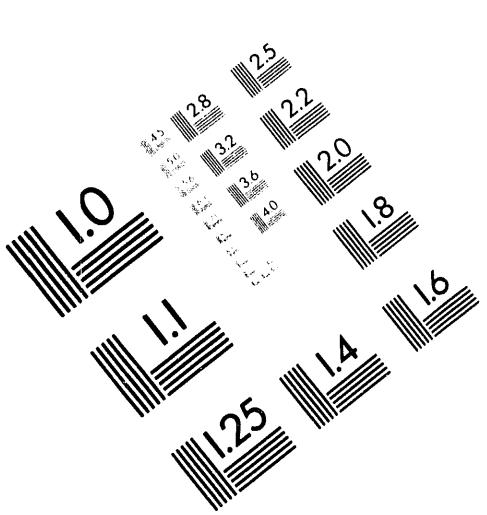

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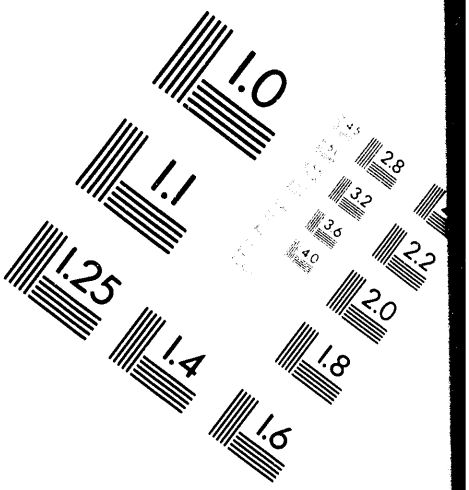

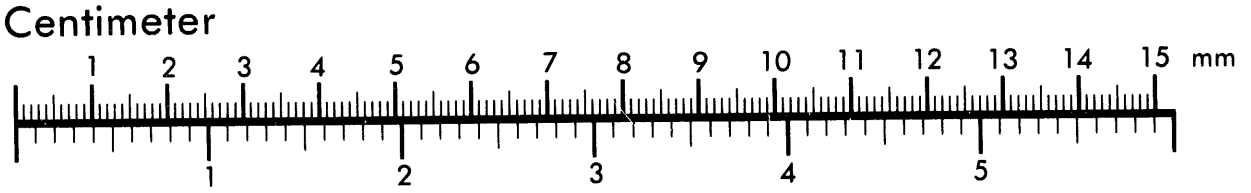

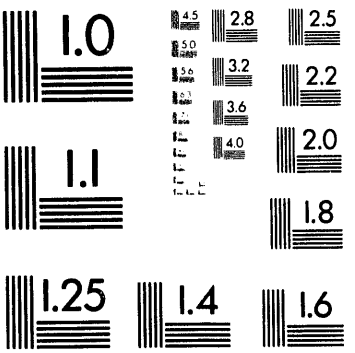

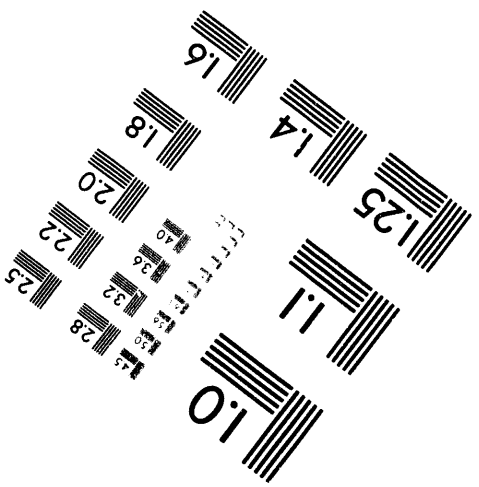

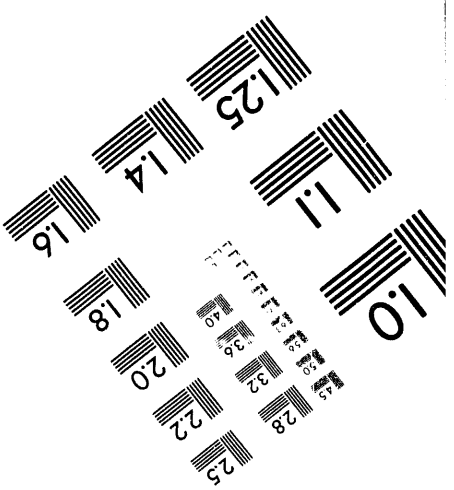

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PAPER

WASTE CONTAINER FABRICATION FROM RECYCLED DOE METAL

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DISCLAIMER

WASTE CONTAINER FABRICATION FROM RECYCLED DOE METAL

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ABSTRACT

The Department of Energy (DOE) has more than 2.5 million tons of radioactive scrap metal (RSM) that is either in inventory or expected to be generated over the next 25 years as major facilities within the weapons complex are decommissioned. Much of this material cannot be surface decontaminated. In an attempt to conserve natural resources and to avoid burial of this material at DOE disposal sites, options are now being explored to "beneficially reuse" this material in applications where small amounts of radioactivity are not a detriment. One example is where RSM is currently being beneficially used to fabricate shield blocks for use in DOE medium energy physics programs. This paper describes other initiatives now underway within DOE to utilize RSM to fabricate other products, such as radioactive waste shipping, storage and disposal containers.

INTRODUCTION

The Department of Energy currently has large quantities of radioactive scrap metal (RSM) in inventory at DOE facilities across the U.S. Since much of this metal cannot be decontaminated easily, past practice has been to either retain this material in inventory or ship it to DOE disposal sites for burial.

A new concept has evolved recently within the Department of Energy - the concept of "beneficial reuse." Under the beneficial reuse concept, RSM that cannot be decontaminated and free released is used in applications where the inherent contamination is not a detriment to its end use. Recently, the beneficial reuse concept was implemented by casting DOE radioactive scrap metal into shield blocks for use by Los Alamos National Laboratory in DOE medium energy physics programs. Initiatives are now underway within the DOE to use radioactive scrap metal that cannot be decontaminated to fabricate radwaste burial containers. It is estimated that more than 300,000 containers will be required for use within the DOE complex for LLW burial over the next 25 years.

DOE RADIOACTIVE SCRAP METAL (RSM) INVENTORIES

The current inventory of DOE radioactive scrap metal is very large. In 1993, the Quadrex Corporation was contracted by DOE to conduct a detailed inventory of radioactive scrap metal currently in storage within the DOE complex. Based only on information "documented in publicly available sources," Quadrex estimated the total DOE-wide RSM inventory to be 396,000 tons. The summary results of this inventory is indicated in Table 1.

PLACE TABLE I. HERE

In its report, Quadrex qualified the data with three major limitations.

1) "Key DOE sites do not presently track RSM as a separate waste item."

TABLE I.
DOE Weapons Complex Scrap Metal Inventory (Quadrex-1993)

METAL TYPE	TONS	PERCENT
Aluminum	16,250	4.1
Brass	10	
Copper	11,215	2.8
Lead	747	.2
Monel	1,745	.4
Nickel	47,524	12.0
Steel	143,221	36.1
Mixed	175,594	44.3
TOTAL	**396,306**	**100.0**

2) It is "very difficult to determine, solely from publicly available documents, either the true quantities of RSM that are in inventory at all DOE sites, or the current and projected generation rates for scrap metal at DOE facilities."

3) "Many sites simply lack the knowledge of on-site RSM inventories due to the length of time that the materials have been stored, and the apparent fact that RSM at some sites has been disposed of for decades with little documentation on metal types or contaminant levels."

Quadrex estimated in the report that if the documented inventory of 396,000 tons is added to the estimated 594,000 tons of metal that will be generated just from the D&D of the Oak Ridge, Portsmouth and Paducah gaseous diffusion plants, that the number could be up to 991,000 tons. If estimates were to include future D&D metal generation (up to 90,000 tons/year) within the complex, the total RSM inventory could easily exceed 2.5 million tons.

Can this RSM be decontaminated? Much of the DOE scrap metal in inventory, perhaps one-third, cannot be decontaminated for one of three reasons.

Economics. In some cases, it is not economical to decontaminate this material due to the thickness of the material, the base metal content, the corrosion layer present, or material configuration. In these cases, the cost of decontamination is sc much higher than the cost of burial that decontamination is not economically feasible even if it is technically possible.

Ability to survey surface areas. In some cases, the configuration of the material (i.e. small tubes, complex machinery) makes it extremely difficult to survey all surface areas. Most DOE facilities have policies in place which require a 100% survey before material containing potential surface contamination can be released.

Volumetric contamination. In some cases, radioactive scrap metal is volumetrically contaminated. Metal may have already been melted or shaped into forms where contamination exists within the metal matrix rather than only on the material surface.

Historically, most of the metal falling into one of these three categories has been shipped to DOE disposal sites for burial or stored in open areas awaiting final disposition. At Fernald, the USEPA viewed open storage as an environmental risk warranting an expedited removal action under CERCLA.

THE "BENEFICIAL REUSE" OPTION

A key issue associated with the release of the scrap metal is volumetric contamination. If scrap metal cannot be economically decontaminated and surveyed for free release, an option exists to melt the metal to reduce its overall burial volume and, at the same time, remove much of the contamination present in the matrix via the slagging process.

The resulting metal, even though only slightly contaminated, cannot be "free released" in the U.S. due to the absence of volumetric contamination release limits. In these cases, this material can either be disposed of as LLW, taking advantage of volume reduction achieved by converting metal with complex configurations into a high density solid block or, alternatively, be used in an

application where slight radioactive contamination is not a detriment.

One company in the United States, the Scientific Ecology Group, Inc. (SEG), currently operates a licensed radioactive metal melting facility in Oak Ridge, TN. SEG recently exercised the "beneficial reuse" option by agreeing to fabricate shield blocks for use by the DOE in medium energy physics programs. The slight contamination present in the shield block metal is not a detriment to its use. Control of the shield blocks remains with the DOE. In fact, the shield blocks will most likely become activated or contaminated during their operating life and will therefore ultimately require another stage of recycling or disposal as radioactive material.

Although shield blocks are an excellent beneficial reuse option for RSM, the facts are that shield blocks are capital goods and DOE can only use so many shield blocks. If the beneficial reuse concept is to become a reality, new (and perhaps consumable) end products for fabrication must be identified.

WASTE CONTAINER FABRICATION

DOE will require hundreds of thousands of waste containers for use in the cleanup of the weapons complex over the next 30 years. Since these containers are ultimately filled with radioactive waste and buried, they do not have to be fabricated from virgin metal. The beneficial reuse concept will work in this application.

Containers fabricated from beneficially-reused RSM require two types of control. "Inventory control" is accomplished in accordance with standard government inventory control practices. "Radioactive material control" would be required since the containers cannot be released to the general public. The authors opinion is that, because of the extremely low radiation levels associated with these containers, radioactive material control of these containers is not a major issue.

CURRENT INITIATIVES

At least four initiatives are currently underway within the DOE to explore the possibility of using recycled radioactive scrap metal to fabricate waste shipping containers.

SEG Scrap Metal PRDA. In 1993, SEG was awarded a contract by the DOE Morgantown Energy Technology Center under a Program Research & Development Announcement (PRDA) to demonstrate "technologies to remove, decontaminate, recycle, reuse and dispose of materials from decontamination and decommissioning activities at DOE sites." SEG will fabricate waste containers made of rolled sheet metal and also experiment with the fabrication of rebar and metal fibers that might be used to reinforce concrete waste containers.

Fernald was directed by DOE to support SEG in demonstrating that radioactively contaminated scrap metal can be recycled and reused to fabricate waste disposal containers. Fernald will be supplying 70 tons of contaminated ferrous and non-ferrous scrap metal to SEG for this project. SEG will decontaminate the metal to less than free-release levels, melt it in the SEG metal melt furnace, ship the metal to a non-licensed rolling mill, and finally use the rolled metal to fabricate LLW shipping containers meeting specifications provided by Fernald.

Since this material will be decontaminated before container fabrication, the containers will not be considered radioactive and therefore will not require any special radioactive control during the casting, rolling or fabrication processes. The PRDA should demonstrate that large quantities of radioactive scrap metal existing within the DOE complex, whether it is melted in a contaminated or uncontaminated state, can be utilized for waste container fabrication.

After waste containers are fabricated by SEG, they will be returned to Fernald, loaded with actual radwaste and shipped to the Nevada Test Site for disposal. Shipment to NTS is currently scheduled to occur in August, 1994.

Recycling of Fernald Plant 7 Structural Steel. Plant 7, one of the largest buildings at the Fernald site, is currently being dismantled and decommissioned under an Environmental Protection Agency (EPA) removal action. The demolition of Plant 7 will generate approximately 700 tons of structural steel.

Fernald intends to recycle this structural steel in a rather unique manner. The contract to recycle this material will be coupled with a contract to provide thousands of waste containers approximately equal in weight to the 700 tons of structural steel. The vendor selected will have the option to provide these waste containers fabricated from either virgin metal, the structural steel provided from the Fernald site, or other DOE metal that cannot be economically decontaminated. The options available to the vendor are illustrated in Figure I.

INSERT FIGURE I HERE

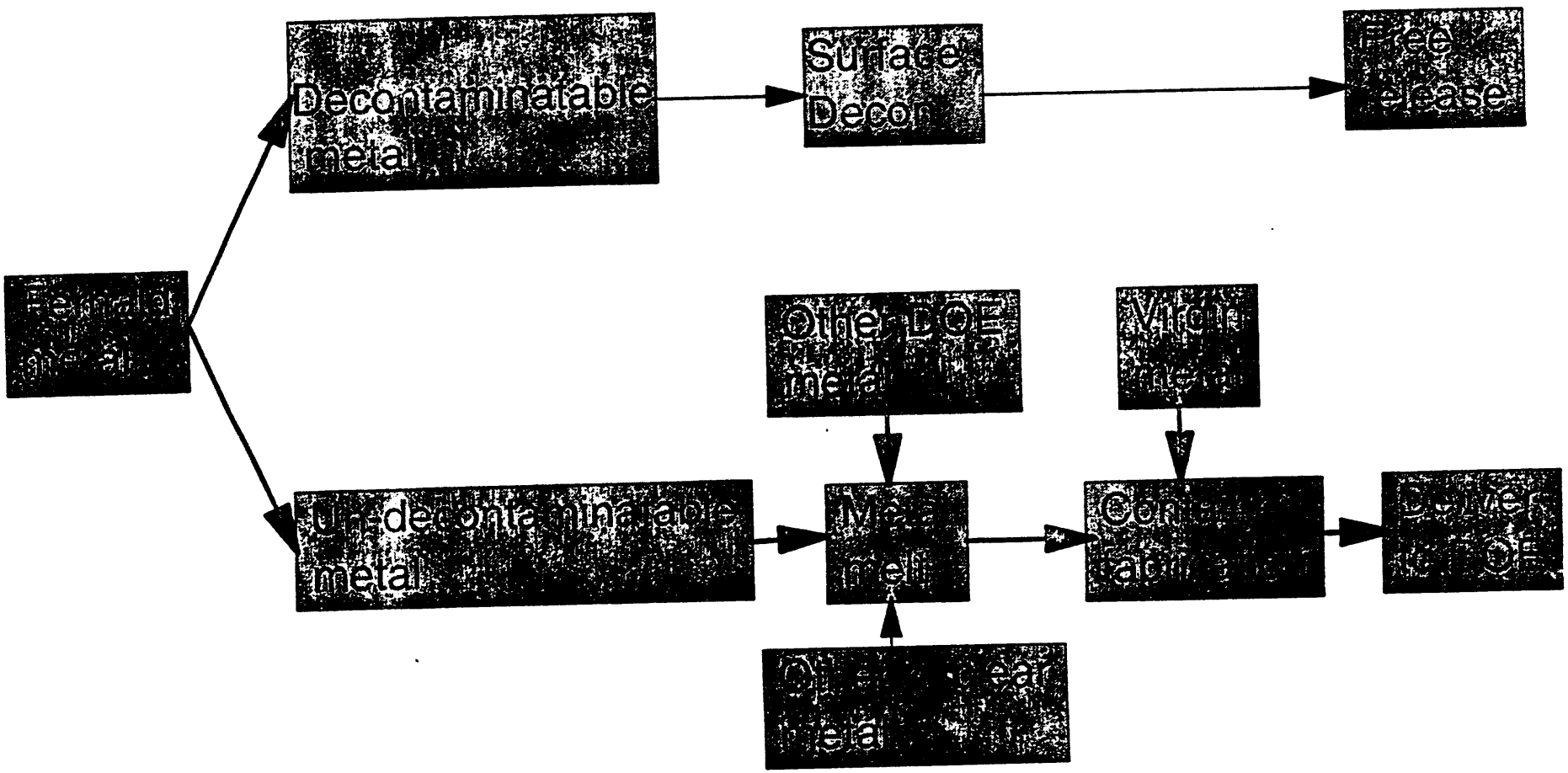
The overall intent of this procurement is to provide some stimulus to the commercial market to consider ways in which facilities might be established to fabricate waste containers out of radioactive scrap metal.

Manufacturing Sciences Corporation National Conversion Pilot Project. Manufacturing Sciences Corporation (MSC) has recently announced its intent to refurbish four facilities at the Rocky Flats Plant for use to setup a commercial recycling center. The project includes decontaminating four major manufacturing buildings formerly used at Rocky Flats to process depleted uranium and then using the extensive metal fabrication equipment within these buildings to recycle RSM into waste containers and other useful products. The project will proceed in three stages: scoping, clean-up and recycling, with a DOE decision required in order to proceed between each stage. MSC, which has been recycling DOE scrap metals into useful products in a licensed facility in Oak Ridge since 1985, has been designated to manage stages one and two. A competition is planned to select the stage 3 contractor.

Some of the Rocky Flats equipment being transitioned for recycling activities include: two large sheet rolling mills, a 1500-ton extrusion press, six hydraulic forming presses ranging from 150-ton to 2000-ton capacity, eight vacuum induction casting furnaces and a vacuum arc melting furnace. This equipment is particularly well suited for recycling RSM into waste containers. Rocky Flats is expected to be both a significant source of RSM as well as a user of RSM waste containers.

Manufacturing Sciences Corporation Metals Recycle PRDA. Manufacturing Sciences Corporation (MSC) was also awarded a contract in 1993 by the DOE Morgantown Energy Technology Center for development of "Advanced Technologies for

Figure I. Metal Flow Chart



Decontamination and Conversion of Scrap Metals." The contract is directed toward development of methods of decontamination and reuse of contaminated nickel from the D&D of the DOE's gaseous diffusion plants. MSC's project will remove contamination by reaction with a molten slag and then incorporate the nickel in stainless steel and high-nickel alloys. MSC will demonstrate the production of stainless steel and fabrication by forming and welding during 1994. Later phases of the project will demonstrate fabrication of full-scale containers for vitrified waste forms starting with contaminated nickel, stainless steel, and carbon steel input materials.

OBSTACLES TO SUCCESS

Although most people would agree with the overall concept of beneficially reusing metal that cannot be decontaminated for the fabrication of waste containers, a number of obstacles need to be removed if this program is ever to get underway within DOE on a large scale basis.

Non-standard container size requirements. A variety of waste containers are used throughout the weapons complex. It seems that virtually every DOE site has its own site specific container design requirements. The lack of a standard design may make it difficult for DOE to purchase containers in a quantity sufficient to justify private investment in licensed metal rolling and container fabrication facilities.

It should be noted that Westinghouse Hanford Company is initiating formation of a "Working Group on Standard LLW containers" to address this issue.

Lack of container needs database. Although it appears that hundreds of thousands of containers will be required for use within the DOE weapons complex, the author is not aware of any single integrated database that documents total DOE waste container requirements. The creation of such a database will be necessary if one is to evaluate the economics associated with waste container fabrication from Radioactive Scrap Metal. The Working Group on LLW containers will also address this issue.

Not-Invented - Here Syndrome. Many facilities within DOE have established recycle programs. Although most of these programs have the same objective in mind, they are not always coordinated. If a major initiative were started within DOE to require the use of waste containers fabricated from recycled metal, some facilities within the complex might resist these efforts.

It is expected that the "Strategic plan for recycle/reuse of contaminated surplus facilities and recoverable materials" being prepared by the DOE Office of Environmental Restoration will be very helpful in addressing this issue.

Perceived institutional barriers. Recognizing that any waste containers fabricated from recycled metal will require radioactive material control within DOE, it is envisioned that some facilities may resist supporting the concept. They may feel that the requirements associated with controlling these containers and preventing inadvertent release would be cumbersome. Again, it is the authors belief that the standard DOE inventory control practices, together with the use of radioactively controlled storage areas, will be sufficient to adequately control these LLW waste containers. Keep in mind that any containers fabricated from RSM will have essentially no measurable radiation level.

High cost associated with licensed metal, rolling and container fabrication facilities. Establishing the commercial infrastructure to manufacture waste containers from radioactive scrap metal on a large scale basis will require considerable investment. Licensed facilities will have to be established for metal smelting, casting, rolling, and container fabrication. The cost estimated to set up such facilities could be as high as 30 Million dollars. This cost could be significantly reduced if DOE rolling facilities could be made available for this purpose. In any event, the licensed commercial facilities required to fabricate waste containers from RSM on a large scale, do not currently exist within the United States.

It should be noted that one company, Manufacturing Sciences Corporation, has a licensed, metal recycle facility capable of manufacturing waste containers starting with contaminated scrap. While limited in capacity, this company, as well as others, have stated that they would expand in response to a commitment by DOE to recycle its RSM into waste containers.

SUMMARY

Recycling is receiving increased emphasis within the Department of Energy. Numerous initiatives are underway to determine if recycling radioactive scrap metal into waste containers is technically and economically feasible. If successful, using RSM to meet waste container metal content requirements could absorb a good fraction of available RSM and, at the same time, conserve valuable burial space and material resources.

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