Progress in Recycling Elemental Lead for Reuse of Radiologically-Contaminated within the Nuclear Industry

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ABSTRACT

Duratek successfully demonstrated a process for reusing contaminated lead as a shielding material for radioactive waste containers. This process offers the Department of Energy (DOE) and commercial utilities a cost-effective strategy for reusing a material that would otherwise require costly disposal as a mixed waste.

During the past year, GTS-Duratek Inc. approximately 500,000 pounds of contaminated and potentially contaminated lead into shielding (bricks) and shielded steel containers. The lead originated from the DOE facilities including INEEL, Hanford, Argonne, Los Alamos, Berkeley and Sandia.

INTRODUCTION

In 2002, Duratek recycled nearly 250 tons of potentially contaminated lead into shielding for multiple Customers, all of which are involved in the nuclear industry. The lead originated from the DOE's Sites at Hanford, Los Alamos, Argonne East, INEEL, Lawrence Berkeley, Sandia and several Department of Defense sites

Products manufactured include shielded drum overpacks, “scoop cavities”, casks for irradiated hardware and lead bricks. This new and exciting product line is the first internal recycling project to be completed since Secretary Richardson announced a new recycling policy last July. The policy suspended the release of potentially contaminated scrap metals from the DOE complex and encouraged the reuse of materials to meet the needs within the department.

Following the project, Bill Richardson, Secretary of Energy was quoted in a DOE publication as saying, "This is a good example of how we can safely and cost-effectively recycle surplus materials. It shows that we can take creative steps to reuse and recycle materials for use within our complex."

The initial project for PNNL was coordinated through the Department's National Center of Excellence for Metals Recycling (NMR), which is managed by DOE's Oak Ridge Operations Office. Another Tennessee Company, Bull Run Metal Fabricators and Engineers, Inc., provided design support and fabricated the storage containers. Duratek and Bull Run are working cooperatively to provide both standardized and customized containers.
CURRENT ACTIVITIES

All lead casting activities performed at Duratek are performed using project-specific procedures and work plans. These procedures and plans are carefully prepared to ensure radiological controls, regulatory requirements, worker safety and compliance with contract terms. Provided below is an example of the many aspects of Duratek’s work plans used for lead recycling activities:

- Contractual commitments
- Regulatory considerations such as compliance with Duratek’s air pollution control permit and Radioactive Materials Licenses.
- Radiological considerations such as survey requirements, and Health Physics review of all manifests of all “picklist material.”
- DOE requirements (scrap metal suspension and moratorium)
- Manufacturing and inspection/test plan
- Packaging, shipping, and rigging plan
- Radiological records including radioisotope analysis report.
- Identification of parent ingot(s) and the lead encased material (LEM) they were separated from.
- QA test results.
- Certification that the material was manufactured and tested to customer specifications.
• Scheduling / Tracking issues such as ensuring that all lead used originated from INEEL and that a certificate of recycle for lead encased item is issued
• Quality documentation under Duratek’s Lead Brick Quality Certification Plan.
• Packaging / Shipping issues such as shipping schedule, package labeling, and rigging plans.
• Product marking specifications. An example of the markings is shown below

**Customer Name**
**LOT-DUR-XXX**
**CONTROLLED PRODUCT**

**EXAMPLES OF CURRENT PROJECTS**

Duratek has worked closely with Bull Run Metal Fabricators and Engineers to provide a “standardized” shielded drum overpack. Each overpack requires approximately 3,600 pounds of lead to meet the shielding requirements of our primary Customer. Shown below is a photograph of the drum overpack:

![Figure 2.0 – Drum Overpacks – Ready to ship to Customer](image)

A second project now being performed is the casting of lead bricks for use in shielding at Idaho State University. Lead for this project is being shipped from the INEEL. The majority of lead received is in the form of shipping casks and transfer shielding. Shown below is a photograph of one of the “typical” lead encased items received from the INEEL for recycling:
Illustrations of the production process are shown below:

A further example of Duratek experience in lead recycling involves railcars from the Hanford Reservation, which were used to move fuel between the reactors. Duratek provided turnkey service, from the initial movement to the Port of Pasco, on to Oak Ridge and 100% recycling of all steel and lead. Shown below is a photograph of the fuel cask received from Hanford.
Several products have been manufactured from the Hanford railcar lead. These products include the PNNL “Scoop Cavities” (figure 1.0), drum overpacks (figure 2.0), 2,500 pound ingots released to the DOE for directed reuse, and 7A-Type A containers used at Hanford for on-site waste storage. Shown below is a photograph of the Hanford 7A-Type A containers:
As a final example of Duratek’s involvement in recycling lead for DOE projects, shown below is a cask manufactured for Los Alamos National Laboratory. LANL provided the empty cask to Duratek for lead casting. This cask consumed approximately 40,000 pounds of lead and was manufactured in less than one week. For this project, LANL was charged approximately 10% of the cost of lead casting, as compared to a commercial foundry using free-released lead.