

**U.S. DEPARTMENT OF ENERGY NATIONAL CENTER
OF EXCELLENCE FOR METALS RECYCLE**

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ABSTRACT

The National Center of Excellence for Metals Recycle (NMR) is the U.S. Department of Energy (DOE) complex-wide source for aggressively pursuing recycle and reuse of scrap and surplus metals. Established in September 1997, this program is designed to educate, promote, and facilitate recycling and reuse of metal. The vision of the program is to cultivate a DOE culture that considers the recycle and reuse of metal as the first and primary disposition option and burial as a last option, while reducing environmental and health risks and life cycle costs. NMR takes the approach that unrestricted release of metal is the first priority because it is the most cost-effective and environmentally-sound disposition pathway. Where this is not appropriate, restricted release, beneficial reuse, and stockpile of ingots are considered.

The program is designed to assist project managers in identifying and expediting recycling activities and will provide tools to facilitate the recycling/reuse process. NMR understands what motivates DOE project managers: meeting schedules, staying within budget, and satisfying regulatory requirements. NMR is developing tools to assist project managers in evaluating methods to reduce costs and schedules by recycling and reusing equipment and materials. These tools are designed to help sites perform life cycle analysis, perform ALARA analysis, produce pollution prevention information, manage their materials inventory, produce independent government estimates, and implement sale/service contracts. By providing project managers with all the necessary information and resources up-front in the planning phase, recycling and reuse of materials and equipment can be successful.

NMR has been successful in leveraging cold war legacy equipment and materials to accelerate cleanups and promote reindustrialization at DOE sites. The program's focus has been to move from traditional service contracts that dispose of contaminated equipment and materials as liabilities, to the sale of both radioactive and clean materials as assets. To date, this approach has

resulted in the recycle or sale for reuse of 10,097 metric tons of material and a saving to the government of \$5 million. NMR staff look forward to working with all DOE sites, regulatory authorities, the private sector, and other stakeholders to continue to recycle metal throughout the DOE complex.

INTRODUCTION

The National Center of Excellence for Metals Recycle (NMR) is the U.S. Department of Energy (DOE) complex-wide source for aggressively pursuing recycle and reuse of scrap and surplus metals. Established in 1997, this program is designed to educate, promote, and facilitate recycling opportunities. As current inventories of scrap metal continue to rise, environmentally safe and cost-efficient solutions are needed. This program is designed to assist project managers in identifying and expediting recycling activities and will provide tools to facilitate the recycling process.

NMR's vision is to implement a DOE culture that considers the recycle and reuse of metal as the first and primary disposition option, and burial as the last option, while reducing environmental and health risks and life cycle costs. Specific services provided by NMR include the following:

- ❑ Provide DOE-wide focus and leadership for the evaluation of metal recycle and reuse as alternatives to disposal and storage strategies.
- ❑ Provide metal recycle and reuse planning inputs to all DOE programs.
- ❑ Develop a national program for metal melt to provide shield blocks and other shielding made from scrap metal to DOE high energy facilities.
- ❑ Establish a contract for technical support.
- ❑ Create and disseminate proven decision-aiding tools that support rapid and thorough evaluation of recycle and reuse alternatives to disposal or storage.
- ❑ Work with the metals recycle industry on the detection of radioactive scrap metal and disposition of abandoned radioactive sources.
- ❑ Represent DOE in interactions with national and international regulatory agencies, including the EPA, NRC, IAEA, OECD, and others, on issues concerning metal recycle and reuse.
- ❑ Represent DOE in interactions with U.S. and international trade associations and umbrella groups, including ISRI, AISI, SMA, ARMOR, and others, on issues concerning metal recycle and reuse.

WHY RECYCLE?

Across the DOE complex the inventory of scrap metal exceeds a million tons. Recycle and reuse can provide significant cost and environmental benefits in addressing this enormous scrap metal problem. The scope of the metals disposition problem is depicted in Figures 1-4. The total U.S. inventory of radioactive scrap metal (RSM) totals two

million tons. Of this, D&D is the principal source of RSM. DOE sites are the major U.S. source of RSM, with an inventory of approximately 1.4 million tons; of the DOE sites, Oak Ridge has the majority of the material. While steel dominates the total quantity of DOE RSM, nickel is the major value component based on commodity value.

Pollution prevention (P2) in the form of recycle and reuse can play a significant role in keeping this valuable resource out of landfills, avoiding the unnecessary contamination of virgin materials, and reducing DOE disposal costs. Enhanced efficiencies and cost savings due to recycle and reuse will allow the DOE to accelerate cleanup and closure schedules and lower overall life cycle cleanup costs. In addition to cost savings, recycling produces significant health and environmental benefits. According to a recent multidisciplinary study by Argonne National Laboratory, in comparison to disposal and utilization of virgin replacement materials, recycling:

- ❑ reduces health risks by 50%;
- ❑ uses 40% less water;
- ❑ uses 70% less energy;
- ❑ decreases water pollution by 80%;
- ❑ produces 90% less air pollution; and
- ❑ allows for a 90% reduction in raw material usage.

In addition, DOE has set specific P2 goals, and recycling provides the means to achieve these goals. Recycling and reuse of metal also support the Secretary of Energy's Strategic Goal outlined in the DOE Strategic Plan to minimize future waste. The Office of Environmental Management's *Accelerating Cleanup: Paths to Closure* specifically addresses the need to continuously seek enhanced efficiencies that will allow DOE to accelerate cleanup and closure schedules and lower overall life cycle cleanup costs. One of the enhanced performance mechanisms outlined in *Paths to Closure* is pollution prevention.

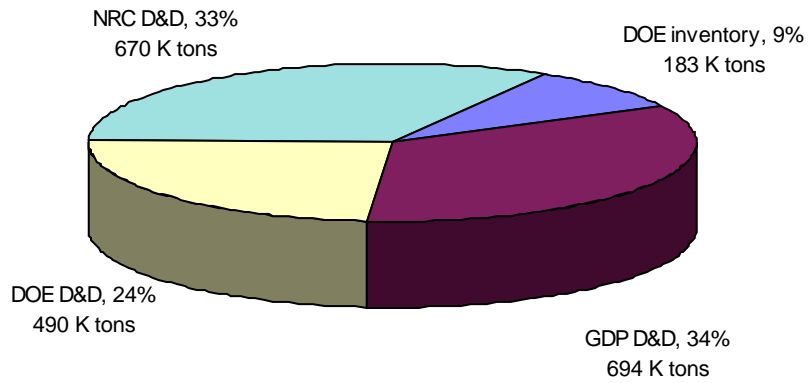


Fig. 1. U.S. Inventory Totals 2 Million Tons: D&D is Principal Source of RSM

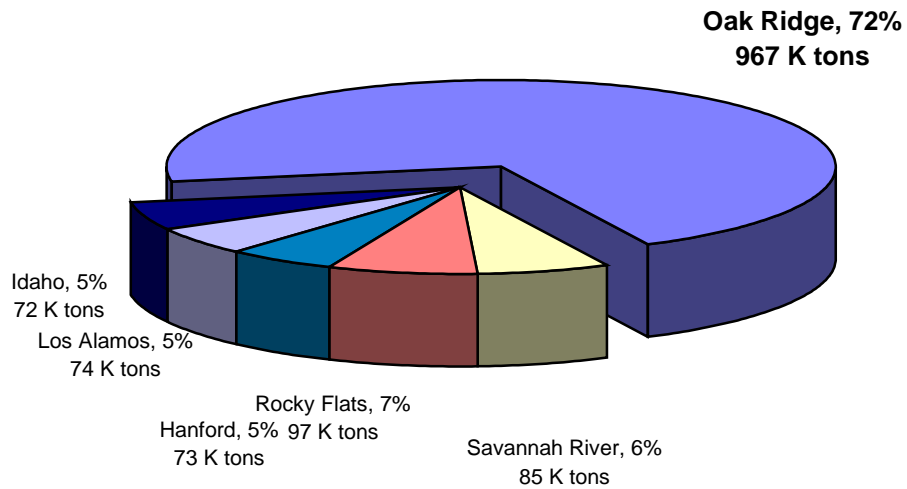


Fig. 2. Distribution of 1.4 Million Ton DOE RSM Inventory by Site: Oak Ridge has Majority of Material

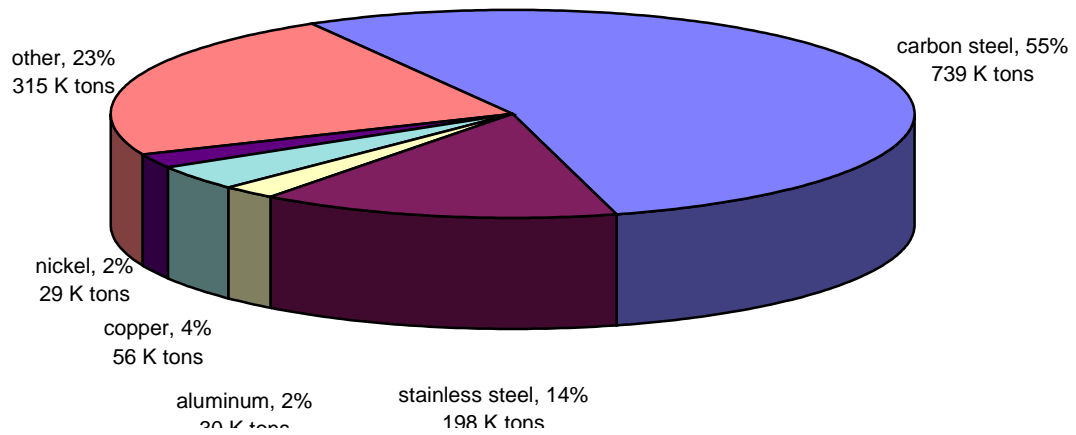


Fig. 3. Distribution of 1.4 Million Ton DOE RSM Inventory by Metal Type: Steel Dominates Total Quantity of DOE RSM

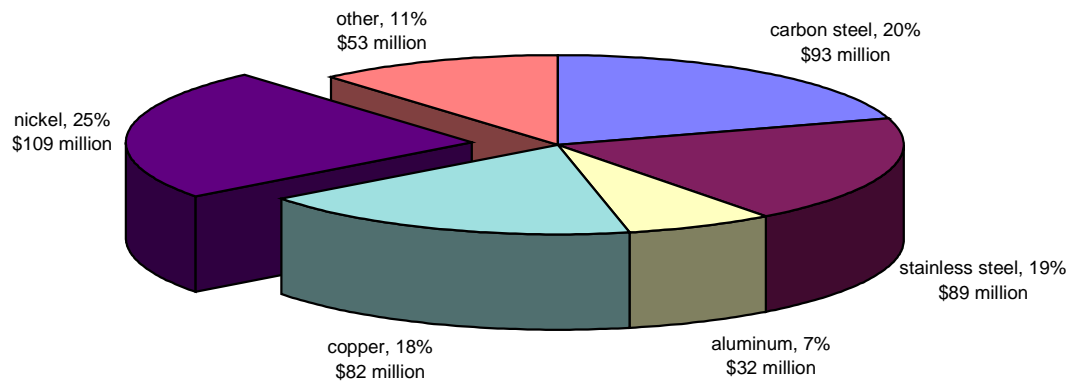


Fig. 4. Distribution of \$457 Million DOE RSM Commodity Value by Metal Type: Nickel is Major Value Component

HOW CAN THE NATIONAL CENTER OF EXCELLENCE FOR METALS RECYCLE HELP PROJECT MANAGERS?

NMR has developed a time-saving, easy-to-use set of tools designed to help project managers recycle metals. This “toolbox” is an Internet-interactive set of tools including primers, computer software, and case studies designed to help project teams to:

- ❑ perform life cycle analysis,
- ❑ perform ALARA (As Low As is Reasonably Achievable) analysis,
- ❑ produce P2 information and documentation,
- ❑ manage their materials inventory,
- ❑ produce independent government estimates, and
- ❑ implement recycle sale/service contracts.

NMR has developed tools to assist sites in performing life cycle analysis (LCA) to support decision-making on whether to recycle or dispose of scrap metal. LCA is a systematic and comprehensive process for identifying, assessing, and comparing alternatives for disposition of materials, and for selecting and documenting a preferred alternative. An LCA includes all of the impacts (benefits and costs) that result from a course of action over the entire period of time affected by the action. The LCA system also includes a visualization component that has been proven to aid communication and stakeholder involvement in the decision-making process (1,2).

Our approach to LCA differs from other approaches by taking into consideration all the factors important to stakeholders. In addition to life cycle cost, we consider health and safety impacts, environmental impacts, programmatic impacts, and other factors. Consideration of these impacts need not be extensive or excessively burdensome; it should be commensurate with the potential benefits. However, the simple process of considering each of the alternatives on each of the relevant attributes will ensure that all factors important to the decision have been considered and will help avoid unintended consequences. The LCA decision-aiding framework has been successfully applied at a number of DOE sites and has been proven to be a robust decision-making aid. The framework can be tailored to meet site and project specific conditions and can easily be applied to P2, D&D, and asset recovery projects throughout the DOE complex.

The ALARA analysis component of the toolbox produces the risk calculations needed to support the life cycle analysis. Of particular importance is the estimation of total risk to the population. The ALARA analysis component of the toolbox will also provide software support, such as RESRAD-RECYCLE, and relies heavily on the extensive analysis of the exposures and risks of metal recycling, such as calculated by EPA (3).

The P2 component of the toolbox will provide the user with information to document P2 project successes, contract language to incorporate into project subcontracts to promote P2, actual project summaries, and references and links to applicable documents, web sites and data bases containing P2 information.

Another component of the toolbox addresses Independent Government Estimates (IGE). These cost estimates, though following most of the traditional techniques, have been modified to incorporate revenue projections for the sale of the scrap materials. Utilizing the assumptions made in the LCA, the IGE provides the government with an assessment of the estimated total project cost with the revenue offset. For the project manager, this modified IGE provides valuable information and is used as a part of the project's IGE in the decision-making process. Although IGEs are generated on a case-by-case basis, the toolbox examples can give the project manager insight into commonalities in metal recycling processes and how they can be applied to each particular project.

The toolbox also includes a component dedicated to contracts. This component will provide example sale and service contracts that can be used to facilitate the metals recycling process. Recognizing that each situation is different, these contracts should be classified as examples and used as a starting point for a project-specific contract. NMR is available to assist in this process and can provide expertise on how to draft a contract to meet specific project needs. In addition, NMR is developing a national contract (described further below) which will provide an avenue by which project managers can get needed recycling and problem solving assistance.

Lastly, the toolbox will provide users with applicable references and links to regulations, guidance documents, web sites, and data bases that collect and report related information. NMR hopes to accomplish extensive information sharing between DOE sites and industry so that recycle and reuse become business as usual on all DOE projects.

NATIONAL CONTRACTS

The NMR contract vehicle enables NMR to implement its mission to provide technical expertise and services throughout the DOE complex and the metals recycle industry and to expedite the dispositioning of scrap metal. The scope of the contract is based on the following needs:

- ❑ cost effective and timely response to pollution prevention and waste minimization initiatives;
- ❑ strategic response planning for metals reuse resulting from current and future facility decontamination and dismantlement;
- ❑ research and implementation of technologies and methods for metals decontamination;
- ❑ recommendations on waste disposition;
- ❑ research of metal melt processes;
- ❑ container fabrication methods and container reuse;
- ❑ project formulation and management;
- ❑ public/regulatory/industry outreach and communication; and
- ❑ general technical input to DOE-NMR.

CONCLUSIONS

NMR is dedicated to providing innovative approaches throughout the complex to facilitate beneficial reuse and recycling of materials. NMR has the expertise, resources, tools, and contacts to help make DOE recycling a reality. NMR has expertise to assist project managers in the areas of metal disposition, waste management, decontamination and decommissioning, radiological controls, life cycle analysis, ALARA analysis, cost estimation, and contracting. Since this is a complex-wide program, NMR can search throughout the DOE complex for possible solutions to individual situations. In many cases, several sites share the same needs. NMR takes advantage of these synergies to maximize the benefits of recycling and minimize potential stumbling blocks. In addition, NMR has developed close contacts with the commercial recycling community; these alliances enable NMR to also utilize their expertise for the benefit of DOE projects. The NMR staff look forward to working with all DOE sites, regulatory authorities, the private sector, and other stakeholders to recycle metal throughout the DOE complex.

REFERENCES

1. K.L. YURACKO, et al., "A Life Cycle Decision Methodology for Recycle of Radioactive Scrap Metal," *Int. J. LCA*, 2 (4), 223-228 (1997).
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FOOTNOTE

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