LA-UR- 97-2997

Approved for public release; distribution is unlimited.

Title:

CONF-970854--

Metal Recycling Experience at Los Alamos National Laboratory

Recycle/Reuse/and Release of Metals from Radiological Control Areas

Author(s):

Sandra Gogol
(n,p) Energy
EM/ESO

Submitted to:

DOE Annual Pollution Prevention Conference, XIII

Atlanta, Georgia
August 26-28

Los Alamos
NATIONAL LABORATORY

DISCLAIMER

Metal Recycling Experience At Los Alamos National Laboratory

"Reuse, Release, and Recycle of Metals from Radiological Control Areas"

Sandra Gogol
(n,p) Energy, Inc.
Los Alamos National Laboratory
Environmental Stewardship Office
(505) 672-0833

Keywords: Radioactive Scrap Metal, Recycling, Free Release

Introduction

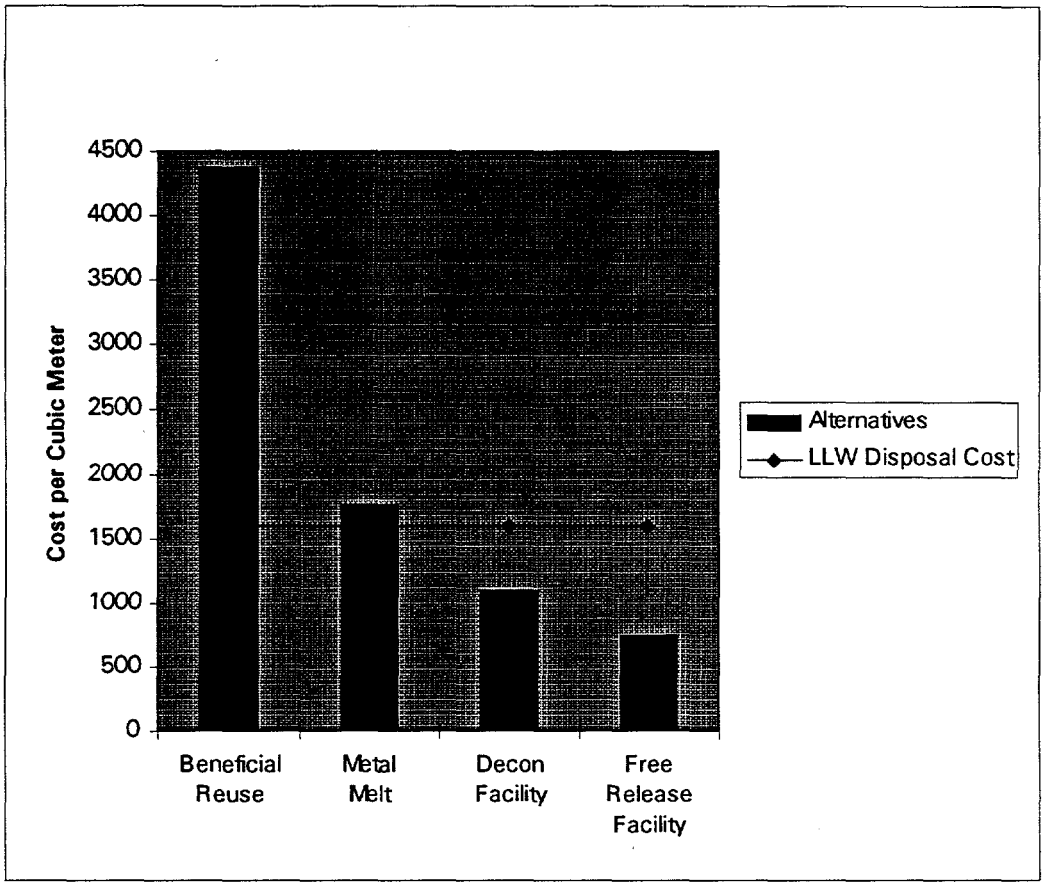
Approximately 15% of the Low Level Waste (LLW) produced at Los Alamos consists of scrap metal equipment and materials. The majority of this material is produced by decommissioning and the modification of existing facilities. To reduce this waste stream, Department of Energy Headquarters, EM-77 Office, sponsored the Reuse, Recycle, and Release of Metals from Radiological Control Areas High Return on Investment (ROI) Project to implement recycle, reuse, and release of scrap metal at the laboratory. The goal of this project was to develop cost effective alternatives to LLW disposal of scrap metal and to avoid the disposal of 2400 m^3 of scrap metal. The ROI for this project was estimated at 948%. The ROI project was funded in March 1996 and is scheduled for completion by October 1997. At completion, a total of 2400 m^3 of LLW avoidance will have been accomplished and a facility to continue recycling activities will be operational. This paper will present the approach used to develop effective alternatives for scrap metal at Los Alamos and then discuss the tasks identified in the approach in detail. Current scrap metal inventory, waste projections, alternatives to LLW disposal, regulatory guidance, and efforts to institutionalize the alternatives to LLW disposal will be discussed in detail.

Approach

Four tasks were identified which needed to be accomplished to develop effective alternatives for scrap metal at Los Alamos. These tasks were:

1. Determine the current inventory of scrap metal waste and develop projections of future quantities.
2. Evaluate the alternatives to radioactive landfill disposal and perform a cost benefit analysis to determine the most cost effective alternatives for Los Alamos.
3. Evaluate the current regulatory guidance for performing radiological analyses of scrap metal to release the metal to commercial recyclers.
4. Assist the waste generators at Los Alamos in the development of a system to institute the cost effective alternatives to LLW disposal.

Figure 1: Cost of LLW Disposal Alternatives for Scrap Metal



To integrate this program into the infrastructure at Los Alamos, a guidance document has been prepared for the waste generators (REF. LA-UR No.) This document includes the cost benefit analysis and a detailed algorithm for the waste generators to follow to determine the most cost effective alternative for their scrap metal waste. In addition, this document includes guidance on local implementation of the release criteria in DOE Order 5400.5 and includes the requirements necessary to release scrap metal to a commercial recycler.

Efforts to develop funding mechanisms for future years is still underway. At the current time, the waste generators are not required to pay for their LLW disposal. All costs of LLW disposal are incurred by the Waste Management Organization. This situation requires that alternate sources of funding be developed to continue this program in future years. Because of environmental assessment waste limitations and other issues some of the waste generators will be willing to support these efforts. However, the amount of income from these sources is uncertain. Since the majority of scrap metal waste generated at Los Alamos is iron or steel, the revenue generated from recycling is nominal. Other sources of revenue must be developed to continue these activities. At the current time, efforts are still underway to develop other sources of revenue to support these activities.

After completion of these four tasks, the remainder of the project would concentrate on integrating the results into the infrastructure of Los Alamos and developing funding mechanisms for future years.

Discussion

A total inventory of 2500 m^3 of legacy scrap metal LLW at an average projected generation rate of 1200 m^3/yr was identified. In addition to these volumes, a potential one time generation of 4000 m^3 of scrap metal LLW from facility upgrade construction activities was identified. These construction activities are scheduled to begin in the FY-98 to FY-99 time frame. In addition to volumes, the physical and radiological characteristics of the scrap metal waste was noted to assist in the development of cost effective alternatives to radioactive landfill disposal. The following summarizes these physical and radiological characteristics.

- The majority (>50%) of the scrap metal LLW can be categorized "suspect" LLW. With adequate radiological characterization, this waste can be released from radiological control and sent to a commercial metal recycler.
- Iron and steel makes up the bulk of the scrap metal waste produced at Los Alamos. Very little stainless steel or copper waste is generated.
- Approximately 25% of the scrap metal LLW can be decontaminated, radiologically characterized, and released from radiological control and sent to a commercial metal recycler.
- Approximately 25% of the scrap metal LLW is either volume contaminated or has inaccessible surfaces or other physical characteristics which make decontamination difficult.

After completing the inventory and waste generation projections, a cost benefit analysis was performed to evaluate the alternatives for scrap metal LLW. The alternatives evaluated were:

1. LLW Disposal
   This alternatives assumes a current LLW disposal cost at the laboratory of $\$1590/m^3$.

2. Decontamination
   This alternative assumes that the metal waste is decontaminated and then surveyed to determine the radiological characteristics. If the waste meets the required radiological criteria, the metal waste is released from radiological controls (free released) and sent to a commercial metal recycler. Based on grit blasting experience at Los Alamos, the cost of this alternative is estimated at $\$5.00/ft^2$ of surface area.

3. Free Release
   This alternative assumes that the metal waste does not require decontamination and only requires a survey to determine the radiological characteristics. If the

waste meets the required radiological criteria, the metal is released from radiological controls and set to a commercial metal recycler. No basis was available to determine the costs of this alternative.

4. Metal Melt
   Metal melt is a process where radioactive scrap metal is smelted and fabricated into shielding blocks. The blocks are then used for shielding at nuclear facilities or buried as LLW. The cost of this alternative is approximately $1.60 per pound.

5. Beneficial Reuse
   This alternative is similar to alternative number 4. However, once the metal is melted, it is refabricated into waste containers. The cost for this alternative is $1.60 per pound for the metal melt and $2700 for an 800 lb B-25 waste container. A standard B-25 box costs $800. Therefore, the cost of this alternative for 800 lbs of scrap is $1280 for metal melt + $1900 in extra costs for the waste container or $3180 total. This is equivalent to a cost of $3.98 per pound.

It is difficult to evaluate the alternatives due to the different cost basis. To perform a cost benefit analysis, all of the costs need to be put on a equal basis. Since landfill is based on a cost per cubic meter basis, it was decided to normalize the costs of the other alternatives to this same cost basis. Based on an analysis of the generator's waste streams, it was determined that typical scrap metal waste had a bulk density of 1100 lbs/m^3 with an average surface area of 0.20 ft^2/lb. These values were used to normalized the costs of each alternative to place them on an equal cost basis. The results of this analysis is depicted in the following graph:

Los Alamos LLW disposal was estimated at $1590/$m^3$, beneficial reuse at $4373/$m^3$, metal melt at $1760/$m^3$, and decontamination at $1100/$m^3$. As mentioned, no costs were available for free release, however, it was assumed that free release would be less than decontamination.

Based on these values, an aggressive program was established at Los Alamos to avoid the disposal of scrap metal LLW. Although the cost analysis indicated that decontamination and free release were the only cost effective alternatives for the average waste generated, a cost benefit algorithm was developed so that the waste could be evaluated on a case by case basis to determine the most cost effective alternatives. For metal waste with a bulk density of less than 900 lbs/m^3, metal melt was considered. If the waste was volume contaminated, had inaccessible surfaces or other factors which made decontamination and free release difficult or impossible, metal melt was considered. If metal melt was more expensive than landfill, then landfill was chosen as the preferred alternative.

During the process of performing the cost analysis, it was recognized that regulatory issues could be an important factor. Surface contamination limits are a factor when determining decontamination and free release costs. Without volume contamination limits, decontamination and free release are not viable alternatives for scrap metal waste that is volume contaminated. The only regulatory guidance to individuals operating under the DOE is contained in DOE Order 5400.5. This order establishes surfaces contamination limits and authorizes the development of

volume contamination limits if the dose to a member of the public is less than 1 mr/yr and the collective dose to the public is less than 10 person-rem in a year. A review of documentation issued by the International Atomic Energy Agency indicated that a good basis has been established to set volume contamination limits and that there may be sufficient justification to increase the surface contamination limits for certain radionuclides. Although pursuit of volume contamination limits and increased surface contamination limits seemed attractive, after discussions with several regulatory bodies, it was decided that the time frame required to gain approval would not produce any advantages for this program. Therefore, any pursuit of volume contamination limits or increases to the surface contamination limits was dropped. All cost analysis were performed based on the requirement to meet the surface contamination criteria in DOE Order 5400.5

A total of 60,000 lbs (67 m^3) of metal waste was processed utilizing the metal melt alternative and a total of 2133 m^3 of waste was processed utilizing the decontamination/free release alternatives. Decontamination was performed at a centralized facility designed for this purpose. For metal not requiring decontamination, the free release process was conducted by the individual generators at their facilities. To our surprise, this cost was more than the cost of decontamination and free release at a centralized facility. The following reasons were identified for this high cost at originating facilities.

1. Inadequate space to properly sort and segregate the waste prior to and after surveying.
2. Free release activities conducted on a piecemeal instead of a production basis.
3. High background levels.
4. Lack of specialized instrumentation to improve the efficiency of the process (i.e. large area survey probes).
5. Variability of Free release implementation between facilities.

Based on this experience, a centralized facility to perform free release surveys is currently being established at Los Alamos. It is estimated that the cost of free release will be \$750 /m^3 for a facility operating at production rate of 625 m^3/yr. At high production rates, it is assumed that the price could be decreased to as low as \$550/m^3. This price reduction is possible through the decrease in costs per cubic meter and the use of more efficient instrumentation, as depicted in Figure 1.

Conclusions

Implementation of decontamination, free release, and metal melt (in specific cases) has resulted in a cost effective program at Los Alamos to avoid the disposal of scrap metal LLW. To date 2200 m^3 of LLW disposal volume has been avoided and it is expected that a total of 2400 m^3 will be avoided by the end of the project.

The only cost effective alternatives identified to avoid the disposal of scrap metal LLW at Los Alamos were decontamination, free release, and metal melt (in specific cases). This result was based on an LLW disposal cost at Los Alamos of $\$1590/m^3$.

In addition to achieving LLW avoidance, ESO has attempted to integrate the program into the Los Alamos infrastructure. To accomplish this task, a guidance document for waste generators was developed to assist waste generators to determine the most cost effective alternatives to LLW disposal. Analysis of the characteristics of scrap metal sent to LLW disposal determined that most metal is a candidate for free release. Based on operating experience, decontamination and free release operations can only be performed in a cost effective manner by centralization of efforts. In response to this, centralized facilities for decontamination and free release have been setup. The centralization of decontamination and free release operations is a cost effective method to avoid disposal of scrap metal LLW.

Figure 1. shows costs of LLW disposal alternatives from a Los Alamos site wide perspective. All costs of LLW disposal are incurred by the Waste Management Organization. There is no direct cost to generators. For generators required, or willing to pay, an institutional fee is being established at Los Alamos to assist in compensating for the costs of performing the alternatives to LLW disposal. In 1999, generators will be responsible for waste costs. We are still in the process of identifying other funding mechanisms for the FY '98.