WINCO-1226

UC-510

**Radioactive Scrap Metal (RSM) Inventory & Tracking System
and
Prototype RSM Field Survey**

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September 1994

**Westinghouse Idaho
Nuclear Company, Inc.**

PREPARED FOR THE
DEPARTMENT OF ENERGY
IDAHO OPERATIONS OFFICE
UNDER CONTRACT DE-AC07-84ID12435

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ACKNOWLEDGMENTS

The author wishes to thank Mr. Terry Holmes (REECo, NTS) for his role in supporting the prototype radioactive scrap metal (RSM) field survey. Mr. Holmes was responsible for identifying RSM available for characterization at the Nevada Test Site, scheduling manpower, heavy equipment, and supplies, and directing NTS personnel throughout the field operation. The author also wishes to thank Ms. Dorinda Funk and Ms. Linda Grant (both with WINCO, INEL) for conducting the preliminary metal characterization survey and Ms. Funk for her participation in the RSM field survey.

FOREWORD

One of the tasks of the WINCO Metal Recycle Program, which was initiated in FY-1992, was to develop a multiple relational database and database management code for recording and tracking DOE RSM inventories. In FY-1993, workshops were conducted with representatives from EM-30, EM-40, EM-50, EH-20, DOE-ID, WSRP, SNL, LANL, WHC, INEL, RFP, and NTS to develop a prototype set of standardized RSM field survey forms for this purpose.

In FY-1994, based on the FY-1993 efforts, a multiple relational database in dBASE IV for recording and tracking DOE RSM inventories was designed and a code written in Clipper 5.0 syntax to expedite data entry, editing, query, and reporting. Also in FY-1994, a prototype field survey was conducted at the Nevada Test Site to demonstrate the field use of the code for data collection while characterizing, sorting, and packaging 50 tons of RSM.

The RSM inventory and tracking database is being designed for complex-wide application. The database management code is intended to be user-friendly enough for data entry on portable PC in the field and powerful enough for networking of office PC throughout the DOE complex.

ABSTRACT

Based on very preliminary information, it has been estimated that the radioactive scrap metal (RSM) inventories at DOE facilities amount to about 1.5 million tons (cited in "Radioactive Scrap Metal Recycling: A DOE Assessment", by M. J. Lilly and coauthors, *Proceedings of the Tucson Symposium on Waste Management at Tucson, Arizona, March 1992*) and a much larger amount will be generated from decontamination and decommissioning of surplus DOE facilities. To implement a national DOE program for beneficial reuse of RSM, it will be necessary to know the location and characteristics of RSM inventories that are available and will be generated to match them with product demands. It is the intent of this task to provide a standardized methodology via a RSM database for recording, tracking, and reporting data on RSM inventories.

A multiple relational database in dBASE IV was designed and a PC-based code was written in Clipper 5.0 syntax to expedite entry, editing, querying, and reporting of RSM survey data. The PC based-code, the multiple relational database files, and other external files used by the code to generate reports and queries constitute a customized software application called the RSM Inventory & Tracking System (RSM I&TS). A prototype RSM field survey was conducted at the Nevada Test Site (NTS) to demonstrate the field use of the RSM I&TS and logistics of conducting the survey. During the demonstration, about 50 tons of RSM were sized, characterized, sorted, and packaged in transport containers.

SUMMARY

To develop the Radioactive Scrap Metal Inventory & Tracking System (RSM I&TS), three software packages are being used. The multiple relational database structure is set up in dBASE IV (Version 1.1), the database management code is written in Clipper 5.0, and the report formats, which include conditional queries, are generated through R&R Report Writer (DOS Xbase Edition Version 5). One of the main objectives of the RSM I&TS is to provide a menu-driven DOS-executable code for RSM data entry through electronic survey forms. Hard copies of the survey forms and relational database reports are generated through report subroutines. To use the RSM I&TS, the DOS-executable version of the RSM I&TS and the RSM database files must reside on the user's PC. However, the user does not need dBASE IV, Clipper 5.0, or R&R Report Writer software. The RSM I&TS is intended to be user-friendly enough for data entry by portable PCs in the field and powerful enough for networking by multiple PC users in the office.

The RSM I&TS currently consists of four databases which contain data on the: a) location and purpose of the survey, b) types and amounts of radioisotopes on or in the metal, c) types and amounts of metal per lot (i.e., a collective number of similar type items), and d) change of location and/or ownership of characterized lots of metal. Since this is a relational database, the records in the database for location and purpose of surveys serves as a "one-to-many" relationship in which one record may contain generic information for several hundred records which reside in one or more of the remaining three databases. This reduces the amount of redundancy that would exist if only one database were used in which the generic data would be repeated for each record in the other three databases. Further redundancy is reduced by having separate databases for the radioactive contamination and type metal surveys so that blank data fields do not exist for radioactive contamination surveys not performed (e.g., in the cases where prior knowledge indicates the scrap metal is nonradioactive).

Although it is not mandatory to develop a source code to use dBASE IV database files, a compiled source code for database management can expedite data entry, editing, querying, and report generation. Some of the advantages provided by a DOS-executable source code include:

- a) dBASE IV and Clipper 5.0 software are required only on the PC which is used to create the customized application software. The compiled RSM I&TS application and database files can be copied to and use on any other PC with DOS 3.1 or higher.
- b) Customized data entry, view, edit, query, and report screens can be designed via the application which provides menu-driven screens with user instructions and controls.
- c) Protection against inadvertent loss of records, copying over records, entry of duplicate records, and entry of invalid records can be built into the code.
- d) Special features such as networking, file and record locks, user identification access, and read only access can be added later into the customized application to expedite expanded customer use.

The RSM characterized in this project was located on the NTS in a yard called the Contaminated Materials Management Area (CMMA) which has been used for about 25 years as temporary storage for both cold and radioactive items. The CMMA is under the custodianship of Reynolds Electrical & Engineering Co (REECo) and the survey was a collaborative program between WINCO and REECo to demonstrate field techniques to characterize, sort, and package RSM for shipment and recycle.

The objective of the prototype RSM field survey was to demonstrate the field use of: 1) the RSM I&TS for data collection, 2) RSM field survey techniques with x-ray fluorescence, gross β - γ counting, and gross α counting instruments, and portable scales, 3) sorting, sizing, and containment of similar items into lots, 4) containment of lots, in this case, by transportainers, and 5) characterization of the lots for future inventory control and tracking. The RSM lots were characterized by 1) location, 2) prior use, 3) type metal, 4) weight, 5) volume, and 6) type and amount of radioactive contamination. About 13.4 tons of Type 316/317 and 36.7 tons of Type 303/304/321/347 stainless steel were characterized and stored in six transport containers (generically called transportainers in this report).

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I. INTRODUCTION

The need to address the disposition of radioactive scrap metal (RSM) in the Department of Energy (DOE) complex was reported in a paper titled "Radioactive Scrap Metal Recycling: A DOE Assessment" by M. J. Lilly (EM-40) and coauthors at the March, 1992 Tucson Waste Management Symposium. Based on very preliminary information, it was estimated that the RSM inventories at DOE facilities was about 1.5 million tons. The amount of RSM that would be generated from decontamination and decommissioning of surplus DOE facilities was unknown but was assumed to be far greater than existing RSM inventories. A standardized methodology among the DOE site complex for recording, tracking, and reporting RSM inventories at DOE facilities was recommended.

At the inception of the Westinghouse Idaho Nuclear Co. (WINCO) Metal Recycle Program in FY-1992, the DOE-Headquarters sponsors of the program indicated that a high-priority task should be developing a methodology to survey and track DOE RSM inventories. To implement a national DOE program for beneficial reuse of RSM, it would be necessary to know the location and characteristics of RSM inventories that were available and would be generated to match them with product demands. It is the intent of this task, which is one of several within the WINCO Metal Recycle Program, to provide a standardized methodology via a RSM database for recording, tracking, and reporting data on RSM inventories.

Under the auspices of the WINCO Metal Recycle Program in FY-1993, workshops were conducted with representatives from DOE-Headquarters (EM-30, EM-40, EM-50, EH-20), the DOE Idaho Operations Office, and several DOE contractors (Savannah River, Sandia, Los Alamos, Hanford, Rocky Flats, and the Nevada Test Site). The purpose of the workshops was to develop a prototype set of standardized RSM field survey forms for recording and tracking DOE RSM inventories. The collaborative effort produced hard-copy survey forms which were streamlined to expedite field use while still providing sufficient data for inventory tracking via a multiple relational database.

In FY-1994, based on input and design of the hard-copy survey forms from the FY-1993 workshops, a multiple relational database in dBASE IV was designed and a PC-based code was written in Clipper 5.0 syntax to expedite data entry, editing, querying, and reporting. The PC based-code, the multiple relational database files, and other external files used by the code to generate reports and queries constitute a customized software application called the RSM Inventory & Tracking System (RSM I&TS). A prototype RSM field survey was conducted at the Nevada Test Site (NTS) to demonstrate the field use of the RSM I&TS and logistics of conducting the survey. During the demonstration, about 50 tons of RSM were sized, characterized, sorted, and packaged in transport containers.

II. RSM INVENTORY & TRACKING SYSTEM (RSM I&TS)

To develop the RSM Inventory & Tracking System, three software packages are being used. The multiple relational database structure is set up in dBASE IV (Version 1.1), the database management code is written in Clipper 5.0, and the report formats, which include conditional queries, are generated through R&R Report Writer (DOS Xbase Edition Version 5). One of the main objectives of the RSM I&TS is to provide a menu-driven DOS-executable code for RSM data entry through electronic survey forms. Hard copies of the survey forms and relational database reports are generated through report subroutines. To use the RSM I&TS, the DOS-executable version of the RSM I&TS and the RSM database files must reside on the user's PC. However, the user does not need dBASE IV, Clipper 5.0, or R&R Report Writer software. The RSM I&TS is intended to be user-friendly enough for data entry by portable PCs in the field and powerful enough for networking by multiple PC users in the office.

1. MULTIPLE RELATIONAL DATABASE STRUCTURE

The RSM I&TS currently consists of four databases named:

- a) Location.dbf, which contains data on the location and purpose of the survey,
- b) Radsurvey.dbf, which contains data on the types and amounts of radioisotopes on or in the metal,
- c) Metaltyp.dbf, which contains data on the types and amounts of metal per lot (i.e., a collective number of similar type items),
- d) Change.dbf, which contains data on change of location and/or ownership of characterized lots of metal.

From a relational database perspective, each record in the Location.dbf has several character string data fields which require about one kilobyte of disk space per record. The records in the remaining three databases each require 240 - 450 bytes of disk space. Based on the capacity of dBASE IV file specifications to accommodate 2000 megabytes per database file, up to two million records in the Location.dbf and about four million records in each of the other three databases could be logged before exceeding dBASE IV capacity for this particular RSM I&TS multiple relational database file structure. If additional record capacity were needed at

some future date, the RSM I&TS could be modified to manage a second set of multiple relational database files with the same file structure (but different file names) and capacity as the first set.

Since this is a relational database, the records in the Location.dbf serves as a "one-to-many" relationship in which one record may contain generic information for several hundred records which reside in one or more of the remaining three databases. This reduces the amount of redundancy that would exist if only one database were used in which the data in Location.dbf would be repeated for each record in the other three databases. Further redundancy is reduced by having separate databases for the radioactive contamination and type metal surveys so that blank data fields do not exist for radioactive contamination surveys not performed (e.g., in the cases where prior knowledge indicates the scrap metal is nonradioactive).

2. DATABASE MANAGEMENT CODE

Although it is not mandatory to develop a source code to use dBASE IV files, a compiled source code for database management can expedite data entry, editing, querying, and report generation. Some of the advantages provide by a DOS-executable source code include:

- a) dBASE IV and Clipper 5.0 software is required only on the PC which is used to create the customized application software. The compiled RSM I&TS application and Location-, Radsurvey-, Metaltyp-, and Change- database files can be copied to and use on any other PC with DOS 3.1 or higher.
- b) Customized data entry, view, edit, query, and report screens can be designed via the application which provides menu-driven screens with user instructions and controls.
- c) Protection against inadvertent loss of records, copying over records, entry of duplicate records, and entry of invalid records can be built into the code.
- d) Special features such as networking, file and record locks, user identification access, and read only access can be added later into the customized application to expedite expanded customer use.

2.1 Electronic Survey Forms

The three electronic survey forms developed to date (i.e., forms for the Change.dbf are planned for FY-95) are illustrated in Tables 2.1-2.3 and titled Radioactive Scrap Metal Location & Purpose, Radioactive Contamination, and Scrap Metal Type/Quantity Survey Forms, respectively. The printed forms were generated via the R&R Report Writer subroutines built into the RSM I&TS application. The format of the printed forms are similar to that seen on the PC screen for data entry except that two-three screens are needed to display all the information. The left column of character strings in Tables 2.1-2.3 are built into the code and instruct the user on the type of data input requested. The right column of character, date, and numeric strings (in italics) represent data entered by the user and stored in the database files (i.e., Location.dbf, Radsurvey.dbf, and Metaltyp.dbf). The data shown is actual data collected during the prototype field survey at the NTS, which will be discussed later in this report.

The Site-Yr Record Identifier (first entry in Table 2.1) is used to assign a record identifier which specifies the DOE site, year, and sequential number (001-999) based on the number of prior surveys made in the current year. Upon entering the Location & Purpose Survey Form, the user is prompted to select a Site-Yr from a picklist (in this example NTS-94-). After the selection, the RSM I&TS scans the Location.dbf, finds the last record of that category entered, and inserts the next record of that category into the survey form. The Site-Yr Record Identifier is also entered into the other two survey forms (Tables 2.2 & 2.3) and serves as the key field to relate records in the three databases to each other when generating relational database queries and reports.

a. The Location & Purpose Survey Form

The RSM Location & Purpose Survey Form (Table 2.1) would be filled out in one's office prior to scheduling a RSM survey. It would serve as a work order for a planned job. If two or more portable PCs were used to collect characterization data during the survey and not connected by networking, it would be necessary to fill out two or more Location & Purpose

Table 2.1

RADIOACTIVE SCRAP METAL LOCATION & PURPOSE FORM

Site-Yr Record Identifier: *NTS-94-001*
 Sponsoring DOE/HQ Office: *EM-30*
 Sponsoring DOE/OPS Office: *ID*
 Activity Data Sheet #: *EW3120011*
 Memorandum Purchase Order #: *231255*
 Date Issued: *12/01/93*

DOE Site of Survey: *Nevada Test Site*
 Acronym: *NTS*
 Contractor Conducting Survey: *Reynolds Electric & Engineering Inc.*
 Acronym: *REECO*

Primary Contact & Phone\Fax #: *Terry Holmes* *(702) 295-0656\6530*
 Secondary Contact & Phone\Fax #: *Tom R. Thomas* *(208) 526-3086\4209*

RAD Contamination Survey (Y/N): *(Y)* Start Date: *07/11/94* End Date: *07/22/94*
 Type/Quantity Metal Survey (Y/N): *(Y)* Start Date: *07/11/94* End Date: *07/22/94*

If One of the Surveys Not Needed,
 Indicate Why:

Primary Location Descriptor: *Area 25 at NTS*
 (Facility, Area, Plant, etc.)
 Acronym: *A-25*

Secondary Location Descriptor: *Contaminated Materials Management Area*
 (Area, Building, Structure, etc.)
 Acronym: *CMMA*

Character-Numeric Identifier: *NONE*

Tertiary Location Descriptor: *none*
 (Sections, Grids, Rooms, etc.)

Prior/Current Use Description
 of RSM Location: *About 5 acres of fenced natural desert terrain. Has been used about 25 years to store variety of neutron activated and cold metal object intended for possible future reuse.*

Photographs(s) Exist or
 Will Be Made (Y/N): *(Y)* Negative #s: *WB-1655 thru WB-1715*

Update of Prior Survey (Y/N): *(N)* If Y, Prior Record:

Reason for Survey: *To characterized type and amount of contamination and metal, separate stain-less steels into high and low molybdenum content categories, & place in shipping containers for reuse.*

Type of Instruments Used:

 A. For RAD Survey: *Ludlum Model 19, Serial # 7741*
 Ludlum Model 2241, Serial # 112693

 B. For Metal Survey: *TN Technologies/Metallurgist-XR*
 Model M606

Table 2.2

RADIOACTIVE CONTAMINATION SURVEY FORM

Site-Yr Record Identifier: NTS-94-001
 Primary Location Descriptor: Area 25 on NTS
 Section, Room, Grid, etc: No Subdivision
 Item or Lot Code: BG
 Item or Lot Bar Code: NTS94001BG001
 # Item per Lot: 999
 Prior Use Codes: 01, 13, 19
TOTAL GROSS β - γ FIELD SURVEY:
 Date: 07/20/94
 Technician: Chris NMN Amaro
 Type Instrument/ Serial #: Ludlum Model 19/ SN 7741
 Ave. & Max. (mrem/hr @ 1 cm): Ave: 0.034 Max: 0.034
 Ave. BKGD in Area (mrem/hr): 0.046
TOTAL GROSS α FIELD SURVEY:
 Date: 07/08/94
 Technicians: Craig Lyons, Greg Fields
 Type Instrument/Serial #: Ludlum 2241, SN 112693
 Max. dpm/100 sq cm @ 1 cm: 0.00
TOTAL γ SCAN FIELD SURVEY:
 Date: 07/20/94
 Technician: Chris NMN Amaro
 Type Instrument/Serial #: NaI multichannel analyzer
 Radionuclide A/Max mCi: Co-60/0.00037
 Radionuclide B/Max mCi: /0.00000
 Radionuclide C/Max mCi: /0.00000

Table 2.3

SCRAP METAL TYPE/QUANTITY SURVEY FORM

Site-Yr Record Identifier:	NTS-94-001
Primary Location Descriptor:	Area 25 at NTS
Section, Room, Grid, etc:	No Subdivision
Item or Lot Code:	BG
Item or Lot Bar Code:	NTS94001BG001
# Item per Lot:	999
Prior Use Codes:	01, 13, 19
Date of Survey:	07/13/94
Technicians:	Dorinda M. Funk
Type Instrument & Serial #:	TN Technologies/XR-M606
<u>AVERAGE DIMENSIONS/LOT (cm):</u>	
Width/diam:	244
Length:	610
Height:	244
Thickness:	0
Container Volume (Cubic meter):	36.32
Fraction of Container Filled:	0.55
WEIGHT/LOT (kg):	12200.0
Weight Method Code:	5
<u>TYPE METAL DATA:</u>	
Type Metal Measurement Code:	3
Main Metal/Alloy Code:	316SS
% by Weight:	100.00
Secondary Metal/Alloy Code:	
% by Weight:	0
Photographs Taken (Y/N):	Y
Negative #'s:	WB-1655 thru WB-1715

Survey Forms with different sequential number (i.e., NTS-94-001, NTS-94-002, etc.) for each PC used and assign each operator his individual work order. This procedure would avoid creation of duplicate "Item or Lot Bar Code" numbers which are unique record identifiers generated automatically in the Radioactive Contamination and Scrap Metal Type/Quantity Survey Forms. The RSM Location & Purpose Survey Form contains a hierarchy list of categories on the RSM location which includes: a) operations office, b) DOE site, c) contractor, and d) primary, secondary, and tertiary location descriptors. Other crucial information regarding sponsors, activity data sheets, purchase orders, and contacts are included and several data entry lines are provided to indicate the description of the RSM location and reason for the survey.

b. The Radioactive Contamination & Scrap Metal Type/Quantity Survey Forms

The Radioactive Contamination and Scrap Metal Type/Quantity Survey Forms (Tables 2.2 & 2.3) contain the characterization data. If prior use knowledge or a preliminary survey indicated that a radioactivity survey were not necessary, the Radioactive Contamination Survey Form would be bypassed. A key feature of the two survey forms is the Item or Lot Bar Code which is the unique record identifier (entry # 5 in Tables 2.2 & 2.3). This identifier is generated automatically by combining the alpha-numeric value of the record identifier in the RSM Location & Purpose record with a two-character Item or Lot Code (selected by the user from a picklist illustrated in Table 2.4) and a sequential number for that item or lot (001-999). The sequential number is generated automatically by the RSM I&TS which searches the Radsurvey.dbf or Metaltyp.dbf to find the last record in the category, increments the record, and inserts the new record identifier into the survey form. This unique record identifier and bar code would be attached to the item or lot of items for future tracking.

The 7th-9th data entry fields in both the Radioactive Contamination and Scrap Metal Type Survey Forms are the Prior Use Codes. The picklist illustrated in Table 2.5 is provided in the RSM I&TS code and up to three choices can be made. In the examples given by Tables 2.2 & 2.3 for the NTS prototype field survey, the choices of 01 (never used), 13 (neutron activated), and 19 (not investigated) were selected. The remainder of the data entries in the

Table 2.4
Item or Lot Codes

<u>Code</u>	<u>Item</u>	<u>Code</u>	<u>Item</u>	<u>Code</u>	<u>Item</u>
AA	Barrel	AN	Fittings	BD	Sheet/Plate
AB	Bench	AP	Heat Exchanger	BE	Structural Support
AC	Blower	AQ	Hood	BF	Scrap-Carbon Steel
AD	Bolt/Nut	AR	Housing	BG	Scrap-Stainless Steel
AE	Box	AS	Machinery	BG	Tank
AF	Conduit	AT	Miscellaneous	BI	Tool
AG	Control Box	AU	Motor	BJ	Tubing
AH	Condenser	AV	Pipe	BK	Valve
AI	Door	AW	Pipe, Flanged	BL	Vessel
AJ	Ductwork	AX	Pump	BM	Wire (electrical)
AK	Electrical Device	AY	Rod	BN	Wire/Cable/Chain
AL	Equipment	BB	Roofing		
AM	Flange	BC	Siding		

Table 2.5
Prior Use Codes

<u>Code</u>	<u>Prior Use</u>	<u>Code</u>	<u>Prior Use</u>
01	Never Used	10	TRU Solutions/Gases/Solids
02	Non-radioactive, Non-RCRA	11	Fissile Solutions/Gases/Solids
03	Non-RCRA Inorganic Chemicals	12	Uranium Solutions/Gases/Solids
04	Non-RCRA Organic Chemicals	13	Neutron Activated
05	RCRA Inorganic Chemicals	14	Mixed LLW/RCRA Materials
06	RCRA Organic Chemicals	15	Mixed HLW/RCRA Materials
07	Tritium	16	Mixed TRU/RCRA Materials
08	LLW Solutions/Gases/Solids	17	Explosive Compounds
09	HLW Solutions/Gases/Solids	18	Unknown
		19	Not Investigated

Radioactive Contamination Survey Form deal with information on the gross β - γ , α , and radionuclide content of the metal item or lot of items. The intent of this data is to provide sufficient information for the shipping manifest and to meet the acceptance criteria of the potential recipient.

The first nine data entry fields in the Type Metal & Quantity Survey Form (Table 2.3) are identical to those in the Radioactive Contamination Survey Form. This allows one to generate the Item or Lot Bar Code via the Type Metal & Quantity Survey Form in the cases where a radioactive contamination survey is not required. The remainder of the form provides data entry fields for dimensions, container size, fraction of container filled, and weight. The Weight Method, Type Metal Measurement, and Metal/Alloy Codes are shown in Tables 2.6-2.8. These codes are selected from pop-up picklists in the RSM I&TS. In the report form illustrated in Table 2.3, the choices of Weight Method Code = 5 (Weighed), Type Metal Measurement Code = 3 (Field X-ray Analysis), and Main Metal/Alloy Code = 316SS (Type 316/317 Stainless Steel) were selected.

2.2 Menu Structure for the RSM I&TS

The menu structure, which was designed to manage the four databases (i.e., Location.dbf, Radsurvey.dbf, Metaltyp.dbf, and Change.dbf), is illustrated in Figure 2-1. The RSM I&TS is accessed by typing RSM at the DOS prompt which boots up the DOS executable file named RSM.EXE. The main menu provides a choice of six options which are: a) Location & Purpose of Surveys, b) Radioactive Contamination Surveys, c) Type Metal & Quantity Surveys, d) Change of Location/Owner Forms (to be developed), e) Report Menu, and f) Return to DOS Prompt. Options "a through d" bring up the same type of menu which guides one through the procedures for a) filling out survey forms, b) editing or viewing survey forms, c) browsing through the database in a spreadsheet format, d) printing single or groups of forms, and e) returning to the main menu. In each option, the RSM I&TS is accessing the appropriate database (i.e., Location.dbf, Radsurvey.dbf, Metaltyp.dbf, or Change.dbf) to add new records, edit or view old records, or print out records based on conditional queries.

Table 2.6
Weight Method Codes

<u>Code</u>	<u>Weight Method</u>
1	Estimated from approximate dimensions and density
2	Estimated from measured dimensions and density
3	Estimated from standard shapes, dimensions and weight/unit length
4	Obtained from records (recorded weights or standard dimensions and densities)
5	Weighed

Table 2.7
Type Metal Measurement Codes

<u>Code</u>	<u>Type Metal Measurement</u>
1	Based On Visual Examination Only
2	Available from Records
3	Field X-ray Analysis
4	Laboratory Analysis of Sample

Table 2.8
Type Metal/Alloy Codes

<u>Code</u>	<u>Metal/Alloy</u>	<u>Code</u>	<u>Metal/Alloy</u>
CS	Carbon Steel	CD	Cadmium
ZNGS	Galvanized Steel	CU	Copper
SN	Tin	CR	Chromium
304SS	Low Moly SS 303/304/321/347	HG	Mercury
316SS	High Moly SS 316/317	NI	Nickel
MIXSS	Mixed Low & High Moly SS	PG	Lead
ZIR	Zircaloy	PT	Platinum
HA	Hastelloy	TI	Titanium
IN	Inconel/Incoloy	ZN	Zinc
AL	Aluminum	ZR	Zirconium
AG	Silver	V	Vanadium
AU	Gold	BE	Beryllium

Figure 2-1. Menu Structure for the RSM I&TS

2.3 Logistics for Adding New Records

Figure 2-2 illustrates the control logistics designed into the RSM I&TS for entry of new records. Since this is a multiple relational database, it is necessary for the code to check within and among the databases to verify that the correct sequential and relational data is being entered into the indexed and relational fields.

Initially, a new record must be entered into the Location.dbf by assigning a record identifier to the RECORDID indexed field. The example given is RECORDID = INEL-94-005 which indicates the fifth record in the year 1994 at the INEL. Before the user can access the survey form for the Location.dbf, one is prompted to select a Site-Yr from a picklist. The RSM I&TS finds the last numerical entry of the Site-Yr category in the database, increments it by +001, inserts the new record identifier into the survey form, and displays a customized form for data entry. The RSM I&TS manages the Location.dbf by assuring that records are entered sequentially, prohibits duplicate record identifiers from being used, and avoids overwriting existing records.

After filling out the survey form for the Location.dbf, the user has a choice of accessing the survey form for characterizing radioactive contamination or the type & quantity of metal. If a radioactive contamination (RAD) survey is not needed, the Radsurvey.dbf is bypassed and a new record is entered into the Metaltyp.dbf as indicated on the left side of Figure 2-2. To use the Metaltyp.dbf survey form, the user must enter a valid record identifier into the relational field RECORDID. The RSM I&TS then checks in the Location.dbf to ascertain that the same record identifier exists there also before allowing the user to access the survey form for the Metaltyp.dbf. If the record identifier is valid, then some data is imported from the Location.dbf and displayed to provide verification to the user that he is working on the right job (e.g., DOE site, facility name, building name).

The RSM I&TS then builds a bar code identifier by removing the hyphens from the record identifier in RECORDID, adding a user selected two-character code (from the picklist illustrated

Figure 2-2. Logistics for Adding New Records via the RSM I&TS

in Table 2.4), finding the last sequential record in the user-selected category, incrementing it by +001 and inserting it into the survey form. The example in Figure 2-2 is BARCODE = INEL94005AB003 which refers to the third bench surveyed using the record identifier INEL-94-005 in the Location.dbf. In this manner, up to 999 items could be surveyed for each item code (in Table 2.4) and made into a unique 14 character BARCODE identifier containing INEL94005 as its first nine alpha-numeric characters. Each of these BARCODE identifiers would be in the indexed field of a record in the Metaltyp.dbf and be related to only one record (i.e, INEL-94-005) in the Location.dbf.

If a RAD survey is needed, it has priority over the type & quantity of metal survey and is conducted first. A new record is entered into the Radsurvey.dbf as indicated on the right side of Figure 2-2. All of the steps described above for accessing the Metaltyp.dbf are used to access the Radioactive Contamination Survey Form (i.e., check the Location.dbf, import data from the Location.dbf, indicate to the user he is working on the right job, and automatically build a unique bar code identifier before accessing the survey form).

After the RAD survey and assignment of a bar code to the lot of metal items, one can access the Type/Quantity Metal Survey Form (via pathway on lower right-hand corner of Figure 2-2 if: a) a valid bar code exists in the Radsurvey.dbf, b) the bar code is not found in the Metaltyp.dbf, and c) a valid relational record identifier is found in the Location.dbf. If these conditions are met, the RSM I&TS imports data from both the Location.dbf and Radsurvey.dbf and opens up the Metaltyp.dbf survey form for data entry.

3. REPORT GENERATOR

As indicated on page 2-1, the RSM I&TS reports were designed using the application software R&R Report Writer DOS Xbase Edition Version 5. R&R Report Writer is compatible with several dBASE applications which include dBASE IV, FoxBASE+, FoxPro, Clipper, Alpha Four, and Arago. R&R allows the user considerable flexibility in designing customized reports such as: a) portrait or landscape orientation, b) positioning text and data anywhere on

the page, and c) generating compressed, bold, italic, underlined, and special character fonts. Of greater importance, a) data can be drawn from several databases simultaneously, b) relational database queries can be designed via menu-driven routines, c) calculated fields based on the database fields can be added, and d) IF .. THEN conditions can be imposed on database fields which will modify the way the data is reported. After designing customized report forms and queries in R&R Report Writer, they are saved in user-named library files. To generate reports, the library files must reside on the PC along with the database files and the RSM I&TS application.

3.1 Query Options

The query options for the Location & Purpose, Radioactive Contamination, Type Metal/Quantity, and Relational Databases Reports are illustrated at the bottom of Figure 2-1. The Site-Yr-### record identifier is the key field for generating reports from the Location.dbf. The user can select an individual Location & Purpose report or a range of reports using the record identifiers. For example, if NTS-94-001 were selected, the one-page report illustrated on Table 2.1 would be generated. If NTS-94-005 through NTS-94-010 were selected, a six page report would be generated (i.e., if the records existed in the database). The other two options include reports on all records in the database by Site (e.g., enter an acronym such as INEL, NTS, ORNL, etc.) and by year (e.g., enter 94, 95, etc.).

For the remaining three type of reports, the key field for identifying the record is the bar code. The options are to request a one-page report via a bar code (e.g., NTS94001BG001 in Tables 2.2 & 2.3) or a larger report based on a range of bar codes (e.g., NTS94001BG001 through NTS94001BG006 as shown in Appendix A). The option to report all the records for a given Site-Yr is also provided (e.g., NTS94). It is anticipated that other query options and report forms will be designed with further development and use of the RSM I&TS.

3.2 Relational Database Reports

Table 2.9 illustrates a relational database report generated from the RSM I&TS. Data is linked in a relational manner among the three database files (three data fields from the Location.dbf, and five data fields from the Radsurvey.dbf and the Metaltyp.dbf) and imported into one report form. The Metaltyp.dbf is the master database and files in it are linked to relational files in the other two database. Data from the three database files (Location.dbf, Radsurvey.dbf, and Metaltyp.dbf) are identified by the headers, Location-, Radioactive-, and Metal Database Survey Data, respectively. For each record in the Metaltyp.dbf, a corresponding record was found in the Radsurvey.dbf, and only one record was found in the Location.dbf (but repeated in the report form). If no relational records had existed in the Radsurvey.dbf, the columns under the Radioactive Database Survey Data heading would have been blank.

Other special features of the report in Table 2.9 include: a) landscape-compressed printing, b) footnotes, c) greek characters in the headings, d) conditional fields under the columns Ave and Max β - γ mrem/hr and Max dpm α /100 cm² which print out zero if the count rate is $\leq$ background, e) use of scientific notation in the column under Nuclide (mCi), and f) a column of calculated fields under Volume/Lot based on four fields in the Metaltyp.dbf. As indicated in Figure 2-1, one can query the relational databases by an individual bar code, over a range of bar codes, by Site-Yr, or generate a report for all sites contained in the database.

Print Date: 08/16/94

Table 2.9

RSM INVENTORY & TRACKING RELATIONAL DATABASE REPORT

<u>Location Database Survey Data</u>			<u>Radioactive Database Survey Data</u>						<u>Metal Database Survey Data</u>			
<u>Site-Yr Identifier</u>	<u>Primary Contact</u>	<u>Primary Location Descriptor</u>	<u>Ave S-r mrem/hr^a</u>	<u>Max S-r mrem/hr^a</u>	<u>Max dpm α /100 cm2</u>	<u>Main Nuclide</u>	<u>Nuclide (mCi)</u>	<u>Bar Code</u>	<u># Items per Lot[*]</u>	<u>Volume/ Lot (m3)^{**}</u>	<u>Weight/ Lot (kg)</u>	<u>Main Metal Code</u>
NTS-94-001	Terry Holmes	Area 25 at NTS	0.00	0.00	0.00	Co-60	3.70E-04	NTS94001BG001	999	20.0	12200.0	316SS
NTS-94-001	Terry Holmes	Area 25 at NTS	0.00	0.00	0.00	Co-60	1.80E-04	NTS94001BG002	999	18.2	6129.0	304SS
NTS-94-001	Terry Holmes	Area 25 at NTS	0.00	0.00	0.00	Co-60	3.00E-04	NTS94001BG003	999	27.2	7400.0	304SS
NTS-94-001	Terry Holmes	Area 25 at NTS	0.00	0.00	0.00	Co-60	1.40E-04	NTS94001BG004	999	10.9	4540.0	304SS
NTS-94-001	Terry Holmes	Area 25 at NTS	0.00	0.00	0.00	Co-60	2.60E-04	NTS94001BG005	999	21.8	8630.0	304SS
NTS-94-001	Terry Holmes	Area 25 at NTS	0.00	0.00	0.00	Co-60	2.00E-04	NTS94001BG006	999	18.2	6630.0	304SS

^a Actual instrument readings are in database, but if <= to background, zero is displayed in report.

* 999 signifies # items were numerous but not counted.

** Volume of container times fraction of container filled.

III. PROTOTYPE RSM FIELD SURVEY

The RSM characterized in this project was located on the NTS in a yard called the Contaminated Materials Management Area (CMMA) which has been used for about 25 years as temporary storage for both cold and radioactive items. The CMMA is under the custodianship of Reynolds Electrical & Engineering Co (REECo) and the survey was a collaborative program between WINCO and REECo to demonstrate field techniques to characterize, sort, and package RSM for shipment and recycle.

Figures 3-1 and 3-2 are areal views of the CMMA located in Area 25. Most of the materials shown in Figure 3-1 (left two-thirds of the figure) are unused carbon-steel structural material which belongs to the Yucca Mountain Project (YMP) and was not included in the survey. Typical type metal items that were surveyed are shown in Figures 3-3 through 3-8 which include: a) large and medium size pipes and flanges, b) large specialty vessels and valves, and c) assorted smaller items.

1. OBJECTIVE

The objective of the prototype RSM field survey was to demonstrate the field use of: 1) the RSM I&TS described in Chapters I & II, 2) RSM field survey techniques with x-ray fluorescence, gross β - γ counting, and gross α counting instruments, and portable scales, 3) sorting, sizing, and containment of similar items into lots, 4) containment of lots, in this case, by transport containers (generically called transportainers in this report), and 5) characterization of the lots for future inventory control and tracking. The RSM lots were characterized by 1) location, 2) prior use, 3) type metal, 4) weight, 5) volume, and 6) type and amount of radioactive contamination. Based on a preliminary metal-type survey, the objective was further refined to characterized only SS scrap metal and to sort the SS by categories of low molybdenum content (Types 303/304/321/347, less than 0.09% Mo) and high molybdenum content (Types 317/317, about 2.5% Mo). These are the two most predominant categories of SS used throughout the DOE complex and would be the most likely categories for recycling purposes.

Figure 3-1. (above)
Southwest corner of Area 25
at the NTS with transportainers
in background.

Figure 3-2. (left)
View of Area 25 looking north.

Figure 3-3. View of large pipes and flanges.

Figure 3-4. View of typical size flanges, pipes, and valves.

Figure 3-5. Large stainless steel valve with motor driven actuator.

Figure 3-6. Two large specialty vessels.

Figure 3-7. View of small pipes, valves, and flanges.

Figure 3-8. View of specialty fittings.

2. PLANNING AND PRELIMINARY SURVEYS

Seven months prior to the prototype field survey, a preliminary WINCO survey of the types and amounts of metals and alloys in the CMMA was conducted (reported by D. M Funk, September 1994). It was determined that about 70% of the items were low molybdenum (303/304/321/347) and 9% were high molybdenum (316/317) stainless steels (SS). The SS were easily identified by a portable x-ray fluorescence (XRF) metal analyzer whereas most of the remaining items fell into categories of questionable readings, rusted carbon steel, and mixed metals. During the preliminary survey, photographs of the various piles of flanges and pipes were taken, and estimates on length, diameter, thickness, and number of large items were also made. Based on the preliminary survey data, it was estimated that the CMMA contained about 65 ton of RSM (i.e., not including the YMP items) and of this about 50 ton was SS.

Two months prior to conducting the RSM field survey, a meeting was held at the Nevada Test Site to plan the logistics for the survey. The key issues addressed were radiological and metal survey techniques, categories of metals to sort, sizing and handling of metals, containers for storage and shipping, weighing techniques, number and type of personnel, and sequence of operations. During the meeting, several decisions were made to expedite the field survey planned for the month of July:

- a) Only SS items would be characterized and the SS would be sorted by high and low molybdenum content. The decision was based on the preliminary WINCO survey which indicated that most of the metal items were SS and could easily be identified by the portable XRF metal analyzer. For recycling purposes, mixing of copper or unknown metals with the SS should be avoided. Therefore, only SS items which are clearly identifiable and 100% SS (i.e., no hidden internal components) would be characterized and sorted.
- b) A preliminary radioactive contamination (RAD) survey would be conducted prior to July to determine what fraction of the SS items had count levels above background

and if detectable count levels were due to surface or volumetric (activated) radionuclides. Prior records indicated that in 1991, seven items in the CMMA yard were found to contain above background beta/gamma count levels. It was not known if the survey was complete or if more items had been added since then.

- c) Six 20-foot long transportainers would be purchased for storage and shipment of the characterized RSM. Up to 20 tons of metal could be loaded into each container before the weight limit by truck and trailer would be exceeded. The intent would be to load the containers to about 10 tons each so that two could be shipped per truck. If more loading capacity would be needed, one or more of the containers could be loaded to the upper limit of 20 tons. At the conclusion of the project, the containers would be locked, tagged for identification, and stored until arrangements for melting and recycle of the SS into a new product could be made.
- d) Long pipes and flanges would be cut to fit into the 20-foot transportainers. The techniques considered were air-arc torch, mechanical, or explosive tape cutting. Air-arc torch cutting was to be the preferred technique if the items were volumetrically contaminated, and mechanical cutting if the items were surfaced contaminated. Explosive tape cutting was considered for its simplicity and speed.
- e) The empty and loaded transportainers would be weighed to determine their net RSM content via a portable scale located at the site of the survey. This would avoid having to track weights of individual items during the characterizing, sorting, and loading steps.
- f) Methods used to survey, cut, sort, move, package, weigh, seal, and tag the RSM would be documented by video and still footage.

A preliminary RAD survey was conducted in which gross β - γ counting, and gross α counting instruments were used in the field, surface smear samples were taken to the laboratory

to check β - γ and α contamination, and some metal items were subjected to γ -ray spectroscopy to determine radionuclide content. The RAD survey indicated that there were no surface contaminated items in the CMMA and about 40% of the items contained detectible but low-level volumetric Co-60 contamination via prior neutron activation. Based on the RAD survey, air-arc torch cutting was chosen and gross beta-gamma survey techniques would be applied in the field to monitor for unexpected count levels.

3. SURVEY LOGISTICS AND IMPLEMENTATION

During the first two days of the prototype field survey, large flanges and pipes were color coded red for high-molybdenum (i.e., about 2.5% in Types 316/317 SS) and green for low-molybdenum (i.e., less than 0.09 % in Types 303/304/321/347 SS) content stainless steels. The two categories were identified by stamped SS Type numbers on the end of the flanges and by readings taken with the portable XRF metal analyzer (TN Technologies/Metallurgist-XR Model M606) as shown in Figures 3-9 and 3-10. Since there were far too many small SS items such as those shown in Figures 3-7 and 3-8 to characterize via the XRF metal analyzer (i.e., about one minute is required per reading), most small items were sorted into Types 316/317 SS (i.e., high molybdenum content) without verification of SS type. It was assumed that the batch molybdenum content of recycled SS could be adjusted upward during the melting process, if necessary, due to mixing in of Type 303/304/321/347 SS.

After the initial characterization effort, parallel activities were initiated in which: a) large pipes and flanges were downsized (see Figures 3-11 and 3-12) and non-SS components (e.g., the actuator in Figure 3-5) were removed with an air-arc cutting torch , b) medium size items were hand loaded into a small front loader for transport into the transportainers (see Figures 3-13 and 3-14), c) large size items were loaded into the transportainers using a medium size forklift with a telescoping boom (see Figures 3-15 and 3-16), d) and more metal items were characterized with the XRF metal detector. Items selected for downsizing were monitored before and after cutting by a gross β - γ analyzer to check for unexpected levels of RAD activity.

Figure 3-9. Procedure for determining alloy composition.

Figure 3-10. Detector for portable x-ray fluorescence metal analyzer.

Figure 3-11. View of large pipes and flanges being down-sized to fit transporters.

Figure 3-12. Close-up of the air-arc cutting technique.

Figure 3-13. Loading small items in a front loader.

Figure 3-14. Front loader inside transportainer.

Figure 3-15. (above)
Forklift with telescoping
boom used to load large
items.

Figure 3-16. (left)
Telescoping boom placing
items to the back of the
transportainer.

Large items requiring downsizing were moved to the cutting area as indicated in Figure 3-17 rather than moving the cutting equipment around the scrap yard. This procedure reduced fire hazards and congestion of the heavy equipment deployed. Figure 3-18 shows two transportainers loaded near their target capacities and Figures 3-19 and 3-20 show the use of a large forklift to move the transportainers to the portable sensor pads for weighing. During the weighing step, Health Physicists measured the gross β - γ field at contact and three feet from the transportainers. All measurements were found to be at or below background levels.

Throughout the prototype RSM field survey, data was entered into the RSM I&TS when it became available. At the end of the survey, embossed brass identification tags with the bar code numbers assigned by the RSM I&TS were riveted to the doors of the transportainers and the doors were locked. This was done to retain integrity in the characterization data collected (i.e., no metal items can be removed or added) and to avoid having to conduct a second internal RAD survey just before the transportainers are shipped. About 13.4 tons of Type 316/317 and 36.7 tons of Type 303/304/321/347 SS were characterized and stored in six transportainers. The characterization data on the SS in the transportainers is given in Appendix A and also resides with Mr. Terry Holmes at the NTS.

Figure 3-17. Forklift hauling large items to the cutting area.

Figure 3-18. Two transportainers loaded to target capacity of about 10 tons.

Figure 3-19. Large forklift moving loaded transportainer to weigh station.

Figure 3-20. View of transportainer being positioned for weighing.

IV. CONCLUSIONS AND RECOMMENDATIONS

No major problems were encountered during the prototype RSM field survey or use of the RSM I&TS. Over a two week period, the RSM was characterized, sorted, sized, and loaded into the transportainers without discontinuity in the various stages of the operation. This was due to the extensive planning, preliminary surveys conducted, development and testing of the RSM I&TS prior to use in the field, and preparatory efforts to identify and schedule heavy equipment, manpower, and resources needed. Two minor problems identified with the use of the portable PC for data collection in the field was poor reliability and longevity of the batteries and difficulty in reading the screen outdoors. These problems could be solved by a portable power generator and use of a housing around the computer to reduce outdoor light intensity impinging on the screen.

The recommendation for future work on the RSM I&TS include:

- a) building additional query and report routines,
- b) implementing technology transfer by soliciting potential customers at INEL and other sites to adopt the code,
- c) as customers are identified, determine additional or revised data entry needs in the databases and update the RSM I&TS to accommodate the revised needs, and
- d) when enough customers have begun using the RSM I&TS, implement networking and management of a centralized integrated database.

If an integrated database accessible by networking were to be developed by several users of the RSM I&TS, it is anticipated that it would be of interest to DOE contractors, DOE, universities, and the private companies. An integrated database containing characterization data for DOE RSM would provide the information needed to match inventories with product demand and expedite the recycle of RSM.

APPENDIX A. DATA SHEETS ON THE NTS RSM FIELD SURVEY

RADIOACTIVE SCRAP METAL LOCATION & PURPOSE REPORT	A-1
RADIOACTIVE CONTAMINATION SURVEY FORMS	A-2
METAL TYPE/QUANTITY SURVEY FORMS	A-8

RADIOACTIVE SCRAP METAL LOCATION & PURPOSE REPORT

Site-Yr Record Identifier: NTS-94-001
Sponsoring DOE/HQ Office: EM-30
Sponsoring DOE/OPS Office: ID
Activity Data Sheet #: EW3120011
Memorandum Purchase Order #: 231255
Date Issued: 12/01/93

DOE Site of Survey: Nevada Test Site
Acronym: NTS
Contractor Conducting Survey: Reynolds Electric & Engineering Inc.
Acronym: REECO

Primary Contact & Phone\Fax #: Terry Holmes (702) 295-0656\6530
Secondary Contact & Phone\Fax #: Tom R. Thomas (208) 526-3086\4209

RAD Contamination Survey (Y/N): (Y) Start Date: 07/11/94 End Date: 07/22/94
Type/Quantity Metal Survey (Y/N): (Y) Start Date: 07/11/94 End Date: 07/22/94

If One of the Surveys Not Needed,
Indicate Why:

Primary Location Descriptor: Area 25 at NTS
(Facility, Area, Plant, etc.)
Acronym: A-25

Secondary Location Descriptor: Contaminated Materials Management Area
(Area, Building, Structure, etc.)
Acronym: CMMA

Character-Numeric Identifier: NONE

Tertiary Location Descriptor: none
(Sections, Grids, Rooms, etc.)

Prior/Current Use Description of RSM Location: About 5 acres of fenced natural desert terrain. Has been used about 25 years to store variety of neutron activated and cold metal object intended for possible future reuse.

Photographs(s) Exist or Will Be Made (Y/N): (Y) Negative #s: WB-1655 thru WB-1715

Update of Prior Survey (Y/N): (N) If Y, Prior Record:

Reason for Survey: To characterized type and amount of contamination and metal, separate stainless steels into high and low molybdenum content categories, & place in shipping containers for reuse.

Type of Instruments Used:

A. For RAD Survey: Ludlum Model 19, Serial # 7741
Ludlum Model 2241, Serial # 112693

B. For Metal Survey: TN Technologies/Metallurgist-XR
Model M606

RADIOACTIVE CONTAMINATION SURVEY FORM

Site-Yr Record Identifier: *NTS-94-001*

Primary Location Descriptor: *Area 25 on NTS*

Section, Room, Grid, etc: *No Subdivision*

Item or Lot Code: *BG*

Item or Lot Bar Code: *NTS94001BG001*

Item per Lot: *999*

Prior Use Codes: *01, 13, 19*

TOTAL GROSS β - γ FIELD SURVEY:

Date: *07/20/94*

Technician: *Chris NMN Amaro*

Type Instrument/ Serial #: *Ludlum Model 19/ SN 7741*

Ave. & Max. (mrem/hr @ 1 cm): Ave: *0.034* Max: *0.034*

Ave. BKGD in Area (mrem/hr): *0.046*

TOTAL GROSS α FIELD SURVEY:

Date: *07/08/94*

Technicians: *Craig Lyons, Greg Fields*

Type Instrument/Serial #: *Ludlum 2241, SN 112693*

Max. dpm/100 sq cm @ 1 cm: *0.00*

TOTAL γ SCAN FIELD SURVEY:

Date: *07/20/94*

Technician: *Chris NMN Amaro*

Type Instrument/Serial #: *NaI multichannel analyzer*

Radionuclide A/Max mCi: *Co-60/0.00037*

Radionuclide B/Max mCi: */0.00000*

Radionuclide C/Max mCi: */0.00000*

RADIOACTIVE CONTAMINATION SURVEY FORM

Site-Yr Record Identifier: NTS-94-001
Primary Location Descriptor: Area 25 on NTS
Section, Room, Grid, etc: No Subdivision
Item or Lot Code: BG
Item or Lot Bar Code: NTS94001BG002
Item per Lot: 999
Prior Use Codes: 01, 13, 19

TOTAL GROSS β - γ FIELD SURVEY:

Date: 07/20/94
Technician: Chris NMN Amaro
Type Instrument/ Serial #: Ludlum Model 19/ SN 7741
Ave. & Max. (mrem/hr @ 1 cm): Ave: 0.034 Max: 0.040
Ave. BKGD in Area (mrem/hr): 0.046

TOTAL GROSS α FIELD SURVEY:

Date: 07/13/94
Technicians: Craig Lyons, Greg Fields
Type Instrument/Serial #: Ludlum 2241, SN 112693
Max. dpm/100 sq cm @ 1 cm: 0.00

TOTAL γ SCAN FIELD SURVEY:

Date: 07/20/94
Technician: Chris NMN Amaro
Type Instrument/Serial #: NaI multichannel analyzer
Radionuclide A/Max mCi: Co-60/0.00018
Radionuclide B/Max mCi: /0.00000
Radionuclide C/Max mCi: /0.00000

RADIOACTIVE CONTAMINATION SURVEY FORM

Site-Yr Record Identifier: NTS-94-001
Primary Location Descriptor: Area 25 at NTS
Section, Room, Grid, etc: No Subdivision
Item or Lot Code: BG
Item or Lot Bar Code: NTS94001BG003
Item per Lot: 999
Prior Use Codes: 01, 13, 19

TOTAL GROSS β - γ FIELD SURVEY:

Date: 07/20/94
Technician: Chris NMN Amaro
Type Instrument/ Serial #: Ludlum Model 19/ SN 7741
Ave. & Max. (mrem/hr @ 1 cm): Ave: 0.036 Max: 0.040
Ave. BKGD in Area (mrem/hr): 0.046

TOTAL GROSS α FIELD SURVEY:

Date: 07/19/94
Technicians: Craig Lyons, Greg Fields
Type Instrument/Serial #: Ludlum 2241, SN 112693
Max. dpm/100 sq cm @ 1 cm: 0.00

TOTAL γ SCAN FIELD SURVEY:

Date: 07/20/94
Technician: Chris NMN Amaro
Type Instrument/Serial #: NaI multichannel analyzer
Radionuclide A/Max mCi: Co-60/0.00030
Radionuclide B/Max mCi: /0.00000
Radionuclide C/Max mCi: /0.00000

RADIOACTIVE CONTAMINATION SURVEY FORM

Site-Yr Record Identifier: NTS-94-001
Primary Location Descriptor: Area 25 at NTS
Section, Room, Grid, etc: No Subdivision
Item or Lot Code: BG
Item or Lot Bar Code: NTS94001BG004
Item per Lot: 999
Prior Use Codes: 01, 13, 19

TOTAL GROSS β - γ FIELD SURVEY:

Date: 07/20/94
Technician: Chris NMN Amaro
Type Instrument/ Serial #: Ludlum Model 19/ SN 7741
Ave. & Max. (mrem/hr @ 1 cm): Ave: 0.030 Max: 0.036
Ave. BKGD in Area (mrem/hr): 0.046

TOTAL GROSS α FIELD SURVEY:

Date: 07/19/94
Technicians: Craig Lyons, Greg Fields
Type Instrument/Serial #: Ludlum 2241, SN 112693
Max. dpm/100 sq cm @ 1 cm: 0.00

TOTAL γ SCAN FIELD SURVEY:

Date: 07/20/94
Technician: Chris NMN Amaro
Type Instrument/Serial #: NaI multichannel analyzer
Radionuclide A/Max mCi: Co-60/0.00014
Radionuclide B/Max mCi: /0.00000
Radionuclide C/Max mCi: /0.00000

RADIOACTIVE CONTAMINATION SURVEY FORM

Site-Yr Record Identifier: NTS-94-001

Primary Location Descriptor: Area 25 at NTS

Section, Room, Grid, etc: No Subdivision

Item or Lot Code: BG

Item or Lot Bar Code: NTS94001BG005

Item per Lot: 999

Prior Use Codes: 01, 13, 19

TOTAL GROSS β - γ FIELD SURVEY:

 Date: 07/20/94

 Technician: Chris NMN Amaro

 Type Instrument/ Serial #: Ludlum Model 19/ SN 7741

Ave. & Max. (mrem/hr @ 1 cm): Ave: 0.032 Max: 0.032

Ave. BKGD in Area (mrem/hr): 0.046

TOTAL GROSS α FIELD SURVEY:

 Date: 07/19/94

 Technicians: Craig Lyons, Greg Fields

 Type Instrument/Serial #: Ludlum 2241, SN 112693

Max. dpm/100 sq cm @ 1 cm: 0.00

TOTAL γ SCAN FIELD SURVEY:

 Date: 07/20/94

 Technician: Chris NMN Amaro

 Type Instrument/Serial #: NaI multichannel analyzer

 Radionuclide A/Max mCi: Co-60/0.00026

 Radionuclide B/Max mCi: /0.00000

 Radionuclide C/Max mCi: /0.00000

RADIOACTIVE CONTAMINATION SURVEY FORM

Site-Yr Record Identifier: NTS-94-001
Primary Location Descriptor: Area 25 at NTS
Section, Room, Grid, etc: No Subdivision
Item or Lot Code: BG
Item or Lot Bar Code: NTS94001BG006
Item per Lot: 999
Prior Use Codes: 01, 13, 19

TOTAL GROSS β - γ FIELD SURVEY:

Date: 07/20/94
Technician: Chris NMN Amaro
Type Instrument/ Serial #: Ludlum Model 19/ SN 7741
Ave. & Max. (mrem/hr @ 1 cm): Ave: 0.034 Max: 0.034
Ave. BKGD in Area (mrem/hr): 0.046

TOTAL GROSS α FIELD SURVEY:

Date: 07/19/94
Technicians: Craig Lyons, Greg Fields
Type Instrument/Serial #: Ludlum 2241, SN 112693
Max. dpm/100 sq cm @ 1 cm: 0.00

TOTAL γ SCAN FIELD SURVEY:

Date: 07/20/94
Technician: Chris NMN Amaro
Type Instrument/Serial #: NaI multichannel analyzer
Radionuclide A/Max mCi: Co-60/0.00020
Radionuclide B/Max mCi: /0.00000
Radionuclide C/Max mCi: /0.00000

SCRAP METAL TYPE/QUANTITY SURVEY FORM

Site-Yr Record Identifier: *NTS-94-001*

Primary Location Descriptor: *Area 25 at NTS*

Section, Room, Grid, etc: *No Subdivision*

Item or Lot Code: *BG*

Item or Lot Bar Code: *NTS94001BG001*

Item per Lot: *999*

Prior Use Codes: *01, 13, 19*

Date of Survey: *07/13/94*

Technicians: *Dorinda M. Funk*

Type Instrument & Serial #: *TN Technologies/XR-M606*

AVERAGE DIMENSIONS/LOT (cm):

Width/diam: *244*

Length: *610*

Height: *244*

Thickness: *0*

Container Volume (Cubic meter): *36.32*

Fraction of Container Filled: *0.55*

WEIGHT/LOT (kg): *12200.0*

Weight Method Code: *5*

TYPE METAL DATA:

Type Metal Measurement Code: *3*

Main Metal/Alloy Code: *316SS*

% by Weight: *100.00*

Secondary Metal/Alloy Code: *0*

% by Weight: *0*

Photographs Taken (Y/N): *Y*

Negative #'s: *WB-1655 thru WB-1715*

SCRAP METAL TYPE/QUANTITY SURVEY FORM

Site-Yr Record Identifier: NTS-94-001
Primary Location Descriptor: Area 25 at NTS
Section, Room, Grid, etc: No subdivision
Item or Lot Code: BG
Item or Lot Bar Code: NTS94001BG002
Item per Lot: 999
Prior Use Codes: 01, 13, 19

Date of Survey: 07/13/94

Technicians: Dorinda M. Funk

Type Instrument & Serial #: TN Technologies/XR-M606

AVERAGE DIMENSIONS/LOT (cm):

Width/diam: 244
Length: 610
Height: 244
Thickness: 0

Container Volume (Cubic meter): 36.32
Fraction of Container Filled: 0.50

WEIGHT/LOT (kg): 6129.0
Weight Method Code: 5

TYPE METAL DATA:

Type Metal Measurement Code: 3

Main Metal/Alloy Code: 304SS
% by Weight: 100.00

Secondary Metal/Alloy Code:
% by Weight: 0

Photographs Taken (Y/N): Y
Negative #'s: WB-1655 thru WB-1715

SCRAP METAL TYPE/QUANTITY SURVEY FORM

Site-Yr Record Identifier: *NTS-94-001*

Primary Location Descriptor: *Area 25 at NTS*

Section, Room, Grid, etc: *No Subdivision*

Item or Lot Code: *BG*

Item or Lot Bar Code: *NTS94001BG003*

Item per Lot: *999*

Prior Use Codes: *01, 13, 19*

Date of Survey: *07/19/94*

Technicians: *Dorinda M. Funk*

Type Instrument & Serial #: *TN Technologies/XR-M606*

AVERAGE DIMENSIONS/LOT (cm):

Width/diam: *244*

Length: *610*

Height: *244*

Thickness: *0*

Container Volume (Cubic meter): *36.32*

Fraction of Container Filled: *0.75*

WEIGHT/LOT (kg): *7400.0*

Weight Method Code: *5*

TYPE METAL DATA:

Type Metal Measurement Code: *3*

Main Metal/Alloy Code: *304SS*

% by Weight: *100.00*

Secondary Metal/Alloy Code: *0*

% by Weight: *0*

Photographs Taken (Y/N): *Y*

Negative #'s: *WB-1655 thru WB-1715*

SCRAP METAL TYPE/QUANTITY SURVEY FORM

Site-Yr Record Identifier: NTS-94-001
Primary Location Descriptor: Area 25 at NTS
Section, Room, Grid, etc: No Subdivision
Item or Lot Code: BG
Item or Lot Bar Code: NTS94001BG004
Item per Lot: 999
Prior Use Codes: 01, 13, 19

Date of Survey: 07/19/94

Technicians: Dorinda M. Funk

Type Instrument & Serial #: TN Technologies/XR-M606

AVERAGE DIMENSIONS/LOT (cm):

Width/diam: 244
Length: 610
Height: 244
Thickness: 0

Container Volume (Cubic meter): 36.32
Fraction of Container Filled: 0.30

WEIGHT/LOT (kg): 4540.0
Weight Method Code: 5

TYPE METAL DATA:

Type Metal Measurement Code: 3

Main Metal/Alloy Code: 304SS
% by Weight: 100.00

Secondary Metal/Alloy Code:
% by Weight: 0

Photographs Taken (Y/N): Y
Negative #'s: WB-1655 thru WB-1715

SCRAP METAL TYPE/QUANTITY SURVEY FORM

Site-Yr Record Identifier: *NTS-94-001*

Primary Location Descriptor: *Area 25 at NTS*

Section, Room, Grid, etc: *No Subdivision*

Item or Lot Code: *BG*

Item or Lot Bar Code: *NTS94001BG005*

Item per Lot: *999*

Prior Use Codes: *01, 13, 19*

Date of Survey: *07/19/94*

Technicians: *Dorinda M. Funk*

Type Instrument & Serial #: *TN Technologies/XR-M606*

AVERAGE DIMENSIONS/LOT (cm):

Width/diam: *244*

Length: *610*

Height: *244*

Thickness: *0*

Container Volume (Cubic meter): *36.32*

Fraction of Container Filled: *0.60*

WEIGHT/LOT (kg): *8630.0*

Weight Method Code: *5*

TYPE METAL DATA:

Type Metal Measurement Code: *3*

Main Metal/Alloy Code: *304SS*

% by Weight: *100.00*

Secondary Metal/Alloy Code:

% by Weight: *0*

Photographs Taken (Y/N): *Y*

Negative #'s: *WB-1655 thru WB-1715*

SCRAP METAL TYPE/QUANTITY SURVEY FORM

Site-Yr Record Identifier: NTS-94-001

Primary Location Descriptor: Area 25 at NTS

Section, Room, Grid, etc: No Subdivision

Item or Lot Code: BG

Item or Lot Bar Code: NTS94001BG006

Item per Lot: 999

Prior Use Codes: 01, 13, 19

Date of Survey: 07/19/94

Technicians: Dorinda M. Funk

Type Instrument & Serial #: TN Technologies/XR-M606

AVERAGE DIMENSIONS/LOT (cm):

Width/diam: 244

Length: 610

Height: 244

Thickness: 0

Container Volume (Cubic meter): 36.32

Fraction of Container Filled: 0.50

WEIGHT/LOT (kg): 6630.0

Weight Method Code: 5

TYPE METAL DATA:

Type Metal Measurement Code: 3

Main Metal/Alloy Code: 304SS

% by Weight: 100.00

Secondary Metal/Alloy Code:

% by Weight: 0

Photographs Taken (Y/N): Y

Negative #'s: WB-1655 thru WB-1715