characterization and Assessment Division of the Office of Solid Waste has issued a memorandum to all EPA Regional Offices stating that the hazardous waste regulations do not restrict the use of ingredients for the purpose of preventing waste from exhibiting a hazardous characteristic.[35] However, the generator should be aware that if adding iron to the abrasive only temporarily prevents lead from leaching from the waste, and the waste is disposed, the generator may be held liable under CERCLA for any environmental damages caused by the release of lead into the environment.

The long-term stability of non-hazardous, lead-containing wastes is a critical issue. Therefore tests were performed to determine the long-term stability of the waste. The first method examined was U.S. EPA Method 1320, Multiple Extraction Procedure (MEP). This test method was designed to simulate the leaching that a waste will undergo from repetitive precipitation of acid rain on an improperly designed sanitary landfill. This method consists of a TCLP extraction, followed by nine further extractions with a pH 3 solution that is a 60/40 mixture of sulfuric and nitric acid (a simulation of acid rain). Each cycle is supposed to represent 100 years in a landfill. Debris from removing lead-based paint with a mineral sand abrasive was tested by the MEP with the following stabilizing methods:

- Untreated waste.
- Waste with 6 percent G-50/80 steel grit.
- Waste with 10 percent G-50/80 steel grit.
- Waste with 15 percent proprietary additive.
- Waste with 22 percent portland cement and 11 percent water.
- Waste with 6 percent G-50/80 steel grit and post-stabilized with 22 percent portland cement and 11 percent water.

Appendix A reports the leachable lead concentration after each cycle for the samples that are presented in graphical form in figures 6 through 11. The untreated waste had a leachable lead concentration of 80 ppm. Further leaching cycles of the untreated waste had a much lower leachable lead concentration, but were still significantly above the 5-ppm regulatory limit (figure 6). Addition of 6 percent by weight of G-50/80 steel grit resulted in an initial leachable lead concentration of 1.3 ppm, which remained relatively constant through five multiple extractions. The leachable lead concentration began to increase on the sixth cycle, and exceeded the current regulatory limit on the ninth cycle (figure 7). Adding 10 percent by weight of the G-50/80 steel grit to the waste gave a similar response in leachable lead as a function of multiple extractions, with similar leachable lead concentrations through five cycles followed by increasing leachable lead through the next six cycles. The only difference was that the leachable lead had not reached 5 ppm by the 11th cycle (figure 7). A proprietary material was tested at the manufacturer's recommended addition level of 15 percent by weight addition. No change in leachable lead concentration was found for the 11 multiple extractions (figure 8).

The untreated waste and waste with 6 percent addition of G-50/80 steel grit were post-stabilized with portland cement. The wastes were mixed with 22-percent portland cement by weight, and water was added to give a 0.5 water/cement ratio. The concrete was allowed to cure, was crushed, and evaluated by the multiple-extraction procedure. The leachable lead concentrations were very low and consistent through the 11 cycles for the waste stabilized with portland cement (figure 9). For the waste treated with steel grit prior to portland cement stabilization, two anomalous results were obtained for the fourth and fifth cycle, with the other cycles all having very low leachable leads (figure 10). These two anomalous results were below the regulatory limit and may have resulted from laboratory error.

The results from these tests indicated that iron addition alone does not produce long-term stability of the waste. Further treatment is necessary. The results also showed that portland cement stabilization was very effective, as was the proprietary material.

FHWA MEP Data