Conf-950216--31

FEMP-2361

RADIOLOGICAL RELEASE CRITERIA AT THE FERNALD ENVIRONMENTAL MANAGEMENT PROJECT THEORY AND PRACTICE

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January 17, 1995

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For Presentation at the
WM'95 Conference
Tucson, AZ
February, 1995

*Fernald Environmental Restoration Management Corporation with the U.S. Department of Energy under Contract No. DE-AC05-920R21972

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RADIOLOGICAL RELEASE CRITERIA AT THE FERNALD ENVIRONMENTAL MANAGEMENT PROJECT THEORY AND PRACTICE

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ABSTRACT

As environmental restoration activities progress at the DOE's Fernald site, and across the country, large volumes of radioactive scrap metal (RSM) are being generated. Despite the existence of "free-release" guidelines from DOE, the strategy of onsite decontamination and release of RSM for unrestricted use has been generally overlooked in recent years. A pilot project was completed at Fernald in which 120 tons of RSM were decontaminated onsite and released for unrestricted use. This paper compares that strategy to more traditional DOE RSM management practices.

BACKGROUND

In managing the Fernald Environmental Management Project (FEMP) for DOE, FERMCO has established an organization founded on the EPA concept of Operable Units (OUs). For the Fernald site, five distinct OUs have been defined, each with a corresponding management organization, known as a CERCLA/RCRA Unit (CRU). CRU3 is responsible for managing the cleanup of OU3, which covers 136 acres and consists mainly of the former uranium processing area, including buildings, equipment, stored wastes, and associated materials. A map of the site showing the boundaries of the various OUs is shown in Figure 1.

PLACE FIGURE 1 HERE

The FERMCO Recycling Department was established to support the CRUs, particularly CRU3, in their remediation efforts. Specifically, Recycling provides CRU3 with information to evaluate the viability of recycling or beneficial reuse as compared to other management options for various materials and waste streams. When recycling is selected as the preferred approach, the Recycling Department then generates the plans, procedures, contracts, etc. to implement the strategy.

DOE Order 5400.5 "Radiological Protection of the Public and the Environment," was issued in February, 1990. Based on the requirements of this order, personnel and equipment have routinely been "free-released" from the OU3 radiologically controlled areas. However, the release of equipment has been strictly limited to relatively small-scale items, such as tools, trailers, and vehicles. The free-release of large amounts of RSM was considered too ambitious (almost "taboo"). FERMCO Recycling sought to demonstrate the viability of free-releasing RSM, after onsite decontamination, by performing the Material Release Facility (MRF) Pilot Project.

DOE GUIDELINES AND REQUIREMENTS

DOE Order 5820.2A "Radioactive Waste Management," issued in 1988, stresses waste minimization. It states "...LLW shall be managed on a systematic basis using the most appropriate combination of waste generation reduction, segregation, treatment, and disposal practices...." This requires DOE contractors to utilize a portfolio of strategies in managing their LLW. For RSM, one element in the portfolio is decontamination and free-release.

In 1990, DOE Order 5400.5 "Radiological Protection of the Public and the Environment," established the radiological contamination guidelines for the free-release of materials and equipment. These guidelines include numerical limits for residual surface contamination (see Table I) and a qualitative evaluation of the effectiveness of segregation and treatment efforts (ALARA evaluation).

PLACE TABLE I HERE

At Fernald, the predominant nuclides of concern are U-natural, U-235, and U-238. The corresponding surface contamination limits from DOE Order 5400.5 are well within the capabilities of swiping and hand-held surveying techniques routinely utilized at Fernald and other DOE sites. Theoretically, material with measurable surface contamination, but which was below the 5400.5 limits, could be released without restriction on end use.

MATERIAL RELEASE FACILITY (MRF) PILOT PROJECT: INTRODUCTION

A multi-disciplinary team of FERMCO personnel was assembled to plan the free-release project. Team members were selected based on experience, area of responsibility, and organizational affiliation, so that all FERMCO divisions with a stake in project outcome were represented. Management empowered each team member with the authority to make decisions which impacted project outcome.

The team's first task was to develop a strategy for conducting the project. Presented in Figure 2 is the basic approach devised by the team. Based on this flowchart, a work plan was developed to decontaminate and free-release 120 tons of RSM.

PLACE FIGURE 2 HERE

The team capitalized on several factors which combined to give a strong indication that the Pilot Project would be successful. First, a building with adequate decontamination and material handling capabilities was readily available. The FEMP's Building 78 was originally designed to decontaminate vehicles and process vessels used in the production of uranium. By the time construction was completed, production operations had ceased and Fernald's mission had become one of environmental restoration. This brand new facility basically sat idle, until the Pilot Project was conducted. Building 78 became known as the Material Release Facility, or "MRF."

Another factor which bode well for the project was the abundance of seemingly ideal RSM available in OU3. Several lots of material were targeted for decontamination and free-release, including stacks of unused structural steel (50 tons), sheets of steel deck plate cut from a decommissioned U.S. battleship (45 tons), and unused furnace pots (120 tons). Although none of these items were ever used in the production of uranium, they had all accumulated significant surface contamination through years of storage in radiologically controlled areas of OU3. The 120 tons of furnace pots were ultimately chosen as the target for the Pilot Project.

The third factor which pointed to a successful project was the existence of a fairly thorough infrastructure of SOPs at Fernald. Although there was no "How to Free-release RSM" procedure, nearly every step of the MRF Process Flow Diagram (see Fig. 2) was covered by an existing SOP. The MRF Work Plan was generated to coordinate the existing SOPs and to fill in any gaps. The MRF Work Plan served as the overall SOP for the Pilot Project.

Quality Assurance (QA) is an integral part of all activities at Fernald. Since this was a somewhat unprecedented undertaking, QA was especially rigorous for the MRF Pilot Project. FERMCO QA was involved throughout the project, from the earliest planning sessions through project completion. Through this QA involvement, the need for extensive documentation was identified as a means to control the system.

MRF PILOT PROJECT: IMPLEMENTATION

With QA input, a new form called the "MRF-100" (see Figure 3) was implemented. This form became the foundation for the documentation package required to free-release material. The MRF-100 served as a reservoir for all information and documentation generated during each step of the MRF process. It was designed to provide QA with a comprehensive, straightforward summary of all the steps taken to justify the free-release of the furnace pots. The MRF-100 greatly simplified QA's job of certifying that the material and documentation met all requirements for free-release.

PLACE FIGURE 3 HERE

To move 120 tons of furnace pots (600 individual items weighing 400 lbs. each) completely through the MRF process took about two-and-a-half months. The main decontamination technique was steam/detergent spraying, although some grinding, scraping, and torch cutting were required for small areas of particularly stubborn surface contamination. All material handling and decontamination tasks were performed by FERMCO hourly (union) employees.

For the final, comprehensive radiological characterization, a conservative approach was adopted. As discussed above, DOE Order 5400.5 theoretically permits the free-release of items with measurable surface contamination, assuming ALARA requirements are satisfied. The approach adopted for the MRF Pilot Project required that no detectable activity be found on any item to be free-released. Again, the radiological surveying techniques used were capable of measuring contamination levels well below the 5400.5 limits. By adopting the "less than minimum detectable activity (<MDA)" limit, a safety net was built into the system and the ALARA process was greatly simplified.

The total cost of release activities for the project was about $72,500. This figure includes ALL costs associated with the onsite processing of the furnace pots: transportation to and from the MRF, material handling at the MRF, flame cutting of stubborn contamination spots from some pots, decontamination activities, radiological surveying, technical, clerical, supervisory, and management support, and supplies. See Table II for a task-by-task breakdown of the total cost on a percentage basis.

PLACE TABLE II HERE

As illustrated in Table II, only 31% of the total cost actually went to release activities (material handling, transportation, and decontamination), while radiological surveying ate up 42% of the budget. This figure was probably driven up by the difficult shape of the pots and by the adoption of the "<MDA" limit.

Nevertheless, a seemingly inordinate chunk of the budget was consumed by this activity. Although MRF processing is a very cost-competitive option for processing some material types (as illustrated below), a great opportunity to improve the system exists in the area of radiological surveying.

MRF COST VS. BURIAL AT NTS

Traditionally, disposition of items like these furnace pots is accomplished by burial at NTS. Fernald has a great deal of experience shipping LLW to NTS, and so an accurate estimate of the cost to disposition 120 tons of furnace pots at NTS was readily available through the FERMCO Estimating Services Dept. This estimate includes the material and labor for packaging, transporting, and burying the material. As depicted in Table III, MRF processing is a very economical option, costing slightly more than half the price for NTS disposal.

PLACE TABLE III HERE

PLANNED ENHANCEMENTS

Because of the success of the Pilot Project, and the abundance of material remaining in OU3 which is ideal for MRF processing, the work plan under which the trial was conducted has been upgraded to an SOP. Funding has been secured for FY-95 to decontaminate and free-release RSM at a rate of 50 tons per month, using a production line approach.

Additional decontamination technologies are also envisioned for FY-95. Start-up of the MRF's high pressure (2,500 psi) and ultra-high pressure (35,000 psi) water spraying systems is anticipated by April. Also this spring, a vacuum grit blaster will be purchased and installed at the MRF (thanks to funding received through EM-334). Procurement of automated radiological surveying equipment is also being considered, as is leasing a mobile, self-contained decontamination facility for specific material lots. With these enhancements, an ambitious goal of 800 tons per year may be achievable.

SUMMARY

Many options exist for managing RSM. DOE orders dictate that contractors demonstrate flexibility in utilizing a combination of techniques to optimize the benefits of waste management activiites. The FERMCO Recycling Department led an effort to provide their customer with an economical alternative to the traditional approach of burying contaminated metal as LLW, based on established DOE free-release guidelines.

Fernald's MRF Pilot Project demonstrated that onsite decontamination and free-release is a viable option for managing RSM in the DOE complex. In developing an overall environmental restoration plan, this approach should be included in the portfolio of strategies to be considered. At Fernald, decontamination and free-release of RSM is becoming a routine operation, part of everyday life.

Fig. 1

FEMP Map with OU Boundaries

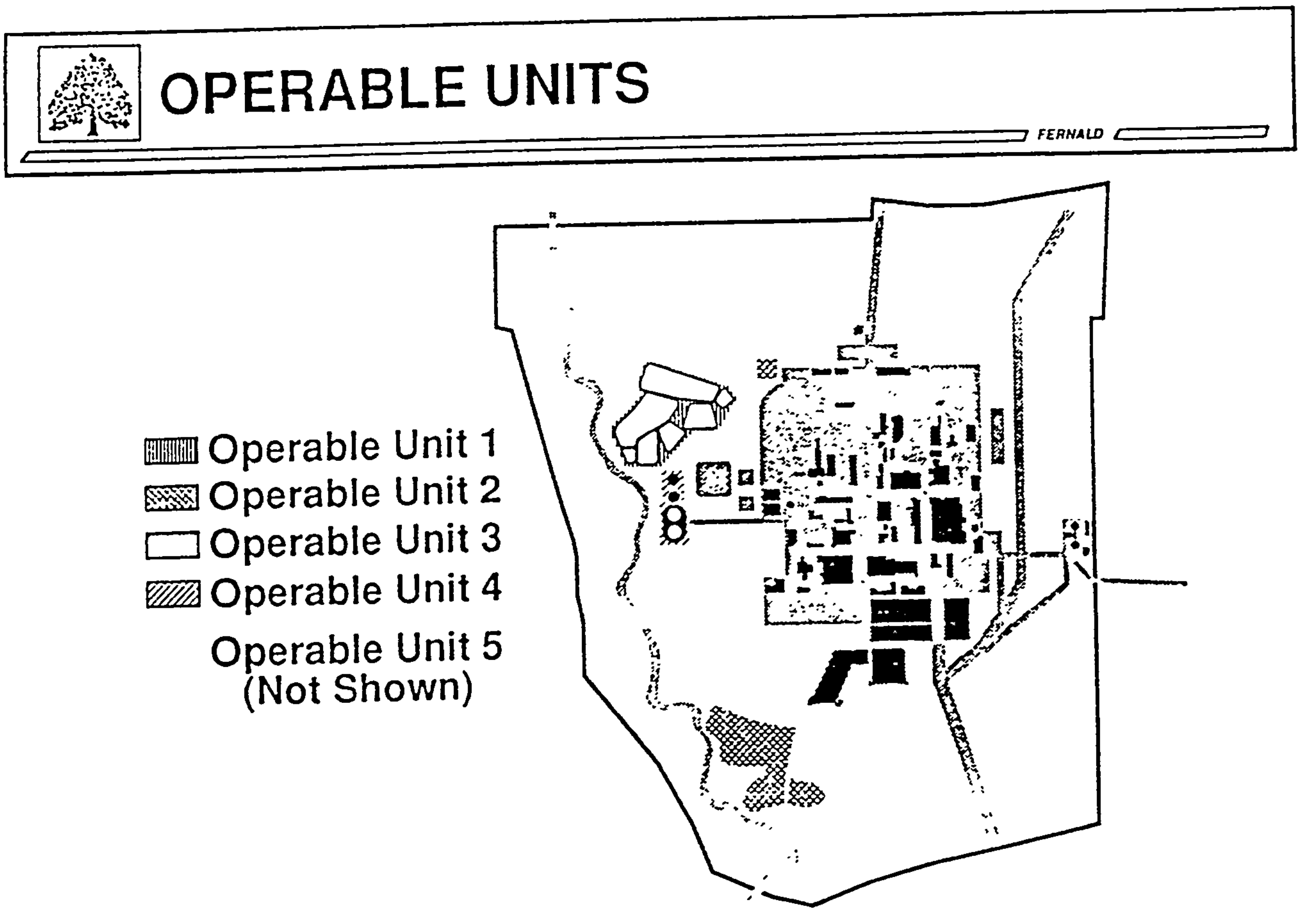

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Fig. 2
MRF Process Flow Diagram

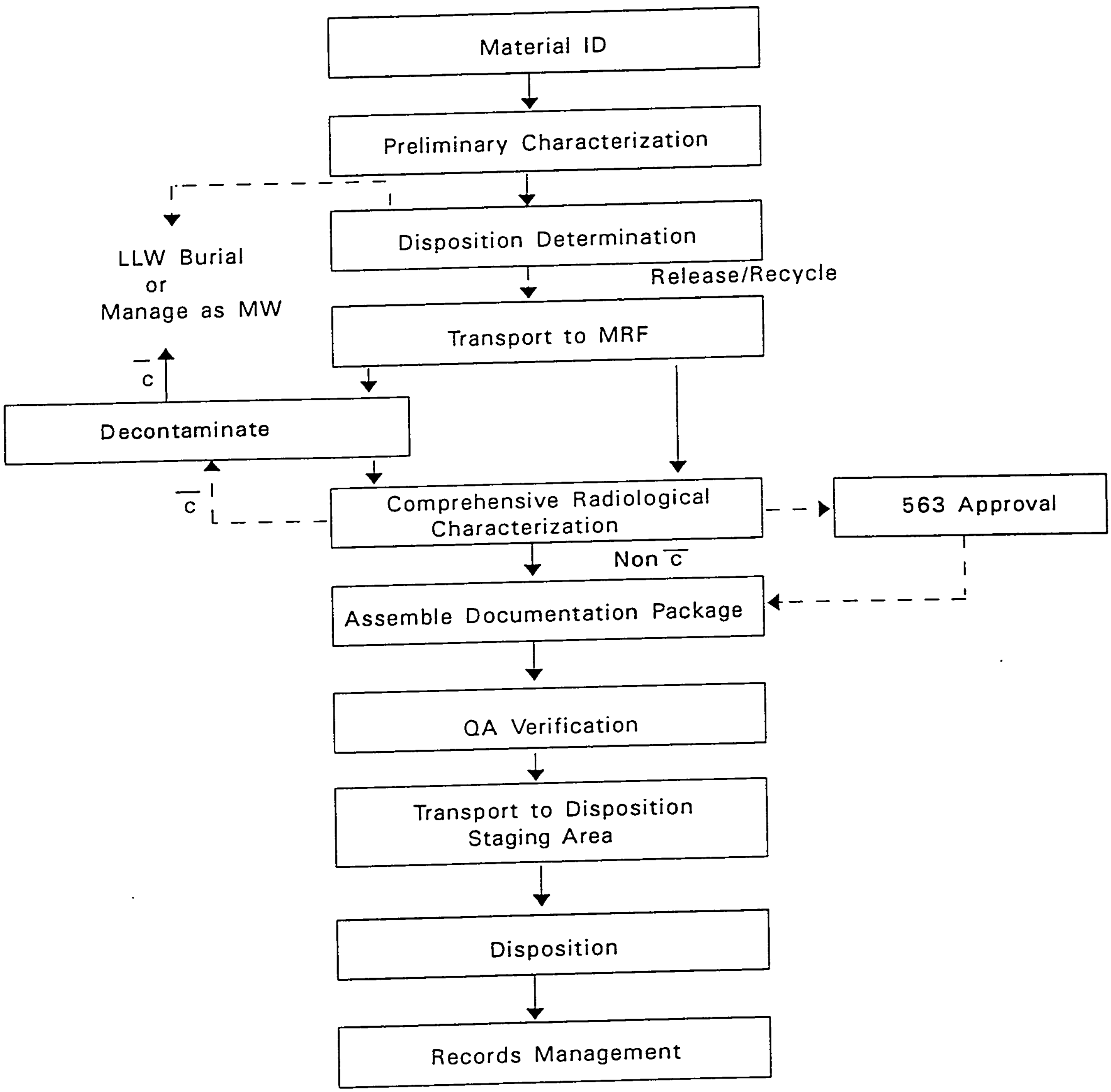


Fig. 3

MRF-100 Form

MRF-100 (Rev. 04/11/94)
MATERIAL RELEASE

1) FORM NO.

2) DATE

3) PHYSICAL DESCRIPTION:

4) MATERIAL PROHIBITED BY SAFETY ASSESSMENT?

[ ] Yes [ ] No

5) OWNERSHIP AND RESPONSIBILITY TRANSFER

FROM: Material Owner Signature: ____________ Date: ______

TO: MRT Facilitator Signature: ____________ Date: ______

6) LOT I.D. NO.: ITEM I.D. NOs.:

7) QA VERIFICATION ITEMS 1-6:

Signature: ____________ Date: ______

8) RADIOLOGICAL SURVEY ATTACHED?

[ ] Yes [ ] No

9) MATERIAL EVALUATION FORM / VERIFICATION FORM ATTACHED?

[ ] Yes [ ] No

10) MATERIAL HANDLING SAFETY ASSESSMENT: LIST AND EXPLAIN ANY SPECIAL SAFETY CONCERNS REGARDING THE HANDLING OR TRANSPORT OF THIS MATERIAL. (PAY PARTICULAR ATTENTION TO CHARACTERISTICS SUCH AS SHAPE, WEIGHT, CONFIGURATION, SHARP EDGES, AND MATERIAL TYPE.)

11) QA VERIFICATION ITEMS 8-10:

Signature: ____________ Date: ______

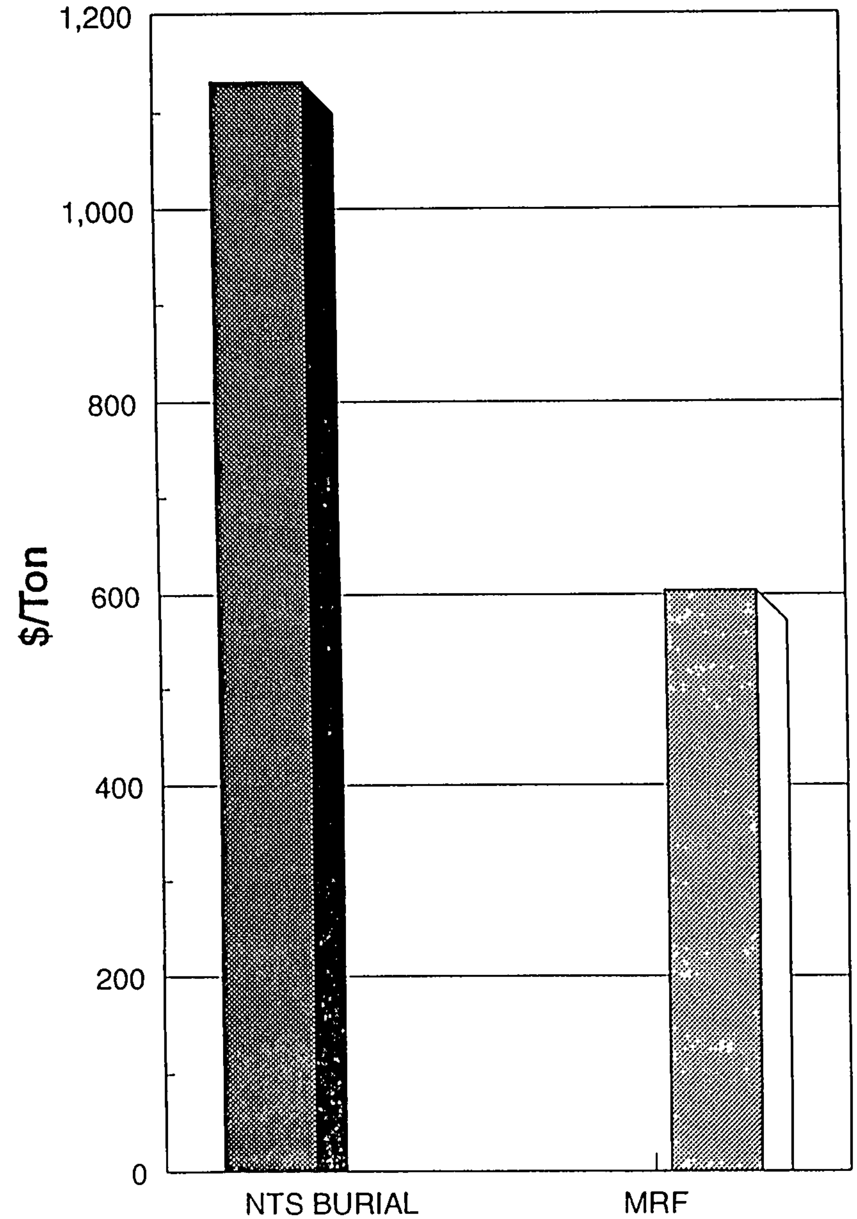
Table I.
DOE Order 5400.5 Surface Contamination Limits

Radionuclides	Allowable Surface Contamination ($dpm/100cm^2$) Average	Maximum	Removable
U-natural, U-235, U-238, and associated decay products, alpha emitters	5,000	15,000	1,000

Table II
MRF Pilot Project Cost Breakdown by Task

Task	% of Total Cost
Radiological Surveying	42.4
Material Handling, Transportation, and Decontamination Labor	30.8
Technical Support and Management	24.4
Clerical, Supplies, Misc.	2.4
Total	100.0

Excess Metal Disposition Costs



OPTION	MATERIAL	$/TON	$/D.E.	$/CU.FT.
MRF- FREE RELEASE	FURNACE POTS	604	66	8.92
NTS BURIAL	FURNACE POTS	1,131	111	14.92

Table III
Cost Comparison of Processing Options