IDAHO NATIONAL ENGINEERING LABORATORY

INEL-94/0067

September 1994

T. M. Bechtold, Editor

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INEL METAL RECYCLE
Annual Report
FY-94

Lockheed
Idaho Technologies Company

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DOE Contract
No. DE-AC07-94ID13223

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INEL-94/0067

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**INEL METAL RECYCLE
Annual Report
FY-94**

**INEL METAL RECYCLE GROUP
T.E. Bechtold, Editor**

September 1994

Lockheed Idaho Technologies Company

PREPARED FOR THE
**DEPARTMENT OF ENERGY
IDAHO OPERATIONS OFFICE**
UNDER CONTRACT DE-AC07-94ID13223

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MASTER

EXECUTIVE SUMMARY

Idaho National Engineering Laboratory (INEL) has managed a program to address DOE's concern about complex-wide accumulation of radioactive scrap metal (RSM). Program initiation, direction, and funding was provided by EM-30. Major objectives for FY-94 were: 1) inventory RSM at DOE sites, 2) validate technologies for conversion of RSM to usable products, and 3) develop private business partners with interest in RSM recycle.

Field inventories of available RSM were conducted at the Idaho, Los Alamos, and Sandia National Laboratories, and at the Savannah, Hanford, and Nevada sites. Measured inventories of RSM were found to be much lower than previous estimates.

Radionuclide removal efficiencies were determined for induction, electro-slag, and plasma remelt technologies. Decontamination factors of 500 to 1000 were achieved using rare earth surrogates to mimic the behavior of radionuclides. Scale-up of bench scale tests were begun in partnership with private industry. Three cost-share agreements were signed which involve eight individual companies.

Private partners have invested in melt technology development in order to strengthen their technical capabilities and to acquire data which could be used to make business decisions regarding the siting and operation of a RSM recycle facility.

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1. INTRODUCTION: INEL METAL RECYCLE

In 1992, the mission of the Idaho Chemical Processing Plant was changed from reprocessing of spent nuclear fuels to development of technologies for conditioning of spent nuclear fuels and other high-level wastes for disposal in a geologic repository. In addition, the Department of Energy (DOE) directed Idaho National Engineering Laboratory (INEL) to develop a program plan addressing the management of radioactive contaminated scrap metal (RSM) within the DOE complex.

Based on discussions with the EM-30 organization, the INEL Metal Recycle program plan was developed to address all issues of RSM management. Major options considered for RSM management were engineered interim storage, land disposal as low-level waste, and beneficial reuse/recycle.

From its inception, the Metal Recycle program has emphasized avoidance of storage and disposal costs through beneficial reuse of RSM.

The Metal Recycle program plan includes three major activities:

- site-by-site inventory of RSM resources,
- validation of technologies for conversion of RSM to usable products, and
- identification of parties prepared to participate in development of a RSM recycle business.

2. INVENTORY ACTIVITIES

INEL Metal Recycle has placed high priority on development of a methodology to survey and track DOE RSM inventories. This information is required to establish whether available RSM inventories are sufficient to justify construction of a facility which would allow cost effective reuse of RSM. This information is essential for future business development.

Metal Recycle hosted three meetings in FY-93 in an effort to coordinate RSM inventory efforts throughout the DOE complex. These meetings were attended by representatives of six DOE sites, DOE-ID, and DOE-HQ. The purpose of these meetings was to develop a standardized set of field survey forms for recording and tracking DOE RSM inventories. The survey forms were designed to expedite field use while providing sufficient data for inventory tracking using a relational database.

Initial conversations with site representatives suggested that large stockpiles of RSM were not available and that initial estimates of the amount of RSM available in the DOE complex may have been grossly overestimated (M.J. Lilly *et al.*, Waste Management '92). For example,

most of the approximately 800,000 tons of RSM reported to be stored at the Nevada Test Site was found to be emplaced in weapons test shafts and was not considered recoverable. This demonstrates the potential unreliability of information gathered by means other than actual measurement.

2.1 Inventories at DOE Sites

Metal Recycle visited four DOE sites (Nevada Test Site, Savannah River Site, Sandia National Laboratory, Los Alamos National Laboratory) in FY-94 in order to compile a preliminary survey of available RSM. A preliminary survey was also conducted at INEL.

Memorandum purchase orders were placed for material and personnel support at each site. Metal Recycle provided a field portable X-ray fluorescence (XRF) instrument and operator for determination of metal alloy type. Each site provided instruments and personnel for radiological characterization. Photographic records were made of lay down areas and individual pieces. Approximate weights were estimated from measured dimensions. Data were recorded in an integrated data base (see Section 2.2).

Impediments to the progress of field surveys include site specific training requirements, limits on access to controlled areas, restrictions on moving sealed radioactive sources (XRF) and personal computers in and out of secure and controlled areas, and inclement weather.

Table 1 summarizes data for RSM stockpiled at select DOE sites.

Table 1: RSM Stockpiled at Select DOE Sites

DOE Sites	Tons
Idaho Engineering National Laboratory	907
Nevada Test Site	70
Sandia National Laboratory	31
Hanford	56
Savannah River	4,812
Los Alamos National Laboratory	Unavailable
Total	5,876

Table 2 summarizes annual burial of RSM at select DOE sites.

Table 2: Annual Burial of RSM at Select DOE Sites

DOE Site	Buried 10/92 to 9/93(tons)	Buried 10/93 to 7/94(tons)
Idaho National Engineering Laboratory		
Aluminum	39.3	32.7
Carbon steel	4.0	3.4
Stainless steel	52.4	43.6
Miscellaneous steel	26.3	22.0
Nevada Test Site Shipments received*	411.9	193.5
Sandia National Laboratory	Recycles uncontaminated metal. Does not generate RSM.	Recycles uncontaminated metal. Does not generate RSM.
Hanford*		
Aluminum	8.8	1.8
Copper	23.0	12.6
Wire	37.4	10.3
Lead	702.3	100.3
metal/Iron/Sheet/Gal	7,828.9	1,426.0
Savannah River*	Does not track metal sent for burial.	Does not track metal sent for burial.
Los Alamos National Laboratory*	1,020.9	850.8
Total	10,155.2	2,697.0

* Buries RSM and uncontaminated scrap

Ownership of stockpiled metals has not been established in many cases. Until a lay-down policy is established in support of RSM recycle, much of the stockpiled material is likely to be buried. Lacking a lay-down policy, efforts at characterization of feedstocks are likely to be wasted, since it may not be possible to maintain a chain of custody. Tables 1 and 2 may not include materials which have been set aside pending resolution of RCRA concerns, or for which there is no chain of custody.

A compilation of preliminary survey results will be published as a separate external document.

2.2 Integrated Data Base

A multi-relational database for recording, tracking, and reporting data on RSM inventories has been developed at the INEL.

RSM I&TS consists of four databases:

- location.dbf, which contains data on the location and purpose of the survey,
- radsurvey.dbf, which contains data on the types and amounts of radioisotopes on or in the metal,
- metaltyp.dbf, which contains data on the types and amounts of metal per item or storage unit, and
- change.dbf, which contains data on change of location and/or ownership of characterized lots of metal.

A site-year record identifier, residing in location.dbf, is used as the key field to relate records in the supporting databases. Up to two million records can be logged in location.dbf before the capacity of this file structure is exceeded. Additional file sets are named as file capacity is exceeded. The code is friendly enough to allow data entry in the field, yet powerful enough to support networking of information between sites.

Details on the features of the "RSM Inventory and Tracking System" (RSM I&TS) will be published in a separate external document.

2.3 Field Demonstration

In FY-94, Metal Recycle inventoried, characterized, and containerized a scrap yard at the Nevada Test Site as a demonstration of field survey methods and the RSM I&TS database.

This survey was a collaborative effort involving INEL Metal Recycle and Reynolds Engineering and Electric Co., custodian of the site surveyed.

The objective of the prototype RSM field survey was to demonstrate:

- field use of the RSM I&TS
- field survey techniques, including chemical analysis by x-ray fluorescence, gross β - γ counting, gross α counting, and use of portable scales
- sorting, sizing, and containment of similar items into lots

- containment of lots, and
- characterization of the lots for future inventory control and tracking.

RSM lots were characterized by location, prior use, metal type, weight, volume, and type and amount of radioactive contamination.

The Contaminated Materials Management Area (CMMA) at the Nevada Test Site had been used for approximately 25 years as temporary storage for uncontaminated and radioactive items.

A preliminary survey conducted in January '94 determined that the CMMA contained approximately 65 tons of RSM, approximately 50 tons being identified as stainless steel.

Prior to conducting the prototype field survey it was decided that:

- only stainless steel items would be sorted and characterized
- high molybdenum (316/317) and low molybdenum (303/304/321/347) alloys would be separated
- small items would be sorted as 'high molybdenum' without verification of alloy type
- items with hidden internal components would be excluded
- 20 foot transportainers would be used for storage and transportation of characterized RSM, and
- long pipes and flanges would be cut-to-fit using air-arc torches.

Sorting of high and low molybdenum alloys was performed since inclusion of high molybdenum feed materials would result in failure to meet chemical criteria for type 304 stainless steel. Carbon steel, copper, aluminum, and galvanized fittings were cut from vessels and valves. Items selected for size-reduction were checked before and after cutting for dispersal of radioactive contaminants.

Approximately 36.7 tons of 'low molybdenum' stainless steel was characterized and stored in five transportainers. An additional 13.4 tons of 'high molybdenum' stainless steel was characterized and stored in one transportainer. Forty percent of the items were found to have detectable levels of ⁶⁰Co, presumably from neutron activation.

At the end of the survey the transportainers were locked and tagged with barcodes generated by the RSM I&TS. Gross β - γ field at the container wall was at or below background levels.

These containers could be classified as non-radioactive for commercial transport, however, the material cannot be free-released as it is volumetrically contaminated.

Details of the prototype field survey will be included in the external document describing the RSM I&TS.

2.4 Future Activities

Metal Recycle expects to perform a complete inventory and characterization of RSM stockpiled at the Hanford and Savannah River sites in FY-95; at Sandia, Los Alamos, and Nevada Test Site in FY-96; and at Oak Ridge in FY-97.

3.0 TECHNOLOGY DEVELOPMENT

Metal Recycle has issued research contracts to Montana Tech, Oregon Graduate Institute of Science and Technology, and Colorado School of Mines for development of processes for decontamination of RSM by melt refining. These studies examine decontamination using induction, plasma, and electroslog remelt. When these studies (phase I) and production scale validations (phase II) are completed in FY-94/95, they will form a basis for technology transfer with private industry.

3.1 University Research

Phase I metal melting/refining studies have been performed at the laboratory scale using non-radioactive rare earth surrogates to mimic the behavior of radioactive contaminants. The test parameters for the melt temperatures, refining slag chemistry, furnace atmosphere and time are based on predictive, thermochemical calculations. The individual research tasks are as follows:

3.1.1 Montana Tech of the University of Montana (formerly Montana College of Mineral Science and Technology).

Work at Montana Tech has focused on induction and plasma hearth melting of carbon and stainless steels. Results show that induction melting can be performed using a variety of metallurgical slags which effectively decontaminate both carbon and stainless steels. Initial results using the plasma hearth do not match the decontamination efficiency of induction melting. Additional tests using a modified plasma hearth will be performed in FY-95.

3.1.2 Oregon Graduate Institute of Science and Technology (OGI)

Work at OGI has focused on Vacuum Arc Remelt (VAR) and Electroslog Remelt (ESR) techniques. These methods are routinely used for the refining of

premium stainless steels and nickel-based superalloys, where high cleanliness is required for corrosion and fatigue resistance. The VAR melts showed poor decontamination efficiency, and will not be pursued further. ESR results show promise for high decontamination efficiency and ingot cleanliness. ESR tests scheduled for FY-95 will optimize process parameters such as slag chemistry, power input, and melt rate.

3.1.3 Colorado School of Mines (CSM)

Work at CSM is studying electrochemical reactions in ESR technique which could drive a metal refining/decontamination reaction when there is negligible thermochemical driving force. Testing will be performed in a divided ESR cell, where anodic and cathodic reactions can be separated and quantified. The January through September contract period has been used to perform literature surveys, construct test equipment, and to write a test plan. Initial equipment check out has been successful and testing has begun.

3.2 Production-Scale Validation

Validation of phase I studies at production scale (phase II) is being performed by private industrial partners who have entered into Cooperative Research And Development Agreements (CRADA) or cost-share agreements (see Section 5.2).

Participants in phase II activities are:

- Retech, Inc. (CRADA), a manufacturer of plasma remelt furnaces
- Newport News Shipbuilding (cost-share agreement), a corporation with interest in induction melting, fabrication, and nuclear services, and
- Northwest Consortium (cost-share agreement), a consortium of researchers, nuclear utilities, metal producers, and fabricators, comprised of Oregon Graduate Institute, Portland General Electric, Sacramento Municipal Utility District, Teledyne Wah Chang Albany, Manufacturing Sciences Corporation, and Northwest Pipe and Casing.

3.2.1 Retech, Inc., Ukiah, CA.

Validation of melt decontamination studies using the plasma hearth furnace will be performed at Retech in FY-95. This work is a continuation of research conducted in FY-94 by Montana Tech.

These studies will examine the use of refining slags, oxygen- containing torch gases, and cold-hearth refractories for removal of rare earth surrogates from stainless steel feedstock. Gaseous effluents, slag, refractories, and refined metal will be sampled. A mass balance will be determined, describing the behavior of surrogates during melt refining.

Retech will supply a written report, mass balance, and process flow sheet at completion of contract.

3.2.2 Newport News Shipbuilding, Newport News, VA.

Production-scale validation melts using an induction furnace were performed at Newport News Shipbuilding on August 16 and September 29, 1994.

Samples of metal, slag, refractories, and off-gases were taken for further analysis.

Initial results confirm that rare earth surrogates can be removed by air induction melting/slag refining to levels less than one ppm. Initial surrogate levels in the feedstock were $\approx$ 270, 230 and 170 ppm for Ce, La, and Nd, respectively.

Two 4"x30"x30" ingots were cast from the refined metal. These will be rolled to plate by a major east coast conversion mill in FY-95. Mechanical tests will be performed to confirm that rolled products meet criteria for ASTM A-240.

Weld tests will be performed at Newport News in FY-95 to confirm that the recycled product can meet criteria for ASME B&PV fabrication.

Newport News will supply a written report, mass balance, and process flow sheet at completion of contract.

3.2.3 Northwest Consortium

Phase II activities with the Northwest Consortium (NWC) will take place in FY-95.

Oregon Graduate Institute will coordinate NWC activities. OGI will prepare all feedstocks for NWC demonstrations using non-radioactive surrogates to mimic the behavior of radioactive contaminants during melting/refining. OGI will also perform electroslog remelt (ESR) studies.

Manufacturing Sciences Corporation (MSC) will demonstrate vacuum induction and inductoslag remelt technologies. MSC has also expressed interest in development of ESR technologies for use at their Oakridge, TN facility.

Teledyne Wah Chang Albany (TWCA) will demonstrate vacuum arc remelt technology. TWCA will forge and roll the ingots produced during melt demonstrations at OGI and TWCA. Rolled products will meet requirements for ASTM A-240. TWCA will also quantitate the amounts of surrogate-containing oxides and scales generated during metal working processes.

Northwest Pipe and Casing will fabricate a spiral-welded stainless steel pipe from the rolled product.

The spiral-welded pipe will be fabricated into a demonstration canister for storage and disposal of vitrified radioactive waste.

The Northwest Consortium will supply a written report, mass balance, and process flow sheet for each process at completion of contract.

3.3 Rolling Activities at SMC

The Special Manufacturing Capability (SMC) was established at INEL for manufacture and assembly of depleted uranium tank armor.

In FY-94, Metal Recycle and Babcock and Wilcox, M&O contractor at SMC, initiated a project to develop rolling parameters to meet mechanical property requirements for ASTM A-240 starting with type 304 stainless steel cast ingots.

Metal Recycle supplied ingots cast from uncontaminated stainless steel scraps excessed from INEL projects. The ingots were successfully rolled to 0.250 inch thick plate using a 300 ton research rolling mill. The rolled plate was annealed to achieve ASTM A-240 mechanical properties.

Future work will evaluate potential surface enrichment of rare earth surrogates during rolling operations.

Details of these studies will be published in a separate external document.

3.4 Future Activities

Radioactive scrap metal removed from INEL projects will be converted to usable products in phase III, 'hot', demonstrations.

Size reduction and melting will be performed at the Waste Experimental Reduction Facility (WERF) in FY-95.

Ingots will be shipped from WERF to the Special Manufacturing Capability (SMC) where they will be rolled to plate or sheet.

Representative products will be manufactured from recycled RSM in FY-96.

Private industrial partners will perform all phase III activities (see Section 5.2).

4. RECYCLE CONCEPTS

The Metal Recycle program has emphasized avoidance of storage and disposal costs through beneficial reuse of RSM. This goal will not be achieved until it has been demonstrated that usable products can be produced from RSM at a competitive price.

4.1 Products for Dry Storage of Spent Fuel

Interest in dry storage of reactor fuels has increased as existing wet storage space is exceeded, as fuels experience degradation during prolonged wet storage, and as facilities are decommissioned. Dry storage has proven to be a cost-effective alternative to prolonged management of wet storage pools. Both DOE and the commercial nuclear sector have stockpiled, or will generate, RSM which could be remanufactured into dry storage canisters. Canister fabrication using recycled RSM is a win-win opportunity, since valuable resources are recovered as disposal costs are avoided.

The DOE Office of Civilian Radioactive Waste Management (OCRWM) is responsible for management of spent commercial reactor fuels. OCRWM is evaluating the use of a multipurpose canister (MPC) for storage, transport and final disposition of spent fuels. Use of the MPC limits the number of fuel transfers between reactor core and final storage site, resulting in a significant reduction in personnel exposure.

Representatives of the Metal Recycle program attended stakeholder workshops held by OCRWM in July and November, 1993, in order to champion the use of recycled RSM for fabrication of the MPC. TRW Environmental Safety Systems, M&O for the OCRWMs' Multipurpose Canister Program, has initiated a systems study addressing the use of recycled RSM for fabrication of the MPC ("The 'Green MPC' Concept", W.R. Hollaway, INMM Spent Fuel Management Seminar XI, Washington, DC, January 26-28, 1994). The Metal Recycle program has addressed most issues identified in the TRW study.

Cost estimates by INEL Metal Recycle suggest that an 11% savings could be realized if the MPC were fabricated from recycled RSM. This estimate includes a credit for resource recovery, a credit for disposal avoidance, and a return on investment for a private investor.

Potential savings are ~\$13M for disposition of DOE spent fuels, and ~\$314M for disposition of commercial spent fuels. Savings would increase with escalation of disposal costs.

This innovation has been recognized by the American Nuclear Society with a Special Award for Innovations in Long-Term Storage of Spent Nuclear Fuels ("Fabrication of Multi-purpose Canisters from Radioactive Scrap Metal", J. D. Christian, American Nuclear Society, June 21, 1994).

4.2 Standardized Low-Level Waste Box

INEL Metal Recycle initiated formation of an informal working group with the goal of defining criteria for a standardized container suitable for transportation, storage and disposal of low level radioactive waste (LLW). Three meetings were attended by representatives of seven DOE sites.

Currently, LLW containers are constructed in accord with the 'strong tight' criteria promulgated by the Department of Transportation (DOT). These containers are commonly constructed of plywood or mild carbon steel, and service life can be as short as a few years. Waste acceptance criteria for the Nevada Test Site presently allows for receipt of 27 different package designs.

It is expected that DOT will adopt more stringent packaging rules, in accord with the 1985 IAEA Safety Series 6 document, which advocates use of packaging similar to DOT type A.

The working group plans to complete a set of recommendations which could be incorporated into waste acceptance criteria for individual disposal sites.

Tentative design features include:

- 70 to 100 ft³ volume
(proposed adoption of m³ box)
- 9000 pound loaded weight limit
(forklift weight limit)
- use of integral forklift access
(≈7-10 ft³ consumed by protruding forklift risers)
- use of flush lid closure
(≈6 ft³ consumed by 3" protrusion)
- use of recycled RSM for container fabrication
(proposed use of flame-applied thermoplastic secondary barrier)

Adoption of such criteria is expected to drive standardization of LLW waste container designs and package acceptance by DOT.

This work was presented at the Workshop on Radioactive Contaminated Scrap Metal, July 12-14, 1994, Knoxville, TN, and the Transportation Management Workshop, August 8-11, 1994, Rockville, MD.

4.3 Dose Modeling at ISU

Work is being performed at Idaho State University to model the effective personnel exposure that would result if recycled RSM were used to manufacture products such as spent fuel canisters, containers for vitrified high level wastes, and low level radioactive waste boxes.

It is assumed that these products would be used in a controlled situation, under DOE or NRC oversight.

This information will be required to assure Health Physics professionals that recycled scrap products will not adversely impact government or commercial ALARA goals.

First estimates, using an isotope inventory typical of RSM removed from a reprocessing plant, indicate that the recycled products would have contact readings of 5 mR if the feedstock has a body field of less than 500 mR.

Future work will model different isotope inventories and hypothetical use scenarios.

The results of ISU dose modeling studies will be published in a separate external document.

5. PRIVATIZATION AND TECHNOLOGY TRANSFER

The primary goal of the Metal Recycle program has been to privatize an industry which will convert RSM into standardized products for management of radioactive and mixed wastes.

5.1 Employee Exchange with SEG

A personnel exchange between INEL Metal Recycle and the Scientific Ecology Group (SEG) of Oak Ridge, TN, was negotiated in early FY-94.

SEG operates the only commercial foundry for size reduction and recycle of RSM in the world. The foundry uses a 20 ton induction furnace. Hot metal is cast into shielding blocks for high-energy physics experiments. Major customers are commercial nuclear facilities, who pay a toll fee to have their RSM processed, and DOE, who purchases shielding blocks on contract.

Each company submitted resume' of employees interested in the exchange. Two employees were selected for exchange for a three month period beginning May 2nd. Glen Kessinger, Senior Scientist with INEL Metal Recycle, went to SEG, while Jeff Jansen, Metallurgical Engineer with SEG, came to the INEL.

Dr. Kessinger worked on a variety of technical problems at SEG, including surface decontamination of stainless steel containers used for storage of uranium, surface decontamination of spent fuel storage racks, surface decontamination of lead, and implementation of a program to standardize pouring temperatures in the metal casting area. Dr. Kessinger also had access to vendors supplying SEG operations and was able to visit specialty steel producers in the Oak Ridge vicinity.

Mr. Jansen participated in development of the melting and sampling procedure used for melt demonstrations at Newport News Shipbuilding, in providing information for dose modeling at Idaho State University, in cost-estimation for operation of an RSM recycling facility, and in developing a public participation plan for siting a recycle facility at INEL. Mr. Jansen also worked with Metal Recycles portable x-ray fluorescence instrument in order to assess its usefulness for feedstock segregation at SEG.

5.2 Partners for Phase II and III Demonstrations

Private industrial partners participating in phase II demonstrations using non-radioactive surrogates were identified using a notice published in the Commerce Business Daily, Issue PSA-0824, April 14, 1993.

Respondents were mailed a questionnaire requesting each companies plan for participation and the nature and magnitude of their contributions. A meeting of 15 respondents was held in Idaho Falls on August 2, 1993. A Scope of Work was sent to respondents with continued interest. CRADA or cost-share agreements were eventually signed with three of the respondents.

Private industrial partners for phase III 'hot' demonstrations will be identified using a process similar to that used to identify phase II partners.

Since these activities will involve the processing and reuse of RSM removed from INEL projects, all operations will be performed under the purview of DOE orders.

Metal Recycle will facilitate private use of DOE facilities at the INEL.

5.3 Public Participation Plan

Metal Recycle is presently developing a public participation plan to assess interest and objections to siting an RSM melting and fabrication facility at or near the INEL.

Metal Recycle believes that by providing preliminary information to interested parties, and meeting with them in small groups, relationships can be built which will help develop trust and credibility in our community.

Metal recycle will obtain concurrence of the DOE-Idaho communications division prior to implementation of the plan.

5.4 Commercialization Plans

Upon completion of phase II and III activities, university and private industrial partners will provide input which will be used for facility design and development of commercialization plans.

Inventory and market information will be used to recruit partners with interest in capitalizing a RSM recycle venture.

6. INEL METAL RECYCLE - REPRISE (SIC)

The INEL Metal Recycle program has maintained momentum despite interruptions in funding.

No funds were obligated to the Metal Recycle program the beginning of FY-95, since the program had not been assigned priority using the contractors risk-based ranking system. Metal Recycle personnel were reassigned to other programs.

In March 1994, the INEL prioritization committee authorized \$1.6M of the original request of \$2.8M. Work continued on slag refining tests at Montana Tech and Oregon Graduate Institute. CRADA and cost-share negotiations went forward with Retech, Newport News, and the Northwest Consortium. In May the budget request for the remainder of the original funding was approved, allowing CRADA, cost-share, and field survey activities to go forward.

Metal Recycle has been advised that EM-30 would not support FY-95 activities. Requests for FY-95 program support from EM-40 and EM-50 have not been successful.

Table 3 lists personnel who contributed to the INEL Metal Recycle effort FY-93/94.

Table 3: Contributors to INEL Metal Recycle Effort FY-93/94

Donna L. Barker
Tom E. Bechtold
Jerry D. Christian
Brad J. Frazee
Dorinda M. Funk
Linda D. Grant
Linda R. Harper
Jeff A. Jansen, SEG, Inc., Exchange Employee
Jim E. Jensen
Glen F. Kessinger
Gerry L. May
Ron E. Mizia
Aaron M. Newton, Summer Intern
Mike M. Ricks
Tom R. Thomas
Steve D. Wahnschaffe
Phil L. Winston

Appendix A INEL Metal Recycle External Reports

INEL Metal Recycle External Reports FY93-94:

Decontamination of Metals by Melt Refining/Slagging - An Annotated Bibliography, S. A. Worcester, L. G. Twidwell, D. J. Paolini, T. A. Weldon & R. E. Mizia, Editor, Westinghouse Idaho Nuclear Company, Inc., Idaho Falls, Idaho, 83415, report number WINCO-1138, July 1993.

Decontamination of FAST (CPP-666) Fuel Storage Area Stainless Steel Fuel Storage Racks, G. F. Kessinger, Westinghouse Idaho Nuclear Company, Inc., Idaho Falls, 83415, report number WINCO-1164, October 1993.

Evaluation of Electrorefining Technique for the Processing of Radioactive Scrap Metals, G. F. Kessinger, Westinghouse Idaho Nuclear Company, Inc., Idaho Falls, Idaho, 83415, report number WINCO-1165, October 1993.

WINCO Metal Recycle Annual Report FY93, T. E. Bechtold, Editor, Westinghouse Idaho Nuclear Company, Inc., Idaho Falls, Idaho, 83403, report number WINCO-1172, December 1993.

Engineering Study for a Melting, Casting, Rolling and Fabrication Facility for Recycling Contaminated Stainless Steel, Alpha Engineering Inc. and Centerline Engineering Corporation, under the direction of J. L. May and S. D. Wahnschaffe, Westinghouse Idaho Nuclear Company, Inc., Idaho Falls, Idaho, 83403, report number WINCO-1189, January 1994.

Radioactive Scrap Metal Market Study: Use of RSM by Electric Utility Industry for Spent Fuel Storage, Oregon Graduate Institute of Science and Technology, under direction of R. E. Mizia and S. D. Wahnschaffe, Westinghouse Idaho Nuclear Company, Inc., Idaho Falls, Idaho, 83403, report number WINCO-1190, January 1994.

Radionuclides in United States Commercial Nuclear Power Reactors, N. C. Dyer and T. E. Bechtold, Editor, Westinghouse Idaho Nuclear Company, Inc., Idaho Falls, Idaho, 83403, report number WINCO-1191, January 1994.

Decontamination of Metals by Melt Refining/Slagging: First Year Progress Report, S. A. Worcester, L. G. Twidwell, D. J. Paolini, T. A. Weldon and R. E. Mizia, Editor, Westinghouse Idaho Nuclear Company, Inc., Idaho Falls, Idaho, 83403, report number WINCO-1198, March 1994.

"Standardized LLW Box from RSM", P.L. Winston, *Proceedings of the Workshop on Radioactively Contaminated Scrap Metal*, Energy, Environment and Resources Center, University of Tennessee, Knoxville, TN, July 12-14, 1994.

"Standardized LLW Box from RSM", P.L. Winston, *Proceedings of the Transportation Management Workshop*, U. S. Department of Energy, Rockville, MD, August 8-11, 1994.

Refining Technology for the Recycling of Stainless Steel Radioactive Scrap Metals: FY-94 Biannual Report, D.G. Atteridge, J. Buckentin, J. Carter, H.L. Davis, J.H. Devletian, M.R. Scholl, R.B. Turpin, S.L. Webster and R.E. Mizia, Editor, Westinghouse Idaho Nuclear Company, Inc., Idaho Falls, Idaho, 83403, report number WINCO-1224, August 1994.

INEL Metal Recycle External Reports in Preparation:

The Montana Tech FY-94 year end report will be published as a separate external document.

The Oregon Graduate Institutes FY-94 year end report will be published as a separate external document.

The Colorado School of Mines FY-94 year end report will be published as a separate external document.

A compilation of preliminary survey results will be published as a separate external document.

Details on the features of the "RSM Inventory and Tracking System" (RSM I&TS) will be published in a separate external document.

The results of SMC rolling studies will be published in a separate external document.

The results of ISU dose modeling studies will be published in a separate external document.