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Enhancement of the Nuclear Materials Management and Safeguards System

Final Report

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ABSTRACT

The Nuclear Regulatory Commission (NRC) awarded a competitive contract to Boeing Computer Services Company to implement specific recommendations developed under the Enhancement of the Nuclear Materials Management and Safeguards System (ENRAS) contract, NRC-02-78-083, and to perform analysis in other specified areas of safeguards concern. The results of the activities of this contract were the production of program specifications for enhancements to the Nuclear Materials Management and Safeguards System (NMMSS) in the areas of inventory difference and authorized possession limit data; the production of acceptance test procedures for testing the implemented capability; an analysis of the NMMSS Safeguards Monitor (SM-1) report and recommendations for its improvement; the production of program specifications for enhancements to the NMMSS SM-1 report based on selected recommendations; an analysis of NMMSS shipper-receiver difference data processing; the production of a safeguards user's manual containing NMMSS reports related to analysis performed under this contract. This activity is part of NRC's effort to continuously enhance their nuclear materials accounting system.

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1.0 INTRODUCTION

A competitive contract entitled "Enhancement of the Nuclear Materials Management and Safeguards System" was awarded to Boeing Computer Services Company in September 1979. This report summarizes the work done under each task of the contract, and contains the results and recommendations developed. The appendices contain the program specifications which were delivered earlier in the contract. A Safeguards User's Manual is bound separately.

This section provides an introduction to the purpose and objectives of the project. Section 1.1 discusses background developments which led to the initiation of this project by NRC. The objectives and scope of the specific tasks of the project are discussed in Section 1.2. An overview to the remainder of the report is provided in Section 1.3.

1.1 BACKGROUND

The Nuclear Regulatory Commission (NRC) has been chartered* with the responsibility for regulating all domestic facilities licensed to possess nuclear material. Among other responsibilities, NRC must assure adequate safeguarding of fissionable nuclear and source material against unauthorized diversion or loss. As a part of the regulatory control exercised by NRC in accomplishing these responsibilities, information is maintained on the quantities and types of nuclear material possessed by each licensee unless the quantities involved are quite small.

Traditionally, NRC has relied on the Nuclear Materials Management and Safeguards System (NMMSS) operated in Oak Ridge, Tennessee by Union Carbide Corporation (UCC) to provide information about transfers of nuclear material between licensed facilities and inventory balances of nuclear material at each facility.

NMMSS receives reports from licensees regarding shipments and receipts of nuclear material by a licensed facility and stores these in an automated transaction data base. Periodic reports of inventoried quantities of nuclear material are also reported to NMMSS by the licensees. NMMSS maintains records of nuclear material based on these

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*The Energy Reorganization Act of 1974 split the Atomic Energy Commission (AEC) into NRC and the Energy Research and Development Administration (ERDA), a predecessor of DOE. "NRC" as used in this report refers to the Nuclear Regulatory Commission created in January 1975 and the predecessor of the NRC in the AEC, the Office of Regulation.

inputs and produces reports which allow safeguards analysts to compare the reported inventory quantities of material against the quantities of material shipped and received.

Although the primary data maintained by NMMSS is received from NRC licensees, NMMSS maintains a number of background data files which contain information supplied by NRC personnel. These background files contain information about the licensees, facilities, and conditions of the license. The transaction data base, the book balances of nuclear material, and the background data files constitute the fundamental data captured, stored, and processed by NMMSS. The value of the information reports produced by NMMSS is a function of the correctness and currency of the data stored in these automated data bases.

As NRC requirements for information to provide adequate safeguarding of fissionable nuclear material evolved, a need for more frequent reporting of information from licensees was identified for plutonium, uranium-233, and High-Enriched Uranium, (HEU; > 20% U-235). In addition, a need was identified to maintain more detailed information regarding the location of Special Nuclear Materials (SNM) within licensee facilities. As a result of these increased informational needs, a second NRC data base was developed, starting in 1974, by NRC's Office of Inspection and Enforcement (OI&E). The OI&E data base was compiled from voluntary licensee reports made to the appropriate Regional Offices of OI&E. Regional Offices transfer the data to OI&E at NRC Headquarters, and there they are assimilated into a document called the Office of Inspection and Enforcement Safeguards Status Report. An automated system called the Safeguards Status Reporting System (SSRS) is used to process and produce much of the information for the Safeguards Status Report.

Although the two systems, NMMSS and SSRS, collect, store, analyze, and report information about the same data (i.e., nuclear material inventories of NRC licensees), the data collected by the two systems differ in such detail as reporting frequency, material enrichment and reporting area (plant, facility, or material balance area level). For this reason, it is not straight forward to compare the material inventory balances and other data reported by the two systems.

NRC is involved in a continuing effort to enhance their nuclear material accounting systems. This project was a part of this effort. It followed from a previous project, "Enhancement of the Nuclear Reporting and Analysis System (ENRAS)." A brief overview of the two projects is presented below.

1.1.1 Enhancement of the Nuclear Reporting and Analysis System Project

NRC, in its continuing effort to maintain accurate nuclear material accounting information for safeguards purposes, identified a number of apparent data inconsistencies in the information stored in the two nuclear material information systems. Additionally, it was known that some of the data in the background data files used by the NMMSS system had not been updated recently. In September 1978, a contract was awarded to perform analysis in these areas (Contract NRC-02-78-083). Results of this work showed that many of the apparent inconsistencies are the result of reporting system procedures, which make comparison of the data difficult and prone to misinterpretation.

1.1.2 Enhancement of the Nuclear Materials Management and Safeguards System Project

To ensure that the problems identified under the previous contract and similar types of problems do not recur, NRC identified four concurrent approaches:

- Implement specific procedural changes to reduce problems of data interpretation and data inconsistencies;
- Design and implement NMMSS system changes to complement procedural changes;
- Document NMMSS procedures to facilitate an understanding of the meaning of the information available from NMMSS reports as well as limitations on the kinds of information NMMSS can provide;
- Analyze other selected NMMSS data to enhance and maintain the quality assurance of the data base.

As a first step in implementing these approaches, NRC initiated a contract to Enhance the Nuclear Materials Management and Safeguards System. The objectives and scope of this contract are discussed in the following section.

1.2 PROJECT OBJECTIVES AND SCOPE

The prior contract (NRC-02-78-083) addressed two specific areas of NMMSS: inventory difference (ID) data and authorized possession limit (APL) data. As a result of analysis of actual data, an assessment of the problems of data interpretation and data inconsistencies was made. Various alternatives to the solution of the problem were considered, and procedural and system changes were recommended.

NRC reviewed the project results and made a decision to implement selected recommendations in the areas of ID and APL data. NRC then awarded a second contract (NRC-02-79-050) to design the NMMSS system changes which would be required to implement the recommendations. The enhancement development stages for ID and APL data are depicted in Figure 1-1. As shown, the design activity has been completed; the next step is for Union Carbide Corporation (UCC) to develop the operational design and to implement the system enhancements. After NRC accepts the implemented capability, UCC may load the historical data and the enhanced capability will become operational.

In addition to preparing ID and APL enhancements for implementation, this project addressed two other areas of safeguards significance in NMMSS--the Safeguards Monitor (SM-1) report and Shipper-Receiver Difference (SRD) data. Analysis in these two areas identified some changes which would further enhance the quality of the NMMSS data base. Following the same sequence of steps as was used to develop the ID and APL enhancements, several alternatives were developed and recommendations were formulated. Figure 1-1 depicts the development stages addressed under this contract for the SM-1 report and for SRD data.

As a final activity of this project, current NMMSS reports related to the four areas of nuclear material accounting--ID, APL, SM-1, SRD--addressed under the contract were documented in the form of a Safeguards User's Manual.

These activities are all a part of NRC's integrated, sequential approach to continuously enhance their nuclear materials accounting system.

1.3 REPORT OVERVIEW

The remainder of this report summarizes the work performed for each activity. Section 2.0 discusses the approach to the preparation of the ID and APL program specifications (Tasks 1 and 2) and presents the results of the analysis performed. Also presented in Section 2.0 is a summary of the historical ID data collection/preparation process (Task 1). Section 3.0 discusses the preparation of the Safeguards User's Manual (Task 3). Section 4.0 discusses threshold values, analysis, and safeguards indicators used in the SM-1 report (Task 4). The recommendations developed as a result of the analysis are also presented. Section 5.0 provides a full description of problem areas in the NMMSS shipper-receiver difference data processing. Section 5.0 also discusses recommended approaches for improving the SRD data analysis in NMMSS, and other recommendations resulting from work under Task 5.

Figure 1-1

Enhancement Development Stages Accomplished for the Four Safeguards Areas Addressed Under this Contract

The appendices contain the program specifications developed in Tasks 1, 2 and 4 and the acceptance test developed in Tasks 1 and 2. The Safeguards User's Manual from Task 3 is provided as a separately bound document.

2.0 NMMSS ENHANCEMENTS

The recommendations for enhancements to NMMSS in the areas of inventory difference (ID) and authorized possession limit (APL) data were documented at the user level during the ENRAS project. The thrust of this activity of the contract was to further define at the operational level all aspects of the enhancements necessary to ensure successful implementation, and prepare program specifications. The approach employed is presented in Section 2.1. Sections 2.2 and 2.3 address the impact of implementing the enhancements, and describe the new and enhanced NMMSS reports which will subsequently be available.

As a result of work performed under the previous contract, historical data are available to utilize the NMMSS APL enhancements. As a part of work performed under this contract, associated ID data were collected and prepared for input. This effort is summarized in Section 2.4.

2.1 METHOD OF APPROACH

The four ID enhancements are:

- Provide for identification of ID enrichment in NMMSS;
- Provide for recording a reference to the original data source of the ID transaction;
- Provide for recording a reference between the date the inventory was performed and the ID entry;
- Provide for recording the components of ID.

The three APL enhancements are:

- Provide for maintaining historic data on SNM APLs;
- Provide for maintaining data on SM APLs;
- Expand the set of data elements maintained on APLs.

A comprehensive approach was employed to assure NRC analysts that NMMSS will be responsive to these needs for ID and APL information. Briefly, the approach was to:

1) Develop a detailed description of each modification to ensure that the requirement is clearly defined;
2) Prepare program specifications which communicate implementation requirements based on NRC approval of the descriptions;
3) Prepare acceptance tests based on the requirements contained in the specification documents.

Each of these steps is discussed below.

2.1.1 Develop Description of Modifications

A detailed narrative description was developed for each modification. This served two purposes:

- Ensuring that all aspects of the use of the data were addressed before the program specifications were written; and
- Providing NRC a basis on which to approve in advance the capabilities to be implemented.

Each modification description addressed the reports to be enhanced and new reports to be produced as a result of the NMMSS modification, the associated impact on licensee reporting, and the projected impact on NMMSS data preparation and input.

2.1.2 Prepare Program Specifications

A program specification is a means of rigorously communicating a requirement (e.g., NRC's requirement for enhanced ID and APL information) to those who will implement the system modifications to provide the enhanced capability. Further, it is unambiguous; NRC and UCC receive the same understanding of the requirement to be satisfied. As a result of the effort concentrated on obtaining a clear and detailed description of the modifications at the onset, the preparation of the more rigorous format of the program specifications was a straight forward task.

There exist several standards for the content of a specification document depending on the application. The outline shown in Figure 2-1 was chosen as the most appropriate one for this application. This resulted in specification documents that were both detailed enough to ensure implementation of the desired capability, and at a level high enough that UCC has the latitude to implement the capability consistent with their standard practices. While NRC is in the best position to define their requirements, UCC possesses the detailed understanding of NMMSS required to determine the most efficient method of physically implementing the capability.

Throughout the process of preparing the specification documents, both NRC and UCC were involved in review of the outline and final documents. The resulting Specification Document for Enhancements Related to Inventory Difference Data in NMMSS and the Specification Document for Enhancements Related to Authorized Possession Limit Data in NMMSS are included in Appendices A and B respectively.

DESCRIPTION

- List of NMMSS Modifications
- NRC/DOE Forms
- Summary of Other Methods by which ID/APL Data Arrive at NMMSS
- NMMSS Reports
- New NMMSS Reports

DESIGN OBJECTIVES/FUNCTIONS

- External Design Objectives
- Internal Design Objectives

PERFORMANCE REQUIREMENTS

OPERATING ENVIRONMENT

DESIGN CHARACTERISTICS

- Design Characteristics of Each of the Enhancements
- Summary of Report Enhancements

Figure 2-1 -- Contents of the Specifications Documents.

2.1.3 Prepare Acceptance Tests

The specification documents provide the basis for acceptance testing of the implemented capability. Accordingly, the requirements set forth in the specification documents were the basis for what is contained in the Test for Acceptance of Enhancements Related to Inventory Difference Data and Authorized Possession Limit Data in NMMSS (included as Appendix C). This document contains all of the information required by NRC to conduct the acceptance tests.

The acceptance test document should become a complete record of the implementation of the ID and APL enhancements. It should evolve to provide backup documentation of the history of and basis for acceptance of the capability by NRC. The structure of the document lends itself to this working nature. It describes the test plan. It also references the documentation of the requirements (specification documents), and contains the test data to be used and the expected results. As the tests are performed the test results (vs. the expected results) should be documented.

2.2 IMPACT OF ENHANCEMENTS

When preparing specifications for changes to any system, decisions concerning the method of implementation must address the impact that the modifications will have on current operating procedure. Accordingly, the program specifications prepared during this project address the impact (or state that no adverse impact exists) on NRC, the licensees who report the data, UCC, and the NMMSS system itself. The conclusions reached are summarized in this section.

2.2.1 Impact on NRC

Implementing this new capability will have no direct impact on NRC. The maximum requirement on NRC will be to ensure that procedures are established within NRC to regularly update and maintain the enhanced APL capability, and to ensure the quality of the data in NMMSS relative to the enhanced ID capability.

2.2.2 Impact on the Licensee

The impact on the licensee will depend upon the extent to which NRC requires reporting of the additional data. NRC may recognize immediate and complete benefit from several of the enhancements without altering the reporting requirements. These enhancements are:

- Provide for recording a reference to the original data source of the ID transaction;
- Provide for maintaining historic data on SNM APLs;
- Provide for maintaining data on SM APLs;
- Expand the set of data elements maintained on APLs.

The benefit that NRC receives from the remaining three ID enhancements will vary. If NRC chooses not to levy additional reporting requirements, licensees continued their present submission practices, and any data reported on a voluntary basis can be captured and some benefit received from the capability.

If NRC chooses to require that the additional data be reported, the impact on the licensee will be minimal because licensee records are already kept to the level required to:

- Provide for identification of ID enrichment in NMMSS;
- Provide for recording a reference between the date the inventory was performed and the ID entry;
- Provide for recording the components of ID.

Therefore, if this requirement were added, it would simply be a matter of reporting the data. In some cases, NRC's currently planned reporting changes will satisfy the requirement.

The specification documents address the methods of reporting the associated data.

2.2.3 Impact on UCC

In some cases, new data will be arriving at NMMSS. In others, data which was not previously input will now be captured. NMMSS data preparation and data input personnel must be made aware of the procedures concerning the preparation and capture of these data. Since the data are closely aligned with the information currently being captured, it is not envisioned that new requirements will have a significant impact on data preparation and input.

Details are addressed in the respective specification documents.

2.2.4 Impact on NMMSS

Part of the design objectives set forth in the specification document calls for UCC to provide the capability in a way compatible with current NMMSS processing of data without significantly impacting the existing NMMSS processing environment.

2.3 NRC BENEFITS

As a result of the expanded NMMSS capability in ID and APL data, NRC analysts will receive enhanced NMMSS reports as well as new reports which more precisely define and organize the data to be reviewed. The NMMSS modifications in the area of ID data will allow six types of report enhancements. In Figure 2-2, these report enhancements are mapped to the NMMSS reports on which they will be available. The first six NMMSS reports listed are currently produced. The program specifications define the way in which NRC/UCC may modify these reports to incorporate the indicated enhancements. The last three NMMSS reports are new reports which will provide increased data sort and display capability to the safeguards analysts. Figure 2-3 summarizes the benefits of the increase of ID capability which will be provided by each of the reports. Figures 2-4 and 2-5 show in a similar fashion the report enhancements and benefits, respectively, which will be received in the area of APL.

More detail on the specific reports, including a discussion of each proposed new report may be found in the respective specification documents.

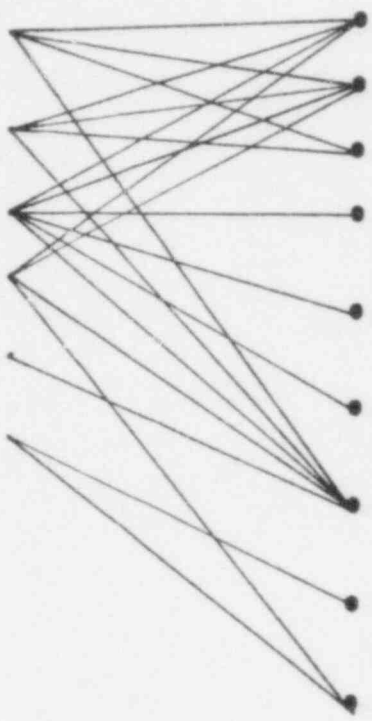
2.4 HISTORIC ID DATA COLLECTION/PREPARATION

After the enhanced capability discussed previously in this section becomes available in NMMSS, future incoming data will be prepared and input as a part of the routine data entry process. However, for periods prior to the implementation date, an historical data retrofit activity must be performed in order to utilize the enhanced capability. The necessary historical APL data were made available to NRC as a part of analysis performed on the ENRAS contract. The necessary historical ID data were previously delivered in proper form for key punching. The ID data collection activity is summarized in this section.

The source of the historical ID data was the analysis and working papers which were compiled and delivered to NRC as backup material for analysis performed on the ENRAS contract. It was not possible to verify (i.e. locate and analyze licensee and regional documentation for) all ID entries for all facilities addressed under the contract, but as entries were verified, the information was recorded in the working papers.

REPORT ENHANCEMENTS

- Display Indication of Original Data Source
- Display Enrichment Category (LEU, HEU)
- Summarize by ID Enrichment Category
- Select on Date of Actual ID Occurrence
- List all Occurrences of ID for a Facility
- List Components of ID Entries



NMMSS REPORTS

- TJ-5; On-Site Gains and Losses
- TJ-14A; Facility Transaction Schedule
- TJ-45; Transaction Journal
- M-70; Material Losses & Ending Inventories
- M-742; Detailed Material Balance Report
- M-50; Concise Material Balance Report
- New Report; List all Occurrences of ID for a Facility
- New Report; Display Components of ID on Process Date
- New Report; Display Components of ID on Actual Occurrence Date

Figure 2-2--Display of NMMSS ID Report Enhancements

NRC BENEFITS

- Ease Validation of Entires
- Allow Comparison of NMMSS Data With Other ID Records (SSRS)
- Identify Occurrence of ID With Actual Time Period
- Provide Complete Facility ID Picture
- Support S/G ID Trend Analysis

NMMSS REPORTS

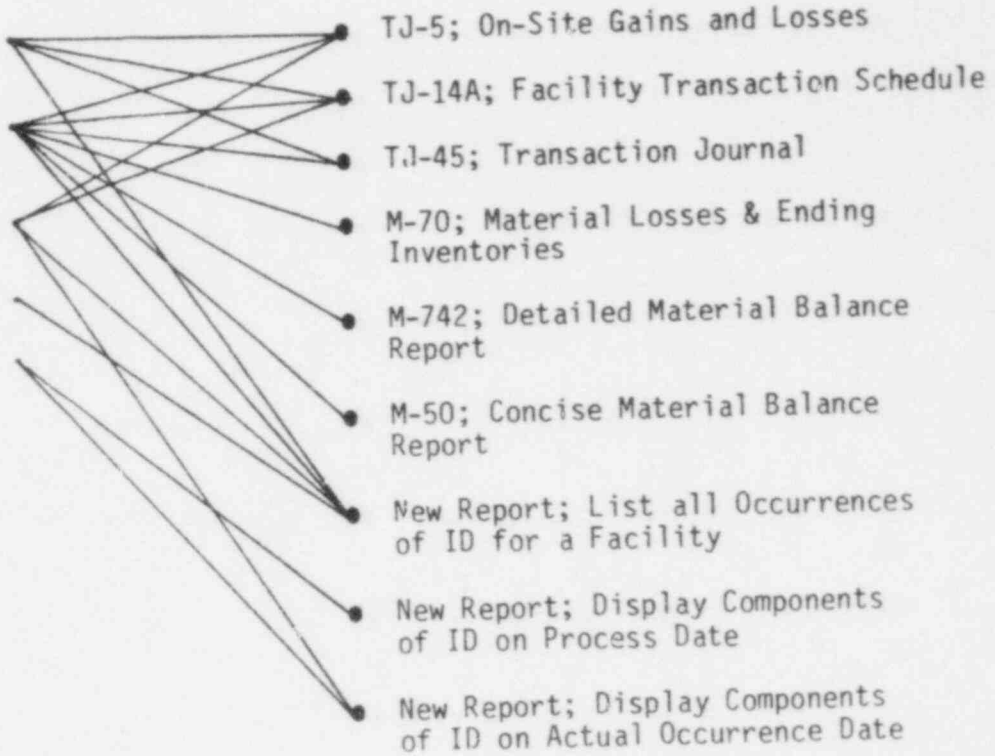


Figure 2-3--Benefits of the Enhanced ID Reports

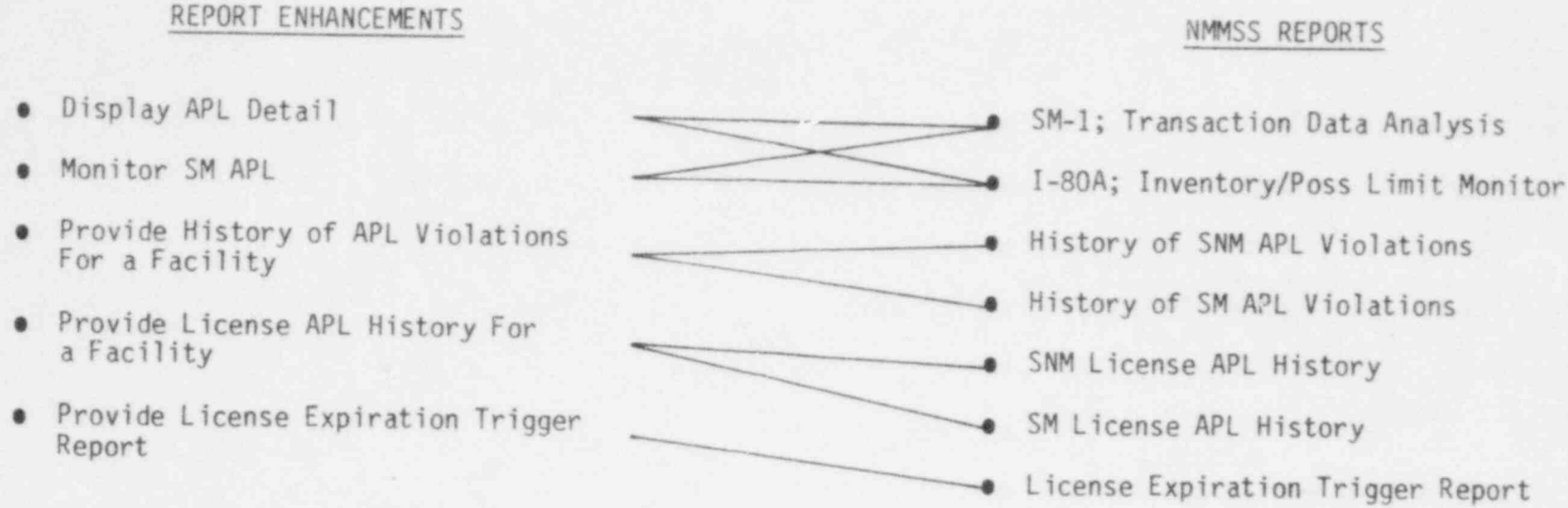


Figure 2-4--Display of NMMSS APL Report Enhancements

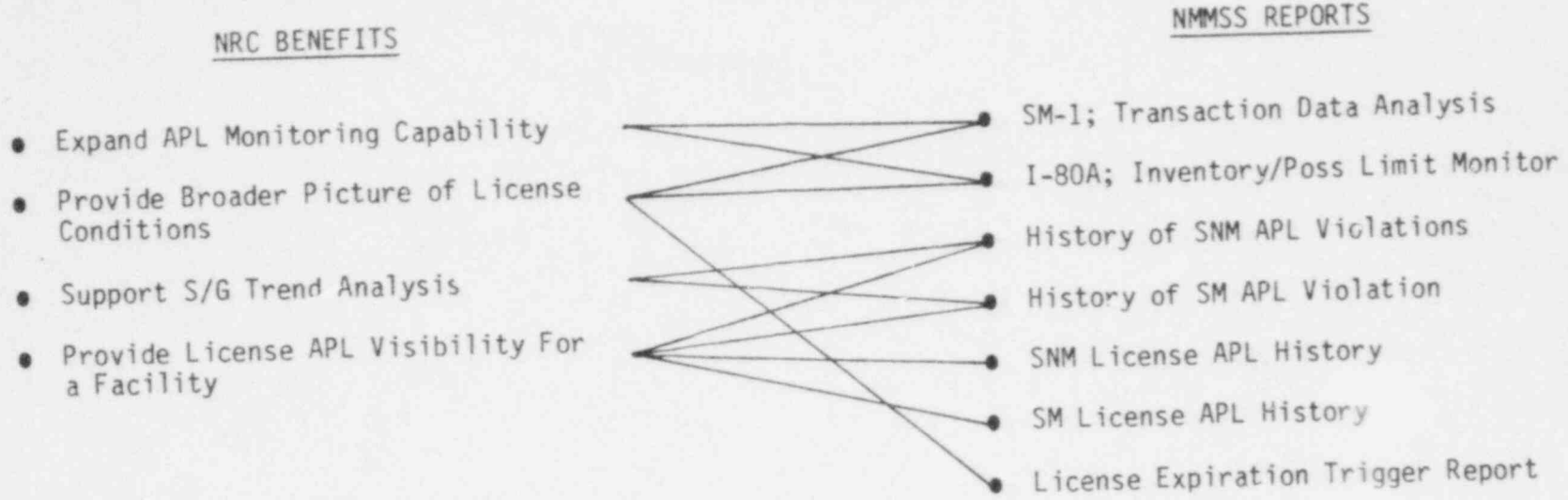


Figure 2-5--Benefits of the Enhanced APL Reports

These papers included copies of source documents and an analysis of the date of actual ID occurrence vs. NMMSS process date.

NRC made available to BCS the backup documentation developed for the plutonium facilities shown in Figure 2-6 and the uranium facilities shown in Figure 2-7. The figures summarize the historical data preparation effort listing alphabetically each of the separate licensee amounts. The period of analysis shown for each licensee corresponds to that I&E reporting period for which backup documentation exists. The figure then shows the total number of NMMSS ID entries in the period and the number of those which are licensee RIS, or XYZ, entries. The distinction is important because it is only licensee entries which may be updated by this data retrofit process. This is because contractors report ID as transactions and all contractor entries are thus subject to the procedural constraints surrounding NMMSS transaction update processing.

The next four columns indicate, respectively, the number of NMMSS entries in the period which were identifiable as LEU or HEU, the number of entries which were validated with a source document, the number of entries of ID for which the actual date of occurrence is known, and the number of entries which had documentation of the ID components. These four areas of historical data entry are discussed below.

2.4.1 ID Enrichment

ID enrichment applies to enriched uranium entries only. Each entry was analyzed on a line-by-line basis, so that if an entry consisted of one line of HEU and one of LEU the enrichment distinction was made. If, on the other hand, it was determined that one line combined HEU and LEU, no attempt was made to identify the magnitude of each. To do this would require negating the ID value and inputting the LEU and HEU values separately. Such an activity was beyond the scope of this contract.

2.4.2 Source Validation

For future incoming transactions, the "source" will indicate the initiator of the NMMSS entry:

'L' - Licensee
'R' - Region
'O' - Oak Ridge (reconcilation entry)

However, since there does not currently exist a formalized structured filing system for the source documents, the source of the historical entries cannot be so strictly defined. The source which is retrofit for

	PERIOD OF ANALYSIS FROM	TO	TOTAL # ID TRANS	#LICENSEE RIS TRANS	SUMMARY OF HISTORICAL DATA COLLECTION # ENRICH	#VALIDATED (SOURCE)	#ACTION DATE	#COMPONENTS OF ID
AEROJET GENERAL	01/01/74	12/30/77	0	0	--	--	--	--
B&W, LRC	03/16/73	04/30/77	18	10	--	7	5	2
B&W, LEECHBURG	02/28/74	12/30/77	59	44	--	27	35	--
BATTELLE PACIFIC NW	10/01/72	12/30/77	14	14	--	--	--	4
EXXON NUCLEAR CO.	01/01/74	11/30/77	26	26	--	16	21	--
GENERAL ATOMICS	05/01/74	09/30/77	7	3	--	1	--	--
GE VALLECITOS	01/01/74	12/30/77	137	40	--	28	7	--
GULF UNC ELMSFORD	01/01/74	12/30/77	1	1	--	--	1	--
GULF UNC NEW HAVEN	01/01/74	12/30/77	1	1	--	--	1	--
KERR MCGEE CORP	01/01/74	11/10/77	15	15	--	8	10	--
NASA LEWIS	01/01/74	12/30/77	1	1	--	--	--	--
NY ASDA	01/01/74	12/30/77	1	1	--	--	--	--
NFS WEST VALLEY	09/01/73	09/30/76	19	19	--	6	13	--

Figure 2-6 -- Summary by Licensee of Historical Plutonium ID Data Collection

	PERIOD OF ANALYSIS FROM	TO	TOTAL # ID TRANS	#LICENSEE RIS TRANS	SUMMARY OF HISTORICAL DATA COLLECTION # ENRICH	#VALIDATED (SOURCE)	#ACTION DATE	#COMPONENTS OF ID
AEROJET GENERAL	01/01/74	12/31/77	1	1	--	--	--	--
ATOMICS INTERNATIONAL	04/01/72	10/30/77	48	10	--	6	4	--
B&W APOLLO/LEECHBURG	02/01/73	10/19/77	132	50	13	34	31	--
B&W, LRC	03/16/73	12/31/77	36	34	5	16	7	--
B&W, LYNCHBURG	08/04/73	12/31/77	42	3	--	1	1	--
GENERAL ATOMICS	11/01/73	11/23/77	317	106	5	77	7	--
GE SAN JOSE	08/15/73	04/07/75	54	33	--	5	5	--
WR GRACE	01/01/74	12/31/74	4	4	--	--	4	--
GULF UNC ELMSFORD	01/01/74	12/31/74	4	4	--	4	4	--
GULF UNC HEMATITE	12/15/73	06/09/78	21	21	--	12	8	--
GULF UNC NEW HAVEN	11/11/73	09/12/77	11	11	--	--	--	--
KERR MCGEE	11/03/73	06/15/77	22	17	10	10	11	--
NATIONAL LEAD	POST 1974		--	--	--	--	--	--
NFS ERWIN	11/14/73	12/12/77	140	36	14	24	15	--
NFS WEST VALLEY	11/01/70	06/30/76	41	--	--	--	--	--
NUCLEAR METALS	06/01/70	06/30/74	12	--	--	--	--	--
TEXAS INSTRUMENTS	12/16/73	10/26/77	17	--	--	--	--	--
UNC WOOD RIVER	03/01/73	10/02/77	112	56	--	36	9	--
US NUCLEAR	10/07/73	05/12/77	37	37	--	30	28	--

Figure 2-7 -- Summary by Licensee of Historical Uranium ID Data Collection

historical data should be interpreted as the "apparent" source, based on available backup documentation. In general:

'L' - The ID entry corresponds to ID reported on an available licensee 742 for the time period.

'R' - The ID entry corresponds to ID reported on a Licensee Status Report filed at the Regional Office.

'O' - The ID entry corresponds to notes or memos made during a reconciliation activity and filed at Oak Ridge.

2.4.3 Action Date

One of the current key problems concerning ID data is lack of consistency in method of interpretation of the action date field. In order to provide consistency, the following procedure has been developed:

- As a part of the historical data retrofit process, Oak Ridge personnel will add 40 to the "day" portion of the action date for all licensee RIS ID entries.
- For those entries for which an action date was verified during the historical data collection activity, this verified action date will replace the above action date.

The purpose of such a procedure is to provide the capability to immediately distinguish verified action dates from questionable action dates and still maintain the action date in question for future analysis and possible verification. It also allows for consistent interpretation of the action date field across both historical and future incoming data, because the verified action dates for historical data conform to the guidelines established in the Specification Document for Inventory Difference Data, Appendix A.

2.4.4 Components of ID

Whenever the licensee recorded the components of an ID value for plutonium or uranium, these data were prepared for input as NMMSS type "I" transaction entries.

The historical data retrofit activity will allow NRC to receive maximum benefit from the enhanced NMMSS capability.

3.0 SAFEGUARDS USER MANUAL

The objective of the User's Manual produced under this contract was to provide a document that would be useful to a Safeguards Analyst investigating various areas of the nuclear material control and accounting process. More specifically, the manual defines what data are available in selected NMMSS reports and provides some background on how the report was produced so that the data are properly interpreted.

The following sections describe:

- The methodology used to determine format and content of the User's Manual;
- The procedure employed to collect the technical information;
- The use of the Manual.

3.1 METHOD OF APPROACH

The first step in the methodology was to define a format appropriate to the intent of the User's Manual. The intent is twofold. It serves as a guide to the interpretation of selected NMMSS reports. Additionally, it serves as an overview to the processing and availability of the data contained in these reports. Two documents provided a guide to federal standards for format of a User's Manual:

- NRC Automated Administrative Financial and Management Information Systems Documentation Handbook;
- Federal Information Processing Standard No. 38 Documentation.

A review of these documents indicated that the requirements are very general and should be tailored for each application.

The next step was to determine what NMMSS reports should be included in the User's Manual. The selection was based upon the areas of safeguards concern addressed in the analysis tasks of this contract. The provisions of the work statement specified that reports associated with Inventory Differences, Authorized Possession Limits, Safeguards Monitoring, and Shipper-Receiver Differences were to be documented. The NMMSS Report Distribution Manual was reviewed to identify those reports which contain data supporting these areas of interest, and which were distributed to NRC Division of Safeguards. The reports are listed in Table 3-1.

TABLE 3-1

NMMSS REPORTS DOCUMENTED IN USER'S MANUAL

TJ-4	Facility Transaction Journal No. 4, Shipments and Receipts
TJ-5	Facility Transaction Journal No. 5, Gains and Losses
TJ-7	Transaction Schedules
TJ-8	Shipper-Receiver Difference Analysis
TJ-11	Open Material Transaction Detail
TJ-14A	Summary Report, On-Site Gains and Losses
TJ-20	Analysis of Shipper and Receiver Transaction Action Codes
TJ-45	Transaction Journal
TJ-51	Shipments Transaction Journal
TJ-52	Receipt Transaction Journal
TJ-53	Annual Total Shipments
TJ-54	Annual Total Receipts
I-18	License Inventories by Ownership
I-21	NRC Licensees; Waste Storage Facilities
I-70	Effective Kilogram Inventory
I-80A	Inventory Possession Limit Comparison
SM-1	Safeguards Data Monitor
M-50	Material Balance Report
M-70	Schedule of Material Losses on Ending Inventory
M-742	Material Status Report

3.2 TECHNICAL CONTENT

The detailed information included in the User's Manual was obtained from a study of the background of the NMMSS system, of the flow of data from the licensee to the UCC data preparation and input personnel, of the NMMSS data input and edit procedures, and of NMMSS data storage formats. This type of information is contained in the User's Manual to provide an overview of NMMSS to an analyst who desires to better understand the report processing environment.

In addition to NMMSS system documentation, the program source listings for each of the reports in Table 3-1 were analyzed to determine user options and report processing characteristics. Actual sample reports were studied for data content and display format. This type of information will allow an analyst to select the report(s) specifically suited to his purposes and to better interpret the data once the report is received. It also will help the analyst to specify the report options with which he can tailor the report to select and display the data he requires.

After reviewing the program source listings, a visit to Oak Ridge, Tennessee was made to obtain additional information from the NMMSS personnel regarding data file identifications and usage and to verify assumptions made as a result of the review of the source listings.

3.3 GUIDE TO USER'S MANUAL

As discussed, the organization and contents of the User's Manual were optimized for the convenience of the intended user. The Safeguards User's Manual will be used for two purposes, either to obtain an overview of NMMSS in terms of the data stored and available in reports, or as a reference manual for details relating to a specific report.

There are four major sections in the manual: Background Information, NMMSS Reports, Data Input, and Data Storage.

The Background section includes a brief history of NMMSS, a description of the data systems included in NMMSS, and a short summary of its operating environment.

The second section, NMMSS Reports, is organized with a separate subsection for each report identified in Table 3-1. Each report subsection includes:

- A report description to explain what data it contains, how the report is ordered, the production schedule, and summary or calculated subtotals included in the report;

- The major processing steps required to produce the report and which data files are used;
- The options or parameters which can be specified to tailor a report for a specific purpose or area of interest;
- A sample report with each data field keyed to a list which defines or describes the data field.

The Data Input section defines the data sources and data processing. The data sources are identified by the forms used to transmit information to NMMSS and the individual data elements on the input records are listed. The data processing part of this section is an overview of the programs used to edit input data and add transactions to the data files.

The Data Storage section identifies the records and data elements that make up the principal files of NMMSS.

The User's Manual is being delivered as a separately bound document.

4.0 ANALYSIS OF SAFEGUARDS MONITOR REPORT

The objective of the analysis of the Safeguards Monitor (SM-1) Report was to determine what changes could be made to the report that would improve its utility. The analysis results are summarized in this section. The first step in the analysis was to identify the safeguards indicators, referred to in NMMSS as monitors, that were included in the SM-1 report and the threshold values associated with each monitor. Section 4.1 describes the four monitors and their thresholds. The data in a typical SM-1 report was analyzed to assess the effectiveness of the report. The data, as explained in Section 4.2, indicated that many of the exceptions identified by the monitor were really data reporting problems. As a result of the analysis, several recommendations were made that would improve the effectiveness of the report. The recommendations include both procedural changes within NRC as well as changes to NMMSS. The recommendations are summarized in Section 4.3. The changes to NMMSS were expanded in "A Specification Document For Modifications and Additions to Safeguards Monitor Reports." These specifications are included as Appendix D of this report.

4.1 DESCRIPTION OF THE SAFEGUARDS MONITORS

The Safeguards Monitor Report (SM-1) is an exception report. Every entry on this report is there because a transaction or a specific data element does not meet some predefined condition. The SM-1 report includes four different monitors and each has a set of criteria for including information in the report. Two monitors examine the NMMSS book balances for maximum allowable value and for positive value, and two monitors examine shipper-receiver transactions for reported limits of error and magnitude of difference in the shippers' quantities and the receivers' measured quantities.

4.1.1 Possession Limit Monitor

The Possession Limit Monitor identifies those facilities where the NMMSS book balances show a larger quantity of material on hand than is authorized by the possession limit specified in the NRC license. This is done on a facility basis. Both possession limits and book inventories are cumulative sums if there is more than one RIS assigned to a . Possession limits are checked for U-235, U-233, and um, and include the following steps:

1) The analysis uses the RIS file as the reference point.
2) For each RIS the most recent material balance file is checked for material on hand.

3) If there is a positive inventory, (see Section 4.1.2 for negative values) the APL file is checked for a possession limit for the material type.

4) If the book balance for any material is greater than the possession limit, the flag "Possession Limit(s) Exceeded" is printed on the report.

5) If there is a positive book balance and no possession limit listed, the flag "No Possession Limit" is printed on the report.

6) If there is a positive balance the program checks the License Directory File for the type of license, either state or federal. If there is no license listed in the License Directory File, the flag "No License in NMMSS" is printed on the report.

The following data are included for each entry on the Possession Limit Report.

- Facility Identification, RIS and Name;
- Other RISs for facility;
- Total possession limits for the facility for all material types including
  Material Type 20 (Uranium 235)
  Material Type 70 (Uranium 233)
  Material Type 50+83 (Plutonium plus Plutonium 238);
- Material balances for the above material types separated by DOE Owned and Non-DOE Owned;
- Total material balance for all material types;
- The percentage of SNM a facility has compared to the combined possession limits (Material Balance weights U-235 plus U-233 plus plutonium; divided by Possession Limits, U-235 plus U-233 plus plutonium).

4.1.2 Negative Inventory Monitor

The Negative Inventory Analysis is a subset of the Possession Limit Analysis. If when checking material balances a negative quantity is found, the flag "Negative Inventory Balance Detected" is printed on the report.

The following data are included for each entry for the Negative Inventory Report:

- Facility Identification, RIS and Name;
- Material balance for the facility for the material type showing the negative balance, separating the material by DOE Owned and Non-DOE Owned for both element and isotope weights.

4.1.3 Limit of Error Monitor

The Limit of Error (LE) Monitor examines all transactions that are shipments or receipts of uranium or plutonium greater than 50 grams and have measured quantities reported in the transaction.

There should be a reported Limit of Error for each measurement. The LE Monitor includes a transaction in the SM-1 report if there is no LE reported for both the element and isotope weights or if the reported LE is not within a predefined upper and lower limit. This analysis is significant because the magnitude of reported LE's affects the criticality of Shipper-Receiver Difference Analysis.

The definition of limits for an acceptable LE is contained in a "Table of Acceptable Limit of Error Ranges," developed by NRC. These limits, expressed as a percentage of the reported weights, are a function of material type and the physical form of the material. The material types include source material and LEU, HEU and U-233, and plutonium. The physical form of the material is defined by a composition code.

The steps in the LE Monitor are:

1) Identify transactions with measured quantities greater than 50 grams.
2) If there is no LE for each measurement, the transaction is written on the SM-1 report placing an "**" flag in the Limit of Error Column.
3) Determine the acceptable percentage ranges for the reported LE's from the composition code and weight percent isotope.
4) Evaluate the acceptable range for the reported LE's in weight units using the upper and lower percentage from the table and the measured weights in the transaction.
5) Compare the reported LE to the calculated limits. If either reported LE is outside the acceptable limits, the transaction is written on the SM-1 report and an "*" is placed beside the LE that is not within range. (There is no indication whether the upper or lower range is exceeded.)

The following data are included for each transaction:

- Transaction Series Number;
- Action Date;
- Composition Code;
- Element Weight;
- Isotope Weight;
- Weight Percent Isotope;
- Material Type;
- Action Code;
- Limit of Error Element;
- Limit of Error Isotope;
- Capture Date.

4.1.4 Shipper-Receiver Difference Monitor

The Shipper-Receiver Difference (SRD) Monitor identifies those transactions where there is a "Statistical Significance in the SRD."

Statistical significance is determined by comparing the magnitude of the SRD to the measurement limit of error reported. Specifically, the transaction is flagged when the isotope SRD is greater than the "combined limits of error" (LE_{SR}) which is equal to the square root of the sum of the squares of the limits of error associated with the receiver's (LE_R) and the shipper's (LE_S) measurement,

$$\text{i.e.,} \quad LE_{SR} = \sqrt{(LE_R)^2 + (LE_S)^2}$$

If only one limit of error is reported, the combined limits of error should be taken to be equal to the square root of two times the single limit of error reported,

$$\text{i.e.,} \quad LE_{SR} = \sqrt{2} \cdot LE_X.$$

For transactions with a SRD greater than zero and no limit of error included in the transaction, the SRD Monitor calculates a limit of error using reported weights and the upper limit from the "Table of Acceptable Limit of Error Ranges" used in the Limit of Error Monitor. The SRD Analysis is made on each line of a transaction except for correction transactions which are treated as a one line entry.

The steps in the SRD Analysis are:

1) Identify transactions that have SRDs for at least one line entry on the transaction.
2) Calculate a Limit of Error for each line if none was reported.
3) Calculate a combined Limit of Error for each line using the above formula.
4) Compare the SRD to the combined Limit of Error for each line on the transaction. If any SRD is larger than the Limit of Error, print all data entries associated with the transaction on the SM-1 Report.
5) Each line entry is annotated as either: "NO SRD," or "SRD," or "significant SRD."
6) For each line printed with a SRD, the "F-Statistic" (F-STAT) is calculated and printed. The "F-STAT" is the ratio of the squares of the two reported Limits of Error.

The following data are included for each transaction:

- Transaction Series Number;
- Action Date;
- Line Number;
- Action Code;
- Material Type;
- Composition Code;
- Weight Percent Isotope;
- Element Weight;
- Element Limit of Error, Flagged "#", if calculated;
- Isotope Weight;
- Isotope Limit of Error, Flagged "#", if calculated;
- Element SRD;
- Element Maximum SRD;
- "F-STAT" for Element LE;
- Isotope SRD;
- Isotope Maximum SRD;
- "F-STAT" for Isotope LE.

4.2 SAFEGUARDS MONITOR REPORT (SM-1) EFFECTIVENESS

The Safeguards Monitor Report was designed to provide NRC a capability to monitor the nuclear material data reported to NMMSS by NRC licensees. The purpose of the monitor was to quickly identify any reports of information from NRC licensees of safeguards significance. At the time an exception was identified by the Safeguards Monitor Report, a safeguards analyst or inspector would study the available data to determine the need for follow-up action.

The effectiveness of the SM-1 report as a safeguards tool can be evaluated in terms of the report's ability to discriminate nuclear material data reports which have safeguards significance. It is useful to consider both errors of omission (safeguards significant data reports not identified as exceptions) and errors of commission (exceptions which are reported but do not have any safeguards significance). Errors of omission can occur either because one of the four existing monitors did not flag a significant data report or because a particular type of significant information is not being monitored by the existing program. Errors of commission deal exclusively with the exceptions as reported by the four existing safeguards monitors. The remainder of this section discusses the effectiveness of each of the existing safeguards monitors. Section 4.3 will address recommendations for new potential safeguards indicators.

4.2.1 Possession Limit Monitor Effectiveness

Many of the entries in the Possession Limit Monitor are reports of data errors rather than indicators of potential safeguards problems. The following are examples of data problems.

- The fact that there are no possession limits for power reactors.
- The noting of no possession limits for RISs that report small quantities of material.
- The reporting of no license in NMMSS. There would be no RIS without a license.
- When the possession limit is exceeded by 1 gram or less.
- The reporting of a material balance that exceeds the possession limit by several orders of magnitude would suggest a data reporting problem.
- When the possession limit is small, i.e., less than 1 kilogram and the limit is exceeded by a small amount.
- Possession limits that are repetitively reported over several months time.

4.2.2 Negative Inventory Monitor Effectiveness

The reporting of the following type of negative inventory would appear to be associated with data problems rather than indicate a potential safeguards problem.

- Negative quantities less than 1 gram.
- Reports where DOE-owned material is negative but equals Non-DOE owned.
- Reports with positive isotope weight but with negative element weight.

4.2.3 Limit of Error Monitor Effectiveness

For the SM-1 report reviewed as part of this study all entries from the Limit of Error (LE) Monitor were caused by either no LE reported or the reported LE was less than the lower limit on the "Acceptable Limit of Error Range Table."

The reporting of low LE's increases the criticality of the SRD analysis. This causes more transactions to be flagged as having SRD that are statistically significant than if LE's in the normal range were used. The reporting of low LE may indicate a data error but by itself does not indicate a safeguards problem.

If there is no LE reported for either half of a transaction and a SRD is reported, the SRD monitor calculates LE using the upper limit from the "Acceptable Limit of Error Range Table." This calculated LE is used to determine if the SRD is statistically significant. While the absence of a LE on a transaction may be a data reporting problem, this does not in itself indicate a significant safeguards problem.

4.2.4 Shipper-Receiver Difference Monitor Effectiveness

There are more entries on the SM-1 report from the Shipper-Receiver Difference Monitor than from either of the other three monitors. These transactions demonstrate that the SRD Monitor is an effective data monitor, and that the data problems can mask potential safeguard indicators. The types of problems noted in the SRD Monitor are:

- Major inconsistencies in data reporting. For example, corrections entered for the wrong line number or with the wrong sign or quantities missing.
- If there are very large SRD's compared to the LE, this also suggests that there may be a data reporting problem rather than a SRD.

- In some cases, the SRD is indicated as significant because the combined limit of error is small due to one of the LE's being less than the "acceptable range of LE." If normal LE values were used, the SRD would not be significant.

4.3 RECOMMENDATIONS

The Safeguards Monitor Report was designed to provide NRC safeguards analysts a tool useful in identifying nuclear material data reports of safeguards significance. As noted in Section 4.2, many of the exceptions "alarmed" by the SM-1 report are more appropriately classified as data problems rather than safeguards problems. For this reason, the recommendations resulting from the analysis of the SM-1 report were grouped into three categories in the interim report:

- General recommendations dealing with overall procedures,
- Data monitor recommendations dealing specifically with data problems; and
- Safeguards monitor recommendations dealing with problems of safeguards significance.

It is difficult to precisely define the "significance" of a safeguards problem. On the one hand, any problem dealt with by NRC's safeguards organization could be considered a safeguards problem. On the other hand, if a problem is so minor that its identification would not require immediate follow-up action, then that problem could not be considered of great safeguards significance. For the purpose of this report, the term "safeguards significance" has been defined as follows:

> A report of nuclear material information is considered to have safeguards significance if, when brought to the attention of a safeguards analyst or inspector, that person would take near-term follow-up action.

The recommendations presented in the interim report are summarized here as:

- Procedural changes; and
- NMMSS Modifications.

4.3.1 Procedural Changes

In order to realize the maximum benefits from the modifications to the Safeguards Monitor Report, the following additional functions should be established:

- An ongoing function to monitor the data reported to NMMSS for possible data error utilizing the capability of a new Data Monitor report (discussed in Section 4.3.2);
- An ongoing function to monitor the new Action Item List (discussed in Section 4.3.2) to ensure that each item is investigated;
- A periodic function to monitor the accuracy of the background authority files used by NMMSS. Many exceptions appear to be generated on the current SM-1 report because of the incompleteness of the background data rather than errors in a current transaction. The monitoring of the background authority files should include an initial validation of the data they currently contain and then an ongoing effort to assure their continued accuracy.

4.3.2 NMMSS Modifications

The NMMSS modifications to be implemented include changes to the Safeguards Monitor Report and the creation of three new reports. The purpose of the modifications is to increase the effectiveness of the Safeguards Monitoring function performed by NRC by more precisely defining and organizing the data to be reviewed. The modifications to the Safeguards Monitor Report are:

- Provide the capability to adjust the exception thresholds for each monitor;
- Change report format to list data by monitor and within each monitor to display data according to the magnitude of the exception;
- Include Inventory Difference transactions greater than the limit of error in the Safeguards Monitor.

The three new reports are:

- Data Monitor Report. This report will:
  - Provide a report similar in format to the Safeguard Monitor but listing exceptions estimated to be caused by data reporting problems.
  - Include in the data monitor shipper-receiver documents open more than 30 days.
  - Include in the data monitor transactions with reported SRDs of zero.
- Action Item List for Monitor Reports. This report will identify every item on either monitor report and provide for feedback that each item was investigated and/or corrected.

- Trend Analysis Report. This report will:
  - Monitor cumulative values of ID for each facility for trends in ID reporting.
  - Monitor cumulative shipper-receiver differences for trends away from zero.
  - Summarize the number of monitor items identified for each facility.

The modifications and new reports designed to support the NRC safeguards monitoring function are defined in detail in "A Specification Document for Modifications and Additions to Safeguards Monitor Reports," Appendix D, and are summarized below.

4.3.2.1 Provide the Capability for NRC to Adjust the Exception Thresholds for Each Monitor

Each of the monitors (possession limit, negative inventory, etc.) has fixed criteria for including data in the SM-1 report. The intent of this modification is to have the individual threshold values defined in such a manner that they can easily be changed at the request of NRC. Similiarly, a separate method should be provided to modify tables, such as the "Table of Acceptable Limit of Error Ranges." This would allow the safeguards analyst to continuously adjust the thresholds so he would only see significant data. As the quality of data improves, the thresholds for the monitors can be reduced to be more critical of the data being monitored.

4.3.2.2 List Data by Monitor by Magnitude of Exception

The intent of this modification is to make the SM-1 report easier to read and use. The major sections of the report would be Possession Limit Violations, Negative Inventories, Limit of Error Irregularities, and Significant SRD, etc. Within each section, all data for that monitor will be sorted in the order of decreasing magnitude. This will allow the analyst to see the magnitude of one type of problem. By sorting the entries by magnitude, the most significant entry will be appear first.

4.3.2.3 Inventory Difference Monitor

This modification will add Inventory Difference monitoring of SNM to the Safeguards Monitor. Any ID transaction where the reported value exceeds the Limit of Error will be included on the next Safeguards Monitor Report. Any ID reported that meets this criteria is a strong indication of a potential problem in material accounting. Including

the transactions on the Safeguards Monitor will ensure that positive action is taken to investigate each occurrence and recommend corrective action.

4.3.2.4 Provide a Data Monitor Report

The intent of this modification is to reduce the length of Safeguards Monitor Reports by including on the report only those entries that indicate a Safeguards (SG) problem. This will allow the SG analyst to concentrate on SG-related problems. On the other hand, the Data Monitor Report will indicate inconsistencies or abnormalities in the reported data that should be corrected if the integrity of NMMSS is to be maintained. A data analyst familiar with NMMSS data input procedures would follow up on each item on the Data Monitor Report to ensure that the problem is corrected or that apparent inconsistencies are explained. The Data Monitor Report could have essentially the same format as the SG Monitor. The use of the data monitor will require that NRC establish two (2) sets of thresholds or criteria, one for including information on the Data Monitor and the other for the Safeguards Monitor.

4.3.2.5 Data Monitor, Open Transaction Monitor

This modification will add an additional monitoring capability to the new proposed Data Monitor. Any shipment transaction of SNM, greater than a minimum value, in which the receiver has not acknowledged both the receipt and correct quantity of material within 30 days (i.e., an open transaction) will be reported on the Data Monitor. This Open Transaction Monitor is, in effect, adding the NMMSS TJ-11 report analyses to the Data Monitor. Any shipment where the quantities cannot be agreed upon and the transaction closed within 30 days indicates some type of data problem. This monitor will highlight the problems so that patterns can be seen which will indicate the need for changes in the system that will improve the quality of the data.

4.3.2.6 Data Monitor, Shipper-Receiver Difference Analysis

This modification will include certain shipment transactions in the Data Monitor report rather than in the Safeguards Monitor depending on the value of the Shipper-Receiver Difference (SRD). Transactions with statistically significant SRD where the SRD is of the same order of magnitude as items on the shipment will be listed on the Data Monitor. Also, transactions where receiver weights are reported and the SRD is zero will be listed on the Data Monitor.

4.3.2.7 Establish Action Item List

This modification to the Monitor Reports will create an action item identification for each entry on either the Data or Safeguards Monitor Report. Each action item will subsequently be added to the Action Item List (a new report) which will require positive response from NRC to remove the item. The intent of this modification is two-fold. First, it increases the effectiveness of the Monitor because any item will only appear on the Monitor Reports once. Each report will contain new information to be investigated. Second, all items will be investigated since it requires positive action to remove the items from the list. The Action Item List should separate Safeguard items from Data Monitor items and list the items by time of reporting. If possible, the action item list should be on an interactive system so that NRC can input codes to indicate what action is being taken and when the item should be deleted.

4.3.2.8 Trend Analysis Report, Cumulative Inventory Difference

The intent of this modification is to provide assurance that the loss of a significant amount of SNM could not be concealed or obscured through the repeated reporting of high values, but within acceptable limits of error, of Inventory Difference (ID). If ID is the result of inaccuracies or accidental errors in the measurement processes then a high value in one period should result in a compensating low or even negative value in some following period. The intent of this modification can be accomplished by the creation of a Trend Analysis Report with one section for Inventory Difference. For each facility and inventory type, cumulative ID data would be calculated, stored, and reported periodically.

4.3.2.9 Trend Analysis Report, Cumulative Shipper-Receiver Differences (SRD)

The repeated reporting of low values for receipts of materials or high values for quantities shipped (all within the allowable limits of error (LE)) would tend to obscure the possession of larger amounts of SNM than the book balance would indicate. The intent of this modification is to provide NRC with a means of monitoring the NMMSS data to ensure that this phenomenon is not occurring at any facility. If SRD is the result of inaccuracies in the measurement processes, SRD values should vary positive and negative within the LE with the cummulative values never becoming large with respect to zero. A Trend Analysis Report for SRD would allow cummulative SRD's to be monitored for each facility with a significant number of shipments each month. Cumulative SRD data would be calculated, stored and reported periodically.

4.3.2.10 Trend Analsis Report, Summary of Data Errors

The intent of this modification is to provide a summary overview to indicate those facilities that are having NMMSS transactions appear on the Data Monitor or SG Monitor. The number of entries on the Data Monitor could be used as an indicator of the data quality reported to NMMSS. The third section of the Trend Analysis Report would report the cummulative number of transactions that appeared on a Monitor Report. The following information would be reported for each facility:

- Number of Transactions on the Current Data or Safeguard Monitor Report;
- Total Number of Transactions on Monitor Reports this fiscal year.

These modifications to the Safeguards Monitor Report and the creation of three new reports will increase the effectiveness of the NRC safeguards monitoring function.

5.0 ANALYSIS OF SHIPPER-RECEIVER DIFFERENCE (SRD) DATA

This section discusses the activity to analyze NMMSS processing of shipper-receiver difference data. The activity involved analyzing the usage of action codes in NMMSS, identifying problem areas, and recommending procedural and system modifications for improving SRD processing.

Section 5.1 discusses the shipper-receiver reporting procedures. Section 5.2 presents the approach taken in the analysis and discusses terminology important to an understanding of SRD analysis. Section 5.3 presents the results of the analysis. The conclusions and recommendations formulated during the effort are contained in Section 5.4.

5.1 PROCEDURES AND PROCESSING OF FORM DOE/NRC-741

NRC regulations require NRC and Agreement state licensees to report nuclear material transfers (shipment and receipt) of specified quantities of SNM, source material, or tritium on form DOE/NRC-741. The form is initiated by the shipper. When the completed shipper's and receiver's data are received by NMMSS, the system considers the transaction to be "closed."

Instructions to NRC and Agreement state licensees for utilizing DOE/NRC-741 outline the procedures for completing the form, for both the shipper and the receiver. Those procedures which contribute to the understanding of shipper-receiver difference data and the way those data are handled by NMMSS are summarized in the following sections.

5.1.1 DOE/NRC-741 -- Data Supplied by Shipper

The shipper must complete and distribute general transaction information and shipper's measurement information on form DOE/NRC-741 on the same day the reportable quantity of material is shipped. The shipper will assign to each DOE/NRC-741 a transaction number. The transaction number entered is the next consecutive number for the shipper-receiver combination; the shipper must not skip numbers in the series. If the 741 is an original notification of transfer of material, the shipper enters the DATE SHIPPED in the appropriate block. If the 741 is a correction to a previously issued 741, he enters the DATE OF SHIPPER'S CORRECTION. Shipper measurement data may consist of several lines, one for each material of a different DOE project number, batch, numbered container, or of a different enrichment. For each line of detail, the shipper indicates, among other things, material type code, composition code, element weight, weight % isotope, isotope weight, and element and isotope limits of error.

5.1.2 DOE/NRC-741 -- Data Supplied by Receiver

Each receiver must acknowledge receipt of a shipment. He may choose to accept shipper's measurement data, or he may choose to make independent measurements. If he chooses the former, within ten days of receipt of the material he must distribute a DOE/NRC-741 with the DATE OF RECEIPT. He must then state on the form "SHIPPER'S VALUES ACCEPTED." If he chooses the latter, within ten days of receipt of the material he must distribute a DOE/NRC-741 with both the DATE OF RECEIPT and the DATE OF RECEIVER'S MEASUREMENT, as well as the line-by-line receiver's measurement data (entered on a one-to-one correspondence with the line-by-line shipper measurement data). If for some reason the receiver cannot complete his measurements within ten days of receipt, he must within ten days of receipt distribute a DOE/NRC-741 with the DATE OF RECEIPT. He must then state on the form "NUCLEAR MATERIAL TRANSFER RECEIPT." The actual measurements must then be completed and reported on a form DOE/NRC-741 within thirty days of receipt of the material.

Whether the receiver accepts shipper's data or makes measurements of his own, he may make corrections to the original DOE/NRC-741 as described in the next section.

5.1.3 DOE/NRC-741 -- Shipper/Receiver Corrections

Either the Shipper or the Receiver may originate "corrected copies," or corrections to an originally submitted DOE/NRC-741. The distribution of a corrected copy must include the other member of the shipper-receiver pair. Upon receipt, that member either marks on his portion of the form: "(Shipper's, Receiver's) ADJUSTMENT ACKNOWLEDGED," "(Shipper's, Receiver's) ADJUSTMENT ACCEPTED," or "REPORTING OWN ADJUSTMENT." For example, a receiver would "acknowledge" shipper's adjustment if he does not want his own measurement data adjusted. NMMSS then will not expect any adjusted measurement data from the receiver; the transaction is considered closed. However, if a receiver "accepts" shipper's adjustment, NMMSS will change the receiver's measurement data to reflect the shipper's adjustment; the transaction is considered closed. If a receiver decides to report his own adjustment, NMMSS will flag the transaction as open until the forthcoming adjustment is received.

5.1.4 DOE/NRC-741 -- NMMSS Processing

When a form DOE/NRC-741 arrives at Oak Ridge for input to NMMSS, data preparation personnel assign it an action code. This action code is used by NMMSS to determine whether a transaction loop is closed (e.g., that a receiver has acknowledged receipt of a shipment or of a shipper's correction), and to verify that DOE/NRC-741s were submitted in a timely

fashion (e.g., if receiver acknowledges receipt of a shipment with intention to perform his own measurements, the results of the measurements must be submitted within thirty days of said receipt).

Once a transaction loop is closed, NMMSS can calculate the shipper-receiver difference (SRD) for the material transfer. This is the absolute value of the difference between the shipper's and receiver's line-by-line and/or total measurement values.

NMMSS produces various reports related to analysis of SRDs. NRC analysts use these reports as the basis for determinations about potential losses of material in transit, or about material measuring and reporting practices of individual licensees.

5.2 APPROACH TO ANALYSIS OF SHIPPER-RECEIVER DIFFERENCE (SRD) DATA

The purpose of the SRD analysis activity was to analyze the processing and usage of shipper-receiver data with the goal of developing recommendations for procedural and/or system modifications to correct any identified problems. The approach selected was to obtain sample reports from NMMSS of SRD analyses, and to apply a knowledge of shipper-receiver reporting practices to an understanding of the validity of NMMSS processing of SRD data. Section 5.2.1 describes the report selected, and Section 5.2.2 provides a discussion of the key shipper-receiver data used in the NMMSS report processing.

5.2.1 NMMSS SRD Analysis Reports

In general, NMMSS produces two reports which process the individual shipper and receiver DOE/NRC-741 data to determine the significance of an SRD. These are the Safeguards Monitors (SM-1) report and the Analysis of S/R Differences (TJ-8) report.

The major difference between the two reports is that the SM-1 displays only those transactions which have an associated significant SRD. The TJ-8 displays all shipments and receipts for a specified time frame. For this reason, and because the SM-1 was a subject of analysis in a prior task of this project, the TJ-8 report was selected as the basis for the SRD analysis. Where there is a notable difference in processing of the shipper-receiver data between the TJ-8 and the SM-1 these differences are described in this report. For a more complete discussion of the SM-1, see Section 4.0 of this report.

The TJ-8 report consists of two sections. The first section is a listing, for a specified RIS, of all shipments and receipts involving that RIS. They are sorted alphabetically by RIS by transaction number

for a specified time frame. Both shipper and receiver data are displayed. Shipper-receiver differences are calculated and displayed.

The second section provided the basis of this analysis. It displays all of those transfers which had SRDs that were classified as "significant" according to the report processing logic. It is in the definition of "significant" that an understanding of the reported data becomes crucial. The TJ-8 report interprets and processes the shipper and receiver data to determine which of the SRDs are significant enough to warrant the attention of an NRC analyst or inspector.

The next section discusses shipper-receiver data and terminology key to the interpretation of the SRD analysis.

5.2.2 Terminology

It is important to understand the procedures for reporting shipper and receiver element and isotope weights because it is from these values that the SRD is computed. The element limit of error and isotope limit of error along with the action code are used to determine whether a calculated SRD is significant. Finally, before analysis may begin, one must understand what is meant by "significant" SRD. These are discussed in the following sections.

5.2.2.1 Element Weight

Element weight reporte by the shipper or receiver is the element weight of the contained nuclear material. The reporting units are given in Table 5-1.

TABLE 5-1 ELEMENT WEIGHT REPORTING UNITS

Nuclear Material	Units
Plutonium; uranium enriched in U-235; uranium enriched in U-233	Nearest whole gram
Plutonium 238	Nearest 1/10 gram
Source Material	Nearest kilogram
Tritium	Nearest 1/100 gram

5.2.2.2 Isotope Weight

Isotope weight reported by the shipper or receiver is the isotope weight of the contained nuclear material. The reporting units are given in Table 5-2.

TABLE 5-2 ISOTOPE WEIGHT REPORTING UNITS

Nuclear Material	Units
Uranium enriched in U-235 or U-233	Nearest gram
Plutonium	Sum of Pu-239 and Pu-241 to nearest gram
Plutonium 238	Nearest 1/10 gram
Depleted uranium	Nearest kilogram
Other source material; tritium	No entry required

5.2.2.3 Element Limit of Error

The element limit of error is the magnitude of uncertainty associated with the reporting of the element weight on a material transfer, expressed as a quantity of material. This uncertainty is a combined function of the accuracies of all the mass measurements and analytical processes used to determine the element weight.

The requirement for a licensee (shipper or receiver) to report a limit of error is subject to certain conditions of his license concerning authorized amount of SNM and authorized use of SNM.

If a licensee meets the criteria for reporting of limits of error, an element limit of error must be reported when the total shipment contains more than 50 grams of U-235, U-233 or plutonium separately or in any combination. In general, the element limit of error should use the same reporting units given in Table 5-1.

5.2.2.4 Isotope Limit of Error

The isotope limit of error is the magnitude of uncertainty associated with the reporting of the isotope weight on a material transfer, expressed as a quantity of material. This uncertainty is a combined function of the accuracies of all the mass measurements and analytical processes used to determine the isotope weight.

The requirement for reporting of an isotope limit of error is subject to the same criteria as the element limit of error (except reporting units are those displayed in Table 5-2). In addition, the isotope limits of error are to be at the 95% confidence level. Isotope limits of error do not have to be reported to anyone but NRC, and must be documented on the reporting licensee's record copy.

5.2.2.5 Action Code

Based on the data recorded on the incoming DOE/NRC-741, Oak Ridge personnel assign an action code to the 741. The action code determines the method by which the transactions are processed by NMMSS, and specifically by the SRD analysis reports. The action codes which may be seen in conjunction with shipper-receiver material transfers are given in Table 5-3 along with their meanings.

TABLE 5-3 SHIPPER/RECEIVER ACTION CODES

Action Code	Meaning
A	Shipper's original data
B	Receiver's data accepting shipper's weights
C	Shipper's adjustment
D	Receiver's adjustment
E	Receiver's data reporting receiver's measurements
N	Nuclear material transfer receipt

These codes are discussed in more detail in the following sections.

5.2.2.5.1 Action Code A

An action code A is assigned to an incoming DOE/NRC-741 when the shipper's portion is completed and an action date is entered for the DATE SHIPPED (see Section 5.1.1).

5.2.2.5.2 Action Code B

An action code B is assigned to an incoming DOE/NRC-741 when the receiver has, on his portion of the form, written "SHIPPER'S VALUES ACCEPTED," and an action date is entered for the DATE RECEIVED (see Section 5.1.2).

5.2.2.5.3 Action Code C

An action code C is assigned to an incoming DOE/NRC-741 when the shipper's portion is completed and an action date is entered for the date the shipper's correction is recorded (see Section 5.1.1). This

code is also associated with any adjustment to shipper data made as a result of a DOE/NRC-741 with an action date for shipper's adjustment and the notation: "RECEIVER'S ADJUSTMENT ACCEPTED" (see Section 5.1.3).

5.2.2.5.4 Action Code D

An action code D is assigned to an incoming DOE/NRC-741 when the receiver's portion is completed, and an action date is entered for date of receiver's correction (see Section 5.1.2). An action code D is also associated with any adjustments made to receiver's data as a result of a receiver's DOE/NRC-741 with an action date for receiver's correction and the notation: "SHIPPER'S ADJUSTMENT ACCEPTED" (see Section 5.1.3). This is true regardless of whether the original receiver DOE/NRC-741 action code was a B or an E.

5.2.2.5.5 Action Code E

An action code E is assigned to an incoming DOE/NRC-741 when the receiver's portion is completed, and an action date is entered for DATE OF RECEIPT and DATE OF RECEIVER'S MEASUREMENT (see Section 5.1.2).

5.2.2.5.6 Action Code N

An action code N is assigned to an incoming DOE/NRC-741 when the receiver has, on his portion of the form, written "NUCLEAR MATERIAL TRANSFER RECEIPT" and an action date is entered for the DATE OF RECEIPT (see Section 5.1.2). An action code E must follow within 30 days of the date of receipt.

5.2.2.6 "Significant" SRD

An SRD is considered significant if it exceeds the combined shipper-receiver limit of error. This combined limit of error is calculated as a part of report processing. The generally accepted equation for combined limit of error (LE_{SR}) when both shipper and receiver limits of error are reported is:

$$LE_{SR} = \sqrt{LE_S^2 + LE_R^2}$$

When only one of the shipper-receiver pair reports a limit of error, the equation used is:

$$LE_{SR} = \sqrt{2}\ LE_S \text{ or}$$

$$LE_{SR} = \sqrt{2}\ LE_R$$

The TJ-8 report looks only at the isotope combined limit of error to determine a significant SRD. The SM-1 report looks at both element and isotope combined limits of error.

5.3 ANALYSIS OF SHIPPER-RECEIVER DIFFERENCE DATA

Five RISs were selected for the analysis based on the numbers of action code E transactions in the shipper-receiver transaction pairs. The five RISs selected were:

- YLJ -- General Electric, Wilmington
- YLM -- Westinghouse Corporation, Columbia
- YNJ -- Babcock and Wilcox, Lynchburg
- YUD -- Exxon Nuclear
- ZWQ -- Combustion Engineering

The number of occurrences of an action code E was used as the basis for selection because it was felt that transactions in which the receiver submitted his own measurements would be more likely to result in a SRD. The TJ-8, "Analysis of S/R Differences" report, was requested for these RISs, showing all shipments and receipts to or from the five RISs in 1979.

Part A of the TJ-8 report was used to establish a baseline to be used in the analysis of significant SRDs. This activity is discussed in Section 5.3.1. Section 5.3.2 discusses the results of the analysis of the SRDs which were identified as significant.

5.3.1 Shipper-Receiver Difference Baseline

A Shipper-Receiver Difference is the difference between two sets of measurements of the same material due to differences in the weight measurements and the analytical techniques used to determine element and isotope percentages. These differences are compared to the limits of error associated with the analytical methods used for each type of material. Criteria have been established by NRC to determine when a reported SRD is statistically significant.

A preliminary analysis of the SRD data received for the five selected RISs was performed. This analysis included the following steps:

1. For each of the five RISs chosen for the analysis, the S-R transactions were divided into those in which the subject RIS was shipper and those in which the subject RIS was receiver. This resulted in ten separate groups of S-R transactions.

2. For each of the groups, only those transactions were selected for the sample in which both shipper and receiver reported measured values. The size of each sample ranged from 33 to 100 percent of the transactions reported to NMMSS in 1979 for that RIS.

3. For each sample in which the subject RIS was receiver, the total weight of all receipts was calculated for both element and isotope. For each sample in which the subject RIS was shipper, the total weight of all shipments was calculated.

4. For each sample, the "total SRD" for both element and isotope was calculated. "Total SRD" was defined as the sum of the absolute values of the SRDs.

5. For each sample, the "cumulative SRD" for all of the shipments was calculated. For cumulative SRD, the SRD was considered positive if the receiver reported larger quantities than the shipper and negative if the shipper quantities were greater than the receipts.

6. For each sample, the total SRD as a percentage of the total weight of the sample was calculated for both element and isotope.

7. The cumulative SRD as a percentage of the total weight of the sample was calculated for both the element and isotope.

This preliminary analysis provided a baseline to understand and further investigate the SRDs indicated as significant.

5.3.2 Analysis of Significant SRD

The purpose of identifing significant SRD is to identify those material shipments where loss of material could be occurring, as in the case of diversion of material during shipment, or where the loss of material could be concealed by reporting higher or lower values than are actually shipped.

The TJ-8B portion of the TJ-8 report identifies those transactions that have significant SRD's as defined by the criteria in the TJ-8 report program and discussed in the following sections. All of the transactions with significant SRD for the five facilities included in this study were examined. The general conclusions that can be drawn from this portion of the analysis are:

- The number of transactions with significant SRD for the five RISs range from 5 to 33 percent of their 1979 transactions, with the average being 12 percent.

- For those transactions reporting limits of error with SRD's greater than the combined limits of error there is insufficient data in the TJ-8 report to allow any conclusions to be made concerning the significance of the SRD. One exception is explained in the next paragraph.
- As the reported LE's become smaller, the determination of significant SRD becomes more critical. The lower reported LEs cause many transactions to be identified as significant when the actual magnitude of the SRD was small.
- Many of the transactions were identified as significant because of factors related to NMMSS processing and procedures rather than the actual values of reported SRD. These factors are discussed in the following sections.

5.3.2.1 Equations for Determining LE_{SR}

The equation used by the TJ-8 to determine the combined isotope* limit of error for a shipper-receiver transaction pair depends upon the limits of error and the action codes involved. This does not in itself pose a problem in SRD analysis, but it requires that an NRC analyst be aware of all of the possible ways in which a particular SRD was classified as significant. The various possibilities are described below.

5.3.2.1.1 Receiver Accepts Shipper's Values

When the receiver accepts shipper's values, an action code of B is associated with the receiver's transaction. There is no SRD at this point. In many cases, the shipper or receiver will subsequently submit corrections, potentially resulting in a SRD in the isotope value. Regardless of whether the shipper and/or receiver submits a correction, the equation used to determine the combined limit of error against which to compare the SRD is:

$$LE_{SR} = \sqrt{2}\ LE_S.$$

5.3.2.1.2 Receiver Submits Measured Values

When the receiver chooses to submit his own measured values (action code of E), a SRD may exist, or may occur as a result of subsequent adjustments by either shipper or receiver.

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*The TJ-8 report only compares the isotope SRD and isotope combined limit of error to determine significance of a SRD. The SM-1 report looks at both element and isotope.

5.3.2.1.2 Receiver Submits Measured Values

When the receiver chooses to submit his own measured values (action code of E), a SRD may exist, or may occur as a result of subsequent adjustments by either shipper or receiver.

If both the shipper and receiver report limits of error, the equation used to determine the combined limit of error is:

$$LE_{SR} = \sqrt{LE_S^2 + LE_R^2}.$$

If the shipper reports a limit of error and the receiver does not, the equation is:

$$LE_{SR} = \sqrt{2}\ LE_S.$$

If the receiver reports a limit of error and the shipper does not, the equation is:

$$LE_{SR} = \sqrt{2}\ LE_R.$$

If neither report a limit of error, the combined limit of error is treated as zero.

5.3.2.2 Computation of LE_S and LE_R

The LE_S and LE_R used in the above equations are the arithmatic sum of the line-by-line limits of error for the shipper and receiver, respectively.* An example is shown in Figure 5-1 Example A.

5.3.2.3 Variations in Reporting Limits of Error

The instructions to shippers/receivers for completing DOE/NRC-741 outline the requirements for reporting limits of error (see Section 5.2.2). The TJ-8 report program then uses whatever limits of error are reported to calculate the combined limit of error (LE_{SR}).**

*The TJ-8 report looks only at the cumulation of the line-by-line reported limits of error. The SM-1 report looks at the cumulative LE_S and LE_R to determine if an SRD is significant; then it does a line-by-line analysis of the SRD.

**Where the TJ-8 report utilizes the limits of error as they are reported, the SM-1 report uses the lower limit from the "Table of Acceptable Limit of Error Ranges" in NMMSS for the material type/composition code whenever a measurement does not have an associated limit of error.

UMMSS TJ REPORT NO. R8 (01/01/79 THRU 12/31/79) MATERIAL 20 ENRICHED URANIUM

	SERIES NUMBER	DATE OF CODE REM/REC COMP	ELEMENT WT	LIMIT OF ERR	WT % U-235	ISOTOPE WT	LIMIT S OF ERR C	S/P ELEMENT	DIFFERENCE ISOTOPE	LIMIT ERR DIF
A	376	10/26/79 103	1,466,648.00	1350	2.9987	43,980.00	46			
	376	10/26/79 103	1,466,341.00	1350	2.9987	43,971.00	46			
		TOTAL	2,932,989.00	2700		87,951.00	92			
	376	10/29/79 100	1,467,388.00	769	3.0040	44,080.00	57E			
	376	10/29/79 100	1,466,775.00	769	3.0040	44,062.00	57E			
		TOTAL	2,934,163.00	1538		88,142.00	114	1,174.00	191.00	146
B	544	09/01/78 G00	124,059.00		4.0000	4,968.00				
	544	09/02/78 G00	124,059.00		4.0000	4,968.00	B			
	544-1	01/15/79 G00	-124,059.00		4.0000	-4,968.00	D			
	544-1	01/15/79 455	123,997.00		4.0060	4,967.00	D			
		TOTAL	123,997.00			4,967.00		62.00	1.00	
C	1080	08/16/79 105	1,500,663.00		2.1867	32,815.00				
	1080	08/16/79 105	1,499,131.00		2.1867	32,781.00				
	1080	08/16/79 105	2,759.00		3.0010	83.00				
	1080	08/16/79 105	2,146.00		3.7950	81.00				
		TOTAL	3,004,699.00			65,760.00				
	1080	08/29/79 100	1,501,154.00		2.1970	32,830.00	E			
	1080	08/29/79 100	1,499,908.00		2.1870	32,803.00	E			
	1080	08/29/79 773	2,759.00		3.0010	83.00	E			
	1080	08/29/79 773	2,146.00		3.7950	81.00	E			
		TOTAL	3,005,967.00			65,797.00		1,248.00	37.00	

Figure 5-1 -- Examples of SRD Data

The way in which the TJ-8 handles the variations in reporting of limits of error causes inconsistencies in the classification of SRDs as significant. Examples are:

- A receiver accepts shipper's measurements. Subsequently, the receiver makes an adjustment, resulting in a SRD. Regardless of receiver limits of error, the equation used when a receiver initially accepts shipper's measurements is:

  $LE_{SR} = \sqrt{2}\ LE_S$.

  When the shipper does not report limits of error, any SRD will be greater than the LE_{SR}; any SRD will be flagged as significant. In the example shown in Figure 5-1 example B, the resulting SRD is isotope 1 gram. The $LE_{SR} = \sqrt{2}\ 0 = 0$ as shown in the "LIMIT ERR DIFF" column. Since $1 > 0$, this SRD is "significant."

- Neither the shipper nor receiver reports limits of error. Any SRD will be flagged as significant. An example is shown in Figure 5-1, C.

- The shipper and/or receiver report multiple lines of material measurements on the DOE/NRC-741. There are occasions when only one line has an associated LE, and others when each line has an associated LE. This results in inconsistent checks for significance, because in the case where each line has a LE, the LE_S or LE_R used in the equation will be the sum of the line-by-line LE (Section 3.2.2). That is, it will be larger, and less likely to indicate a significant SRD, than in the case where one line has a LE.

  Sometimes when only one line has an associated LE, it appears that the licensee may have already calculated the LE on a line-by-line basis and summed them on the one line, but this is by no means consistent. An example (shipper's data only) is shown in Figure 5-2, A.

- The shipper and/or receiver report multiple lines on the DOE/NRC-741. Occasionally, several but not all lines have associated limits of error. The problem is similar to that discussed in the previous paragraph.

In summary, the LE_S and LE_R will vary depending on the rigor associated with reporting of limits of error for each measurement. This will impact the numbers of SRDs flagged as significant. In general, the examples given above will result in a LE_S or LE_R which is smaller than it would be if all limits of error were reported. This means that some SRDs are being flagged as significant which might not otherwise be flagged.

MSMSS TJ REPORT NO. AR (01/01/79 THRU 12/31/79) MATERIAL 20 ENRICHED URANIUM

	SERIES NUMBER	DATE OF CODE REM/REC COMP	ELEMENT WT	LIMIT OF ERR	WT % U-235	ISOTOPE WT	LIMIT S OF ERR C	S/P ELEMENT	DIFFERENCE ISOTOPE	LIMIT ERR DIF
A	203	07/16/79 105	1,463,530.00	3270	2.1050	30,807.00	275			
	203	07/16/79 105	1,465,063.00		2.1050	30,840.00				
	203	07/16/79 105	1,464,053.00		2.1350	31,258.00				
	203	07/16/79 105	5,212.00		3.1060	162.00				
	203	07/16/79 105	5,823.00		3.0980	180.00				
	203	07/16/79 105	5,514.00		3.0900	170.00				
		TOTAL	4,409,195.00	3270		93,417.00	275			
B	10	01/16/79 309	2,045,195.00	6257	2.6210	53,605.00	274			
	10-1	06/19/79 309	-2,045,195.00	-6257	2.6210	-53,605.00	-274			
	10-1	06/19/79 309	2,037,874.00	6257	2.6100	53,188.00	274			
		TOTAL	2,037,874.00	6257		53,188.00	274			
	10	309	2,045,195.00		2.6210	53,605.00	U	7,321.00	417.00	387
C	376	08/31/78 455	2,541,394.00		3.1840	80,925.00				
	376-1	02/02/79 455	-2,541,394.00	-2650	3.1840	-80,925.00	-231			
	376-1	02/02/79 455	2,539,182.00	2662	3.1840	80,843.00	231			
		TOTAL	2,539,182.00	12		80,848.00				
	376	09/01/78 455	2,542,851.00		3.1900	81,117.00	E			
	376-1	02/15/79 455	2,540,638.00	2294	3.1700	81,046.00	1930			
	376-1	02/15/79 455	-2,542,851.00	-2296	3.1900	-81,117.00	-1930			
		TOTAL	2,540,638.00	-2		81,046.00		1,456.00	198.00	

Figure 5-2 -- Examples of SRD Data

It should be noted that according to the current procedures for reporting significant SRDs, the TJ-8 and SM-1 reports are actually using the significant SRD as a flag for either absence of a LE or presence of an SRD. Both situations result in a significant SRD being identified.

5.3.2.4 Open Transactions

After a shipper's DOE/NRC-741 is captured in NMMSS and before the receiver's DOE/NRC-741 is captured, NMMSS considers the transaction to be open. For purposes of TJ-8 report processing, the receiver's values are considered to be equal to the shipper's original DOE/NRC-741 values until a receiver's DOE/NRC-741 is received. However, if the shipper subsequently adjusts his original values, the TJ-8 does not simultaneously adjust the "receiver's" values. This results in an "SRD" which the TJ-8 then tests for significance. Thus, some of the SRDs flagged as significant are simply open transactions. An example is shown in Figure 5-2, B (the code 'O' in the "receiver's" data signifies open).

Since the receiver does not have any associated limits of error, any calculation of LE_{SR} will depend upon how the shipper reported limits of error (see previous section).

5.3.2.5 Corrections to Shipper/Receiver Entries

Both receivers and shippers may adjust an original entry (see Section 5.1.3). The procedure is to negate each line which is being changed and input the corrected line. When this is done incorrectly, several situations may occur:

- The limit of error (either LE_S or LE_R) of the shipment or receipt becomes zeroed out. An example is shown in Figure 5-2, C.
- The limit of error (either LE_S or LE_R) of the shipment or receipt becomes negative. In the case of a negative LE which will be used to calculate a LE_{SR}, even if the SRD is zero it could be flagged as significant because zero (SRD) is greater than, say, $\sqrt{2}$ LE where LE is negative. An example is shown in Figure 5-3, A. In this example, the LE_{SR} = -6. Since 0 > -6, the SRD is "significant." The absolute value of the LE_{SR} is shown in the "LIMIT ERR DIFF" column.

If the resulting limit of error will be used in an equation to determine significant SRD, it will impact the number of SRDs flagged.

NMMSS TJ REPORT NO. AR (01/01/79 THRU 12/31/79) MATERIAL 20 ENRICHED URANIUM

	SERIES NUMBER	DATE OF CODE REM/REC COMP	ELEMENT WT	LIMIT OF ERR	WT % U-235	ISOTOPE WT	LIMIT S OF ERR C	S/P ELEMENT DIFFERENCE	LIMIT ISOTOPE ERR DIF
A	172	05/12/78 F00	2,487.00		2.2920	57.00			
	172-1	12/11/79 F00	-2,487.00	-208	2.2920	-57.00	-5		
	172-1	12/11/79 F00	2,457.00	18	2.2792	56.00	1		
		TOTAL	2,457.00	-190		56.00	-4		
	172	05/16/78 F00	2,487.00		2.2920	57.00	B		
	172-E	10/10/78 F13	-2,487.00		2.2920	-57.00	D		
	172-E	10/10/78 F13	2,457.00		2.2792	56.00	D		
		TOTAL	2,457.00			56.00			6
B	168	05/05/78 773	22,496.00		2.6271	591.00			
	168-G	05/31/78 773	37,092.00	25450	2.5450	944.00			
	168-G	05/31/78 773	-22,496.00		2.6271	-591.00			
	168-G	05/31/78 773	37,092.00		2.5450	944.00			
	168-G	05/31/78 773	-22,496.00		2.6271	-591.00			
	168-1	05/31/78 773	22,496.00		2.6271	591.00			
	168-1	05/31/78 773	22,536.00		2.5293	570.00			
	168-1	05/31/78 773	-37,092.00		2.5450	-944.00			
	168-1	05/31/78 773	-37,092.00		2.5450	-944.00			
		TOTAL	22,536.00	25450		570.00			
	168	05/18/78 773	22,496.00		2.6271	591.00	B		
	168-E	09/30/78 773	-22,496.00		2.6271	-591.00	D		
		TOTAL						22,536.00	570.00

Figure 5-3 -- Examples of SRD Data

5.3.2.6 Discrepencies in Reporting Corrections

In reviewing the transactions with significant SRDs, there are some transactions with very large SRDs, i.e., equal to the total transaction or one line of a transaction. An examination of the data indicated that these SRDs are caused by error in making corrections to a transaction and are not true SRDs. The type of errors that causes these large SRDs are:

- Negating a line entry and neglecting to input a new value. An example is shown in Figure 5-3, B.
- Leaving the negative sign off the negating line entry. An example is shown in Figure 5-4, A.
- Many combinations of these kinds of errors. Three examples are shown in Figure 5-4, B.

The previous sections have indicated that there are several factors outside of the actual SRD magnitude which could cause an SRD to be categorized as significant. The conclusions drawn from the analysis are summarized in the following section, along with the recommendations which were formulated as a result of the analysis.

5.4 CONCLUSIONS AND RECOMMENDATIONS

The analysis of shipper-receiver differences (SRD), performed under the Enhancement of NMMSS contract (NRC-02-79-050), has resulted in several conclusions and recommendations which are presented in Sections 5.4.1 and 5.4.2, respectively.

5.4.1 Conclusions

A summary review of the SRD data was performed to establish a baseline for the SRD analysis. It indicated that, on the average, the magnitude of the SRDs included in the analysis was smaller than the apparent NRC threshold for significance. Also, the cumulative SRDs tended to be smaller than the total of the absolute values of the SRDs. Why, then, are there so many SRDs categorized as significant by the "Analysis of S-R Differences" (TJ-8) report? Although there is not sufficient data in NMMSS to determine the cause of an SRD, the analysis showed that indeed many of the "significant" SRDs were due to NMMSS TJ-8 processing factors. These transactions cause the list of significant SRDs to be so large that it is difficult for an NRC analyst or inspector to identify the SRDs having actual safeguards significance.

NMMSS 1J REPORT NO. 88 (01/01/79 THRU 12/31/79) MATERIAL 20 ENRICHED URANIUM

	SERIES NUMBER	DATE OF CODE REM/REC COMP	ELEMENT WT	LIMIT OF ERR	WT % U-235	ISOTOPE WT	LIMIT OF ERR	S C	S/P ELEMENT	DIFFERENCE ISOTOPE	LIMIT ERR DIF
A	578	01/25/79 G00	340,068.00	279	2.9700	10,108.00		24			
	578	01/26/79 G00	340,068.00		2.9700	10,108.00		R			
	578-1	04/02/79 G00	340,068.00	279	2.9700	10,108.00		24D			
	578-1	04/02/79 455	340,231.00	358	2.9580	10,064.00		51D			
		TOTAL	1,020,367.00	637		30,280.00		75	680,299.00	20,172.00	34
B	166	03/15/78 409	351,904.00	7798	2.4640	8,671.00		202			
	166	03/16/78 409	*		.2000	*		E	351,904.00	8,671.00	86
	167	03/15/78 409	562,664.00	12469	2.5120	14,134.00		329			
	167	03/15/78 409	443,378.00	9825	2.4880	11,031.00		257			
		TOTAL	1,006,042.00	22294		25,165.00		586			
	167	03/16/78 409	*		.2000	*		E			
	167	03/16/78 409	*		.2000	*		E			
		TOTAL	*			*			1,006,042.00	25,165.00	829
	168	03/15/78 409	217,599.00	4822	2.2900	4,983.00		116			
	168	03/15/79 409	1,575,279.00		2.4525	38,635.00		E	1,357,680.00	33,652.00	164

Figure 5-4 -- Examples of SRD Data

The recommendations which follow have as a goal to make the NMMSS SRD reports more useful and supportive of NRC's mission by refining the report processing to reflect NRC's meaning of the phrase "significant SRD." It should also be noted here that the method of reporting limits of error by a licensee becomes critical in determining which SRDs are classified as significant.

5.4.2 Recommendations

The recommendations developed by BCS as a result of shipper-reciever difference analysis can be categorized as either procedural in nature or as a system modification.

5.4.2.1 Procedural Recommendations

The instructions to licensees for completing the DOE/NRC-741 to indicate that the licensee should report limits of error for each line of measurement, if limits of error are required. It is critical that this be consistently performed.

5.4.2.2 System Recommendations

The most obvious recommendation is that the criteria used by the SM-1 and TJ-8 reports to identify significant SRDs be consistent. As this document has discussed, the major area of inconsistency is that the SM-1 utilizes the NMMSS "Table of Acceptable Limits of Error Ranges" to supplement missing licensee limit of error data before ca'culating the combined limit of error against which the SRD is compared. The TJ-8 simply uses whatever limits of error are reported and treats missing data as a limit of error of zero.

It follows that since some licensees may not be required to report a limit of error on a particular shipment, the TJ-8 should also reference the table to supplement missing values. The table should be reviewed for currency. This recommendation would focus the emphasis of the TJ-8 report on shipper-receiver differences rather than discrepencies in reporting limits of error.

Another area in which the two reports differ is that the SM-1 looks at both element and isotope values. BCS recommends that the TJ-8 do the same. BCS also recommends that a line-by-line SRD analysis be performed. There may exist a situation in which the total transaction SRD will not be significant but one of the lines of the shipment will differ significantly in shipper's and receiver's values. It is appropriate here to note that by defining LE_S and LE_R to be the straight sums of the line-by-line limits of error, the combined limit of error

(LE_{SR}) will be larger than if the standard method of combining errors is used. This means that there may be some transactions which should be flagged as significant which are not, using the current method.

There is increasing analysis being done in the area of cumulative SRDs. When there is agreement within NRC on the appropriate approach in this area, BCS recommends that it be included as a part of the NMMSS SRD analysis processing.

One additional area which would increase the usefulness of the significant SRD report would be to exclude open transactions on the list of significant SRDs. They are flagged as open on the first section of the TJ-8 report; that is sufficient.

Implementation of these recommendations would enhance the usefulness of the SRD reports produced by NMMSS as well as reduce the likelihood of safeguards analysts misinterpreting the data.

APPENDIX A

ENHANCEMENT OF THE NUCLEAR MATERIALS MANAGEMENT AND SAFEGUARDS SYSTEM

A SPECIFICATION DOCUMENT FOR ENHANCEMENTS RELATED TO INVENTORY DIFFERENCE DATA IN NMMSS

DECEMBER 21, 1979

BOEING COMPUTER SERVICES COMPANY
A DIVISION OF THE BOEING COMPANY
FEDERAL SYSTEMS GROUP
7980-90 GALLOWS COURT
VIENNA, VIRGINIA 22180

PREPARED FOR

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
CONTRACT NO. NRC-02-79-050

ABSTRACT

The computerized system used by NRC to receive, store, analyze, and report information on tne nuclear material possessed by each licensee is called the Nuclear Materials Management and Safeguards System (NMMSS). It is located at the DOE computer facility, Oak Ridge, Tennessee. In September 1978, a contract (NRC-02-78-083) was competitively awarded to, as one of the tasks, determine and document inventory difference (ID) inconsistencies between NMMSS and the Safeguards Status Reporting System (SSRS) maintained by the Office of Inspection and Enforcement (OI & E). Results of this work showed that many of the apparent ID inconsistencies are the result of reporting system procedures, which make comparison of the data difficult and prone to misinterpretation. Several recommendations were developed which, if implemented, would reduce the probability of an ID data error going undetected and ease the task of comparing the data captured by the two systems.

To this end, NRC outlined a strategy of four concurrent approaches:

- Specific procedural changes must be implemented to reduce problems of data interpretation and data inconsistencies;
- NMMSS system changes must be designed and implemented to complement procedural changes;
- NMMSS procedures must be documented to facilitate an understanding of the meaning of the information available from NMMSS reports as well as limitations on the kinds of information NMMSS can provide; and
- Analysis of other selected NMMSS data is required to enhance and maintain the quality assurance of the data base.

It is in support of this second approach that four specific NMMSS enhancements will be implemented per this specification. These modifications are:

- Provide for identification of LEU/HEU in NMMSS;
- Provide for recording a reference to the original data source of the ID transaction;
- Provide for recording a reference between the date the inventory was performed and the ID entry;
- Provide for recording the components of ID.

These modifications to NMMSS will result in enhancements to six existing NMMSS reports. In addition, they will enable three new reports to be produced which will support the NRC safeguards analyst or regional inspector in performing his function.

No significant impact to the current NMMSS processing environment is projected.

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APPENDIX A
A SPECIFICATION DOCUMENT FOR ENHANCEMENTS
RELATED TO INVENTORY DIFFERENCE DATA IN NMMSS

1.0 DESCRIPTION

This document comprises a specification for the implementation of four enhancements to NMMSS. This specification details the design objectives/functions (Section 2.0) of the enhancements, and addresses possible impacts to the performance requirements and operating environment currently associated with NMMSS ID data processing (Sections 3.0 and 4.0 respectively). Then for each of the individual modifications, Section 5.0 addresses the arrival and preparation of the associated data at Oak Ridge, and describes minimum edits and error processing required. Report enhancements are also discussed in Section 5.0 by modification. Section 5.5 is a special section which simply contains a summary of the report enhancements by report.

In order to maintain compatibility with current NMMSS processing of ID data, Union Carbide Corporation (UCC) will have latitude in the method of actual physical implementation of the four modifications.

The remainder of Section 1.0 lists in concise form the four modifications, the input forms and output reports which will be impacted or enhanced as a result, and the new reports which may be made available.

1.1 LIST OF NMMSS MODIFICATIONS

These four NMMSS modifications will be implemented, per this specification, to provide the capability within NMMSS for direct comparison of ID data stored in NMMSS and SSRS:

- Provide for identification of LEU/HEU in NMMSS;
- Provide for recording a reference to the original data source of the ID transaction;
- Provide for recording a reference between the date the inventory was performed and the ID entry;
- Provide for recording the components of ID.

1.2 NRC/DOE FORMS

Following is a list of NRC/DOE forms which will be impacted by procedural changes which will support the utilization of the above four NMMSS modifications.

- DOE/NRC - 741 — Nuclear Material Transaction Report (not currently used to submit ID data, but projected to be used in the near future)
- NRC/DOE - 742 — Material Status Report
- DOE/NRC - 740 — ADP Transaction Report

A fourth form, the NRC/DOE-742C, Physical Inventory Listing, is currently being proposed to satisfy IAEA reporting requirements. When this form is officially adopted, it should be reviewed in terms of these modifications.

1.3 SUMMARY OF OTHER METHODS BY WHICH ID DATA ARRIVE AT NMMSS

In addition to the official forms listed in Section 1.2, ID data and corrections to previously reported ID entries may arrive at NMMSS by one of the following methods:

- SACNET — Has same format as DOE/NRC-740, therefore whatever changes are made to that form will be incorporated into the format of SACNET submissions as appropriate.
- Regional Letter — It is projected that as a result of IAEA, the regions will soon no longer input data to NMMSS; these monthly loss reports will be sent directly to Oak Ridge by the licensee on a DOE/NRC-741.

1.4 NMMSS REPORTS

Following is a list of current NMMSS reports which will be enhanced to provide the newly implemented NMMSS capability.

TJ-5	Facility-Transaction Journal No. 5; On-Site Gains and Losses
TJ-14A	Survey Package; Facility Transaction Schedules
TJ-45	Transaction Journal
M-50	Concise Material Balance Report
M-70	Material Losses and Ending Inventories
M-742	Detailed Material Balance Report by Facility

1.5 NEW NMMSS REPORTS

Three new NMMSS reports are being defined. These reports will provide:

- A detailed list designed for the safeguards analyst of all reported ID for a facility within a specified time frame;
- A list of components of ID entries in NMMSS, selected on process date;
- A list of components of ID entries in NMMSS, selected on action date.

2.0 DESIGN OBJECTIVES/FUNCTIONS

The function of the four NMMSS modifications is presented in terms of external and internal design objectives. External design objectives are those enhancements, in terms of capability, which are visible to the user. Internal design objectives have to do with the way in which that capability is provided by NMMSS.

2.1 EXTERNAL DESIGN OBJECTIVES

The external design objectives of these modifications are:

- To provide a report which reflects ID which actually occurred in a specified time frame. This requires selection of ID transactions by a date which references the actual inventory period.
- To provide a report option to allow an analyst to select a report of ID summarized by high enriched (HEU) and low enriched (LEU) uranium ID.
- To produce reports which more completely characterize each ID transaction so that analysts may feel confident of the origin and validity of data they are using. Specifically, to indicate for each ID transaction whether it is LEU or HEU, the source of the transaction, and any identified components of ID which are not strictly book physical inventory difference (BPID).

2.2 INTERNAL DESIGN OBJECTIVES

The internal design objectives of these modifications are:

- To provide for recording of these additional data for each ID entry so that the external design objectives can be met.
- To meet these external design objectives in a way compatible with current NMMSS processing of ID data; to not significantly impact the processing or turnaround requirements currently specified by NRC.
- To design sufficient edit checks to ensure that data entered are valid.

3.0 PERFORMANCE REQUIREMENTS

Accuracy requirements, response time, update processing, and flexibility requirements are unchanged from those performance requirements currently associated with ID data transaction processing.

4.0 OPERATING ENVIRONMENT

The current Oak Ridge hardware and operating system will be used. Current NMMSS security features are adequate. Actual physical implementation, such as interface with current software, use of internal storage areas, and program controls, is at the discretion of UCC.

Before proceeding to Section 5.0, which addresses the arrival and preparation of the associated data at Oak Ridge, it is important to describe at this point the top-level data flows. In general, ID data are reported by licensees/contractors. Currently, the licensee reports ID (and material discards) to the appropriate region on a monthly basis. The region summarizes these losses and sends them to Oak Ridge. On receipt at NMMSS, UCC prepares a DOE/NRC 740 from which the data are key punched and entered into the Current Transaction file. With the approval of IAEA, the licensee will report losses directly to Oak Ridge on form DOE/NRC-741.

The licensee also submits a NRC/DOE 742 on a scheduled basis directly to Oak Ridge. The reported ID entry (line 77) represents the total of the ID occurring in the months covered by the 742. If no monthly regional data for a licensee had been received, UCC will capture this line from the 742 (and selected other lines which do not arrive as transactions) on a DOE/NRC 740 and enter it into the Current Transaction file.

In addition, ID or corrections to ID entries may infrequently be received by a phone call. Contractor submissions of ID are made via a DOE/NRC 741 or via SACNET.

The data, after a series of edit checks, update the Transaction Data File, one of the primary data systems of which NMMSS is comprised.

These modifications will not impact the frequency with which ID data currently arrive at NMMSS. Current procedures addressing the handling of historical data in the Transaction Data File will not be impacted. For a discussion of edit requirements, anticipated data volumes, and other design characteristics associated with each of these supplemental ID data, see Section 5.0.

5.0 DESIGN CHARACTERISTICS

The implementation of the four NMMSS modifications listed in Section 1.1 is addressed in a single specification due to the overlap in NRC/DOE forms and NMMSS reports impacted by these enhancements, as well as a similarity in objective that may render it beneficial to consider them simultaneously.

This section characterizes three aspects of each of the modifications:

- Procedures. Data preparation and input personnel must be able to assess the way in which data to support these modifications will arrive at NMMSS, and what impact this will have on current data preparation procedures.
- Input. NMMSS systems analyst and programmer personnel must understand what minimum edits and error processing will be required to effect the enhancement.
- Output. NMMSS systems analysts, programmers, and operations personnel must be aware of what report generating requirements are expected utilizing the enhanced NMMSS capability.

5.1 PROVIDE FOR IDENTIFICATION OF LEU/HEU ID IN NMMSS

The thrust of this modification is to provide the capability to distinguish LEU from HEU ID entries in NMMSS. This modification will address ID submissions/entries only.

5.1.1 Procedures

This section discusses the way in which ID data, specified by enrichment, will arrive at Oak Ridge, and discusses data preparation procedures.

5.1.1.1 DOE/NRC-741

The enhancement to provide for identification of LEU/HEU in NMMSS will apply only to ID transactions submitted by a licensee (after IAEA implementation) for material type 20, characterized on the DOE/NRC-741 by a line item with a Use Code of 77 and a Material Type of 20. When it is used for this purpose, the 741 will be input in to the system following current guidelines for 741s; in addition, a new field is defined as follows.

Every line item of ID should be described as LEU (< 20% enrichment) or HEU (> 20% enrichment) or a combination; a line item of ID will never carry more than one of these distinctions.

The indication of enrichment (LEU, HEU, or a combination) will occur in column M, "Weight % Isotope," highlighted in Figure 1. Possible entries in this column are given in Table 1. This interpretation of the entries in this column applies only to ID transactions for material type 20.

TABLE 1
INTERPRETATION OF VALUES SUBMITTED ON DOE/NRC-741

FIELD TYPE	ALLOWABLE VALUES	INTERPRETATION
NUMERIC	-any positive number less than 20	-ID entry is less than 20% enriched (LEU)
NUMERIC	-any number greater than 20	-ID entry is greater than 20% enriched (HEU)
NUMERIC	-20	-ID entry is enriched uranium (total of LEU and HEU for this licensee)

5.1.1.2 NRC/DOE-742

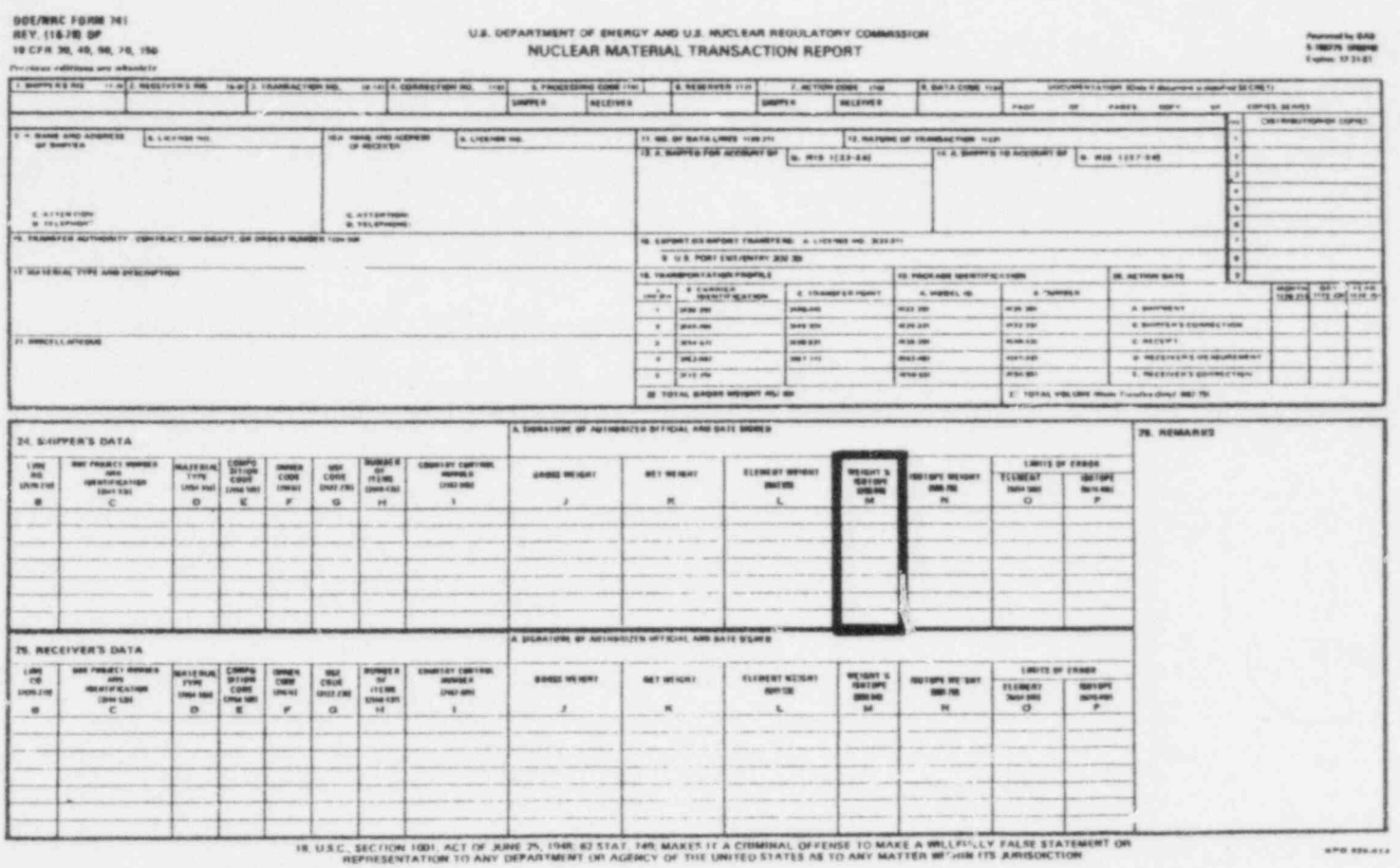
Since NRC/DOE-742s are prepared by material enrichment, the enrichment category (i.e., LEU (<20%), HEU (> 20%), or combination (simply material type 20)) for the reported ID may currently be found in block 5 (highlighted in Figure 2). No change in use or interpretation of this form is required by this modification.

5.1.1.3 DOE/NRC-740

This form may be prepared by UCC upon receipt of monthly reports by the region or prepared by UCC upon receipt of a licensee NRC/DOE-742.

5.1.1.3.1 Prepared from Monthly Regional Loss Letter

Upon receipt of a monthly loss letter from the region, UCC will prepare a DOE/NRC-740, extracting from the letter all currently extracted data, plus ID enrichment for material type 20 ID. Every line item of ID on



DOE/NRC FORM 741
REV. (10-79) DP
10 CFR 30, 40, 50, 70, 150

U.S. DEPARTMENT OF ENERGY AND U.S. NUCLEAR REGULATORY COMMISSION
NUCLEAR MATERIAL TRANSACTION REPORT

24. SHIPPER'S DATA

25. RECEIVER'S DATA

26. REMARKS

18 U.S.C., SECTION 1001, ACT OF JUNE 25, 1948, 62 STAT. 749, MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION

Figure 1 - The "Weight % Isotope" Field on the DOE/NRC-741 Will Be Used to Report Enrichment of An Occurrence of ID

FORM NRC/ERDA-742
(5-76)
10 CFR 70/ERDAM 7401
(Previous editions are obsolete)

U.S. NUCLEAR REGULATORY COMMISSION
AND
U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

APPROVED BY GAO
B-180225 (R0041)
EXPIRES 12-31-78

MATERIAL STATUS REPORT

1. NAME AND ADDRESS	2. LICENSE NUMBER(S)	3. REPORTING IDENTIFICATION SYMBOL (RIS)
	4. REPORT PERIOD: FROM / TO	5. MATERIAL TYPE (Submit separate report for each type)

MATERIAL ACCOUNTABILITY		
6. QUANTITY BY ELEMENT AND ISOTOPE WEIGHT	A. ELEMENT WEIGHT	B. ISOTOPE WEIGHT
8. BEGINNING INVENTORY – ERDA OWNED		
9. BEGINNING INVENTORY – NOT ERDA OWNED		
RECEIPTS		
11. PROCUREMENT FROM ERDA RIS FROM:		
13. PROCUREMENT – OTHER		
14. DOD RETURNS – USE A		
15. DOD RETURNS – USE B		
16. DOD RETURNS – OTHER USES		
21. PRODUCTION		
22. FROM OTHER MATERIALS		
30. RECEIPTS REPORTED TO NRC/ERDA ON FORM NRC/ERDA-741 (Not listed elsewhere) RIS FROM:		
40. TOTAL		
REMOVALS		
41. EXPENDED IN SPACE PROGRAMS		
42. SALES TO ERDA RIS TO:		
43. SALES TO OTHERS FOR THE ACCOUNT OF ERDA RIS TO:		
44. DOD – USE A		
45. DOD – USE B		
46. DOD – OTHER USES		
47. EXPENDED IN ERDA TESTS		
48. ROUTINE TESTS		
49. SHIPPER-RECEIVER DIFFERENCE		
61. SHIPMENTS REPORTED TO NRC/ERDA ON FORM NRC/ERDA-741 (Not listed elsewhere) RIS TO:		
71. DEGRADATION TO OTHER MATERIALS		
72. DECAY		
73. FISSION AND TRANSMUTATION		
74. NORMAL OPERATIONAL LOSSES/MEASURED DISCARDS		
75. ACCIDENTAL LOSSES		
76. APPROVED WRITE-OFFS		
77. MATERIAL UNACCOUNTED FOR		
80. ENDING INVENTORY – ERDA OWNED		
81. ENDING INVENTORY – NOT ERDA OWNED		
82. TOTAL		

(See Reverse Side)

Figure 2 - When a Licensee Reports Inventory by High and Low Enrichment Categories, the Indication of Enrichment is Found In Block 5

the DOE/NRC-740 must be described as either LEU (<20% enrichment) or HEU (>20% enrichment) when the information is submitted. When this information is not submitted, i.e., when the ID is characterized simply as enriched uranium, the ID enrichment should be interpreted simply as 20%. Following this procedure, UCC will enter ID enrichment into positions 59-64 (highlighted in Figure 3) of the DOE/NRC-740 for an ID entry as shown in Table 2.

TABLE 2
PREPARATION OF DOE/NRC-740 FROM SUBMITTED REGIONAL LOSS LETTER

SUBMITTED INFORMATION	CORRESPONDING DOE/NRC 740 VALUE	FIELD TYPE
-"<20%" OR "LEU" OR "low-enriched"	-any positive number less than 20	-NUMERIC
-">20%" OR "HEU" OR "high-enriched"	-any number greater than 20	-NUMERIC
-"U235" OR "MT 20" OR "enriched uranium"	-20	-NUMERIC

5.1.1.3.2 Prepared from Licensee NRC/DOE-742

Upon receipt of a NRC/DOE-742, and upon determination (using current criteria) of the need to enter line 77 into the Current Transaction file, UCC will prepare a DOE/NRC-740, extracting from the 742 all currently extracted data, plus ID enrichment for material type 20 from block 5. Every line item of ID on the DOE/NRC-740 must be described as either LEU (< 20% enrichment) or HEU (>20% enrichment) when the information is submitted. When this information is not submitted, i.e., when the ID is characterized simply as enriched uranium, the ID enrichment should be interpreted simply as 20%. Following this procedure, UCC will enter ID enrichment into positions 59-64 of the DOE/NRC 740 as shown in Table 3.

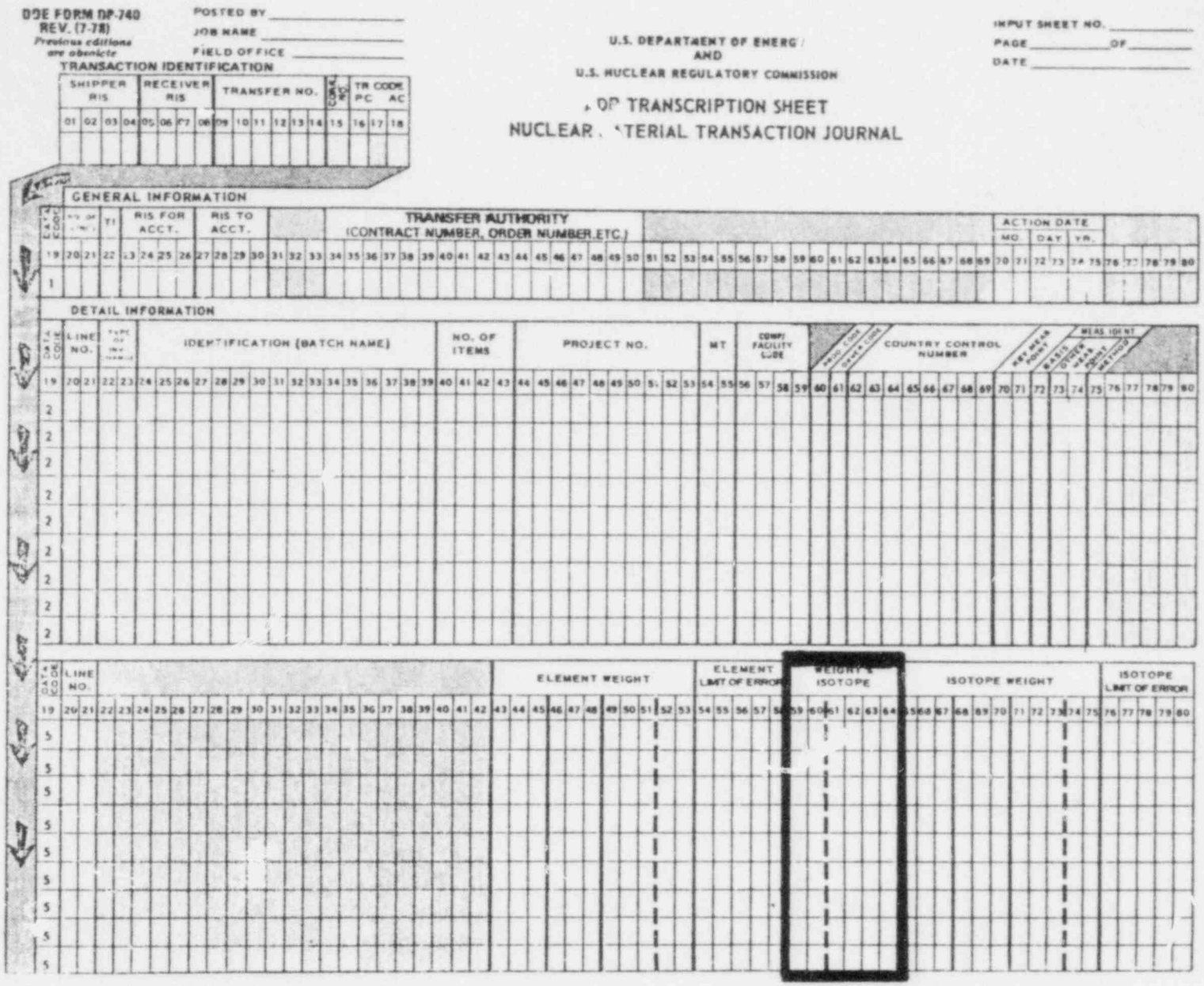


Figure 3 - The "Weight % Isotope" Field on the DOE/NRC-740 Will Be Used to Record Enrichment of a Submitted ID

TABLE 3

PREPARATION OF DOE/NRC-740 FROM SUBMITTED NRC/DOE-742

SUBMITTED IN BLOCK 5	CORRESPONDING DOE/NRC 740 VALUE	FIELD TYPE
-"<20%" OR "LEU"	-any positive number less than 20	-NUMERIC
-">20%" OR "HEU"	-any number greater than 20	-NUMERIC
-"MT 20" OR "U235"	-20	-NUMERIC

5.1.1.4 Additional Information

An ID entry in NMMSS may also result from an Oak Ridge reconciliation. If, in the reconciliation process Oak Ridge personnel and the licensee determine that an ID reconciliation entry of material type 20 should be made, the following standards should apply:

- If the need for a reconciliation entry arises from an adjustment to the NMMSS LEU inventory for a RIS, UCC should enter some positive number less than 20 into positions 59-64 (i.e., the field corresponding to "Weight % Isotope").
- If the need for a reconciliation entry arises from an adjustment to the NMMSS HEU inventory for a RIS, UCC should enter some number greater than 20 into positions 59-64.
- If HEU/LEU breakout cannot be determined for an ID reconciliation entry, then UCC should enter the value 20 into positions 59-64.

5.1.2 Input

The result of the input preparation process described above is that for every material type 20 entry of ID prepared for input into NMMSS following current guidelines, a field in the Transaction Data File previously not defined for an ID entry will be redefined for specific values with specific interpretations for material type 20 ID. This is consistent with procedures currently employed by DOE contractors, minimizing the impact of this modification.

Minimum edit checks in addition to those currently required are:

- If Material Type is 20 and Use Code is 77, the "Weight % Isotope" field must be used. If this check is violated, the transaction should be flagged.*
- If the "Weight % Isotope" field is used, it must be positive numeric. If this check is violated, the transaction should be flagged.

Error messages and codes as required will be designed by UCC.

Actual physical record layout is at the discretion of UCC. It is projected that the layout will remain unchanged; the current format of the Transaction Data File already contains the "Weight % Isotope" field. No requirement for change in field length is foreseen.

5.1.3 Output

Each of the reports listed in Section 1.4 will be enhanced utilizing the capability to distinguish LEU and HEU ID transactions in NMMSS. Each of these reports is discussed in this section. Any significant comments or suggestions concerning report layout are included. Otherwise, report layout decisions are left to UCC.

Additionally, UCC must recognize that to produce these reports efficiently may require modifications to interfacing software. As an example, inventories are generated and stored to correspond to material status report (MSR) format. Instead of storing one line 77 for material type 20, UCC might consider generating and storing a line 77 of HEU, a line 77 of LEU, and a line 77 of combination enrichment uranium. Note that this and other comments concerning method of implementation should be reviewed by UCC in light of their broader understanding of NMMSS ID processing.

5.1.3.1 TJ-5

Enhancements to this report only apply when type of gain/loss is "77", Inventory Difference, and when material type is "20", Enriched Uranium. Two enhancements have been identified:

*The most notable instance in which this field may not be used is in the case of historical ID entries that were in the system before this modification occurred.

- Whenever individual ID entries are displayed on the report, display the ID enrichment field per Table 4.

TABLE 4
ENRICHMENT DISPLAY LOGIC FOR TJ-5

IF WEIGHT % ISOTOPE IS	THEN DISPLAY
- any positive number less than 20	- "LEU"
- any number greater than 20	- "HEU"
- "20"	- "20"
- none of the above	- blank

- Provide a user option to group and summarize material type 20 ID transactions for each month by enrichment category. A sample of a possible report format is given in Figure 4. The selection logic for the three enrichment categories is given in Table 5.

TABLE 5
SELECTION LOGIC FOR TJ-5

IF WEIGHT % ISOTOPE IS	THEN ENRICHMENT CATEGORY IS
- any positive number less than 20	- LEU
- any number greater than 20	- HEU
- "20"	- Combined HEU/LEU
- none of the above	- Combined HEU/LEU

5.1.3.2 TJ-14A

Enhancements to this report only apply when type of gain/loss is "77", Inventory Difference, and when material type is "20", Enriched Uranium. Two enhancements have been identified:

TRANS FORM NO	S C	DATE OF REMOVAL	ENRICH	ELEM WT REMOVAL	LIMIT OF ERR	ISOTOPE WT REMOVAL	LIMIT OF ERR	. . .
YYXXXX	M	MM/DD/YY	HEU	2.00		2.00		
HEU TOTALS				2.00		2.00		
YYXXXX	M	MM/DD/YY	LEU	12.00		1.00		
YYXXXX	M	MM/DD/YY	LEU	7.00		1.00		
LEU TOTALS				19.00		2.00		
YYXXXX	M	MM/DD/YY		5.00		2.00		
COMBINED HEU/LEU				5.00		2.00		
MONTH TOTALS				26.00		6.00		

Figure 4 - Sample Report TJ-5 Format
Incorporating Material Type 20 ID Enrichment

- Whenever individual ID entries are displayed on the report, display the ID enrichment as shown in Table 6.

TABLE 6
ENRICHMENT DISPLAY LOGIC FOR TJ-14A

IF WEIGHT % ISOTOPE IS	THEN DISPLAY
- any positive number less than 20	- "LEU"
- any number greater than 20	- "HEU"
- "20"	- "20"
- none of the above	- blank

- Provide a user option to group and summarize material type 20 ID transactions for each month by enrichment category. The selection logic for the three enrichment categories is given in Table 7.

TABLE 7
SELECTION LOGIC FOR TJ-14A

IF WEIGHT % ISOTOPE IS	THEN ENRICHMENT CATEGORY IS
- any positive number less than 20	- LEU
- any number greater than 20	- HEU
- "20"	- Combined HEU/LEU
- none of the above	- Combined HEU/LEU

5.1.3.3 TJ-45

The desired enhancement to this report applies only when material type is "20", Enriched Uranium. For every line #77 ID entry, display the ID enrichment per Table 8.

TABLE 8
ENRICHMENT DISPLAY LOGIC FOR TJ-45

IF WEIGHT % ISOTOPE IS	THEN DISPLAY
- any positive number less than 20	- "LEU"
- any number greater than 20	- "HEU"
- "20"	- "20"
- none of the above	- blank

5.1.3.4 M-50

The desired enhancement to this report applies only to line #77 when material type is "20", Enriched Uranium. The enhancement is to provide a user option to display line #77 broken out by enrichment category. The selection logic for the three enrichment categories is given in Table 9.

TABLE 9
SELECTION LOGIC FOR M-50

IF WEIGHT % ISOTOPE IS	THEN ENRICHMENT CATEGORY IS
- any positive number less than 20	- LEU
- any number greater than 20	- HEU
- "20"	- Combined HEU/LEU
- none of the above	- Combined HEU/LEU

For example, when the current report displays a line #77 as follows:

S Date RIS **20** **077** 26.00 6.00

A user may now opt to display that same line as follows:

S	Date	RIS	**20**	**077**	HEU	2.00	2.00
S	Date	RIS	**20**	**077**	LEU	19.00	2.00
S	Date	RIS	**20**	**077**	COMB	5.00	2.00

5.1.3.5 M-70

The desired enhancement to this report applies only when material type is "20", Enriched Uranium. The enhancement is to provide a user option to display the Inventory Difference for a RIS broken out by enrichment category. The selection logic for the three enrichment categories is given in Table 10.

TABLE 10
SELECTION LOGIC FOR M-70

IF WEIGHT % ISOTOPE IS	THEN ENRICHMENT CATEGORY IS
- any positive number less than 20	- LEU
- any number greater than 20	- HEU
- "20"	- Combined HEU/LEU
- none of the above	- Combined HEU/LEU

5.1.3.6 M-742

The desired enhancement to this report applies only to line #77 when material type is "20", Enriched Uranium. The enhancement is to provide a user option to display line #77 broken out by enrichment category. The selection logic for the three enrichment categories is given in Table 11.

TABLE 11
SELECTION LOGIC FOR M-742

IF WEIGHT % ISOTOPE IS	THEN ENRICHMENT CATEGORY IS
- any positive number less than 20	- LEU
- any number greater than 20	- HEU
- "20"	- Combined HEU/LEU
- none of the above	- Combined HEU/LEU

For example, where the current report displays a line #77 as follows:

77. INVENTORY DIFFERENCE 26.00 6.00

A user may now opt to display that same line as follows:

77. INVENTORY DIFFERENCE

HEU	2.00	2.00
LEU	19.00	2.00
COMB	5.00	2.00

5.2 PROVIDE FOR RECORDING A REFERENCE TO THE ORIGINAL DATA SOURCE OF THE ID TRANSACTION

This NMMSS modification will allow each entry of ID to be tied, or referenced, to its original data source.

ID entries may be generated as a result of:

- licensee submission
- regional submission (until IAEA implementation)
- Oak Ridge reconciliation
- contractor submission

This modification will address ID submissions/entries only.

5.2.1 Procedures

The above distinctions will not be submitted on a form, but rather will be entered by UCC at the time of input preparation depending on the

source of the original transaction. Every licensee RIS ID entry in NMMSS must carry one and only one of these source references.

If the submission is an ID entry of any material type for an XYZ RIS submitted on a DOE/NRC-741 (after IAEA implementation) or is a line entry 77 taken from a licensee NRC/DOE-742, then it should be distinguished as a "licensee" entry. (This applies equally to phone calls and any other licensee ID submissions.)

If the submission originated from a region, then the entry in the system should be distinguished as a "regional" entry.

If, in the reconciliation process, Oak Ridge reconciliation personnel and the licensee determine that an ID reconciliation entry of any material type should be made, this entry should be distinguished as an Oak Ridge "reconciliation" entry.

If the submission is an ID entry of any material type for a RIS other than an XYZ RIS, the default should be to distinguish it as a "contractor" entry.

The actual values to be entered into the system to reflect these distinctions are to be determined by UCC consistent with any current standards. The only constraints are that the values be coded so that when output reports are generated there exists the capability to select on source of transaction.

5.2.2 Input

Minimum edit checks include verification that the value input is one of the allowable values and that every entry of ID for a licensee RIS has associated with it one of these values. If these checks are violated, the transaction should be flagged. Additional edit checks and error messages as required will be designed by UCC.

Actual physical record layout to accommodate this additional field is at the discretion of UCC. Field length is estimated at one character. Even though this modification addresses ID entries only, this additional field could be added to the format of the Transaction Data File in general, but only defined at this point for ID entries.

5.2.3 Output

Three of the reports listed in Section 1.4 will be enhanced utilizing the capability to distinguish the source of the ID entry. Each of these reports is discussed in this section. Any significant comments or

suggestions concerning report layout are included. Otherwise, report layout decisions are left to UCC.

5.2.3.1 TJ-5

The enhancement to this report only applies when type of gain/loss is "77", Inventory Difference. Whenever individual ID entries are displayed on the report, display the valid code for the source of that entry. When the valid code is not available or is invalid, display a blank field. In the back or at the front of the report, print a table for interpretation of the code.

5.2.3.2 TJ-14A

The enhancement to this report only applies when type of gain/loss is "77", Inventory Difference. Whenever individual ID entries are displayed on the report, display the valid code for the source of that entry. When the valid code is not available or is invalid, display a blank field. In the back or at the front of the report, print a table for interpretation of the code.

5.2.3.3 TJ-45

For every line #77 ID entry, display the valid code for the source of that entry. When the code is not available or is invalid, display a blank field. In the back or at the front of the report, print a table for interpretation of the code.

5.3 PROVIDE FOR RECORDING A REFERENCE BETWEEN THE DATE THE INVENTORY WAS PERFORMED AND THE ID ENTRY

This modification will provide the capability to store a reference between the date the inventory was performed and the NMMSS transaction representing the ID occurrence. This modification will address ID submissions/entries only.

5.3.1 Procedures

The "action date" field on the DOE/NRC-740 and the Transaction Data File itself is currently used for ID entries. However, since licensees do not currently report ID as transactions, there is no rigor associated with the date that is input. The new procedures for inputting this date are presented in terms of the method of data arrival and preparation for input to NMMSS.

5.3.1.1 DOE/NRC-741

Upon receipt of a licensee ID reported on a DOE/NRC-741 (after IAEA implementation), UCC can do nothing but input the date that is reported in the action date (block 20) field (subject to current edit checks). This field is highlighted in Figure 5. ONMSS is currently restructuring the date sequence on transaction reporting. Under this new concept, it is envisioned that the date will reflect the date of the physical inventory which resulted in the submitted ID.

5.3.1.2 NRC/DOE-742

The licensee NRC/DOE-742 is submitted for a reporting period, the dates for which are specified in block 4, highlighted in Figure 6. No change in use or interpretation of this form is required by this modification.

5.3.1.3 DOE/NRC-740

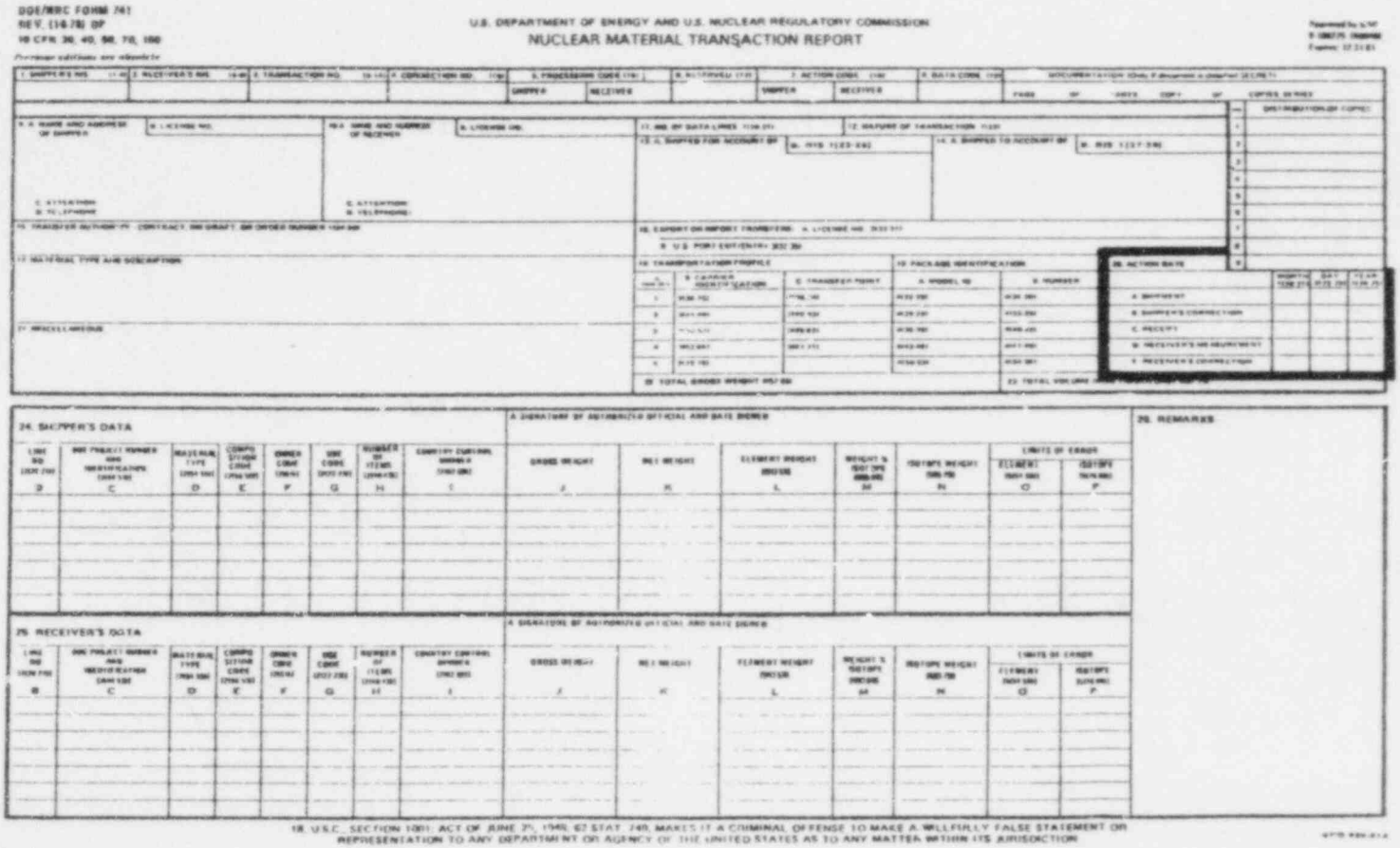
This form may be prepared by UCC upon receipt of monthly reports by the region or prepared by UCC upon receipt of a licensee NRC/DOE-742.

5.3.1.3.1 Prepared from Monthly Regional Loss Letter

There may be as many as four dates associated with one regional letter: the date of the letter, the OI&E reporting period (a beginning and an ending date), and a reference to the date of the actual inventory resulting in the submitted ID. Upon receipt of a monthly loss letter from the region, UCC will prepare a DOE/NRC-740, extracting from the letter all currently extracted data, plus the inventory date. If this date is not made available in the letter, the ending date of the reporting period will be captured. The date will be entered into positions 70-75, highlighted in Figure 7, of the DOE/NRC-740 corresponding to the "Action Date" field.

5.3.1.3.2 Prepared from Licensee NRC/DOE-742

Upon receipt of a NRC/DOE-742, and upon determination (using current criteria) of the need to enter line 77 into the Current Transaction file, UCC will prepare a DOE/NRC-740, extracting from the 742 all currently extracted data, plus the ending ("to") date of the inventory period found in block 4. The date will be entered into positions 70-75 of the DOE/NRC 740 corresponding to the "Action Date" field.



DOE/NRC FORM 741
REV. (10-78) DP
10 CFR 30, 40, 50, 70, 150

U.S. DEPARTMENT OF ENERGY AND U.S. NUCLEAR REGULATORY COMMISSION

NUCLEAR MATERIAL TRANSACTION REPORT

24. SHIPPER'S DATA

25. RECEIVER'S DATA

26. REMARKS

18 U.S.C. SECTION 1001: ACT OF JUNE 25, 1948, 62 STAT. 749, MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION

Figure 5 - The "Action Date" Field on the DOE/NRC-741 Will Be Interpreted as the Date of the Physical Inventory Which Resulted in the Submitted ID

POOR ORIGINAL

FORM NRC/ERDA-742
(6-76)
10 CFR 70/ERDAM 7401
(Previous editions are obsolete)

U.S. NUCLEAR REGULATORY COMMISSION
AND
U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

APPROVED BY GAO
B-180225 (R0041)
EXPIRES 12-31-78

MATERIAL STATUS REPORT

1. NAME AND ADDRESS	2. LICENSE NUMBER(S)	3. REPORTING IDENTIFICATION SYMBOL (RIS)
	4. REPORT PERIOD: FROM / TO	5. MATERIAL TYPE (Submit separate report for each type)

MATERIAL ACCOUNTABILITY		
6. QUANTITY BY ELEMENT AND ISOTOPE WEIGHT	A. ELEMENT WEIGHT	B. ISOTOPE WEIGHT
8. BEGINNING INVENTORY – ERDA OWNED		
9. BEGINNING INVENTORY – NOT ERDA OWNED		
RECEIPTS		
11. PROCUREMENT FROM ERDA RIS FROM:		
15. PRODUCT – OTHER		
34. DOD RETURNS – USE A		
35. DOD RETURNS – USE B		
36. DOD RETURNS – OTHER USES		
21. PRODUCTION		
22. FROM OTHER MATERIALS		
30. RECEIPTS REPORTED TO NRC/ERDA ON FORM NRC/ERDA-741 (Not listed elsewhere) RIS FROM:		
40. TOTAL		
REMOVALS		
41. EXPENDED IN SPACE PROGRAMS		
42. SALES TO ERDA RIS TO:		
43. SALES TO OTHERS FOR THE ACCOUNT OF ERDA RIS TO:		
44. DOD – USE A		
45. DOD – USE B		
46. DOD – OTHER USES		
47. EXPENDED IN ERDA TESTS		
48. ROUTINE TESTS		
49. SHIPPER-RECEIVER DIFFERENCE		
51. SHIPMENTS REPORTED TO NRC/ERDA ON FORM NRC/ERDA-741 (Not listed elsewhere) RIS TO:		
71. DEGRADATION TO OTHER MATERIALS		
72. DECAY		
73. FISSION AND TRANSMUTATION		
74. NORMAL OPERATIONAL LOSSES/MEASURED DISCARDS		
75. ACCIDENTAL LOSSES		
76. APPROVED WRITE-OFF		
77. MATERIAL UNACCOUNTED FOR		
80. ENDING INVENTORY – ERDA OWNED		
81. ENDING INVENTORY – NOT ERDA OWNED		
82. TOTAL		

Figure 6 - The Ending Date of the Report Period Will Be Input Into NMMSS When Line 77 Is Input

DOE FORM DP-740
REV. (7-78)
Previous editions are obsolete

POSTED BY _____
JOB NAME _____
FIELD OFFICE _____

U.S. DEPARTMENT OF ENERGY
AND
U.S. NUCLEAR REGULATORY COMMISSION

INPUT SHEET NO. _____
PAGE _____ OF _____
DATE _____

ADP TRANSCRIPTION SHEET
NUCLEAR MATERIAL TRANSACTION JOURNAL

TRANSACTION IDENTIFICATION

SHIPPER RIS	RECEIVER RIS	TRANSFER NO.	CORR. NO.	TR CODE PC	TR CODE AC
01 02 03 04	05 06 07 08	09 10 11 12 13 14	15	16	17 18

GENERAL INFORMATION

DATA CODE	NO. OF LINES	TI	RIS FOR ACCT.	RIS TO ACCT.	TRANSFER AUTHORITY (CONTRACT NUMBER, ORDER NUMBER ETC.)	ACTION DATE MO. DAY YR.
19	20 21	22	23 24 25 26	27 28 29 30	31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69	70 71 72 73 74 75
1						

DETAIL INFORMATION

DATA CODE	LINE NO.	TYPE OF INV. MATL.	IDENTIFICATION (BATCH NAME)	NO. OF ITEMS	PROJECT NO.	MT	COMP. FACILITY CODE	PERIOD CODE	COMP. CODE	COUNTRY CONTROL NUMBER	KEY MEAS. POINT	BASIS MEAS. CODE	MEAS. IDENT. ENTRY METHOD
19	20 21	22 23	24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39	40 41 42 43	44 45 46 47 48 49 50 51 52 53	54 55	56 57 58 59	60 61	62 63 64 65 66 67 68 69	70 71 72 73 74	75	76 77 78 79 80	
2													
2													
2													
2													
2													
2													
2													
2													

DATA CODE	LINE NO.	ELEMENT WEIGHT	ELEMENT LIMIT OF ERROR	WEIGHT % ISOTOPE	ISOTOPE WEIGHT	ISOTOPE LIMIT OF ERROR
19	20 21	22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42	43 44 45 46 47 48 49 50 51 52 53	54 55 56 57 58	59 60 61 62 63 64	65 66 67 68 69 70 71 72 73 74 75	76 77 78 79 80
5						
5						
5						
5						
5						
5						
5						
5						
5						

Figure 7 - The "Action Date" Field on the DOE/NRC-740 Will Be Used to Indicate the Time Frame in Which the ID Actually Occurred

5.3.1.4 Additional Information

An ID entry in NMMSS may also result from an Oak Ridge reconciliation. If, in the reconciliation process, Oak Ridge personnel and the licensee determine that an ID reconciliation entry of any material type should be made, the action date entered should be the ending date of the corresponding inventory period (NMMSS reporting period close-out).

5.3.2 Input

The edit checks currently performed on the action date field should be adequate.

Error messages and codes as required will be designed by UCC.

Actual physical record layout is at the discretion of UCC. It is projected that the layout will remain unchanged; the current format of the transaction data file already contains the "Action Date" field. No requirement for change in field length is foreseen.

5.3.3 Output

Two of the reports listed in Section 1.4 will be enhanced utilizing the capability to select, for any specified time interval, the ID which actually occured in that time interval. In addition a new report is being defined. Each of these reports is discussed in this section. Any significant comments or suggestions concerning report layout are included. Otherwise, report layout decisions are left to UCC.

5.3.3.1 TJ-5

The enhancement to this report only applies when type of gain/loss is "77", Inventory Difference. The enhancement is to provide a user option to select on action date. All other report processing will remain the same. The report title should clearly indicate the selection criterion. If the user date specified will select data prior to the implementation of these modifications, warn the report recipient that data contained on the report may not have actually occurred in the indicated time frame due to lack of rigor associated with ID action date prior to this time.

5.3.3.2 TJ-14A

The enhancement to this report only applies when type of gain/loss is "77", Inventory Difference. The enhancement is to provide a user option

to select on action date. All other report processing will remain the same. The report title should clearly indicate the selection criterion. If the user date specified will select data prior to the implementation of these modifications, warn the report recipient that data contained on the report may not have actually occurred in the indicated time frame due to lack of rigor associated with ID action date prior to this time.

5.3.3.3 New Report

A new report has been defined which will allow a safeguards analyst to see the entire ID picture for a facility. This report should have the following key features:

- produce on request;
- apply to ID gain/loss only;
- select on action date;
- generate for all RISs for all material types for a facility;
- sort by action date, providing monthly totals;
- allow user options:
  - date time frame
  - facility
  - material type

A sample report layout is given in Figure 8.

5.4 PROVIDE FOR RECORDING THE COMPONENTS OF ID

This enhancement will provide the capability to identify the components of an entry of ID in NMMSS. This modification will address ID submissions/entries only.

5.4.1 Procedures

This section discusses the way in which ID component data will arrive at Oak Ridge, and discusses data preparation procedures.

5.4.1.1 DOE/NRC-741

This form is not applicable to this modification. When IAEA changes are implemented, ID components will be handled in another fashion on the 741.

RIS	ACTION DATE	TRANSACTION NUMBER	ELEMENT WEIGHT	ISOTOPE WEIGHT	SOURCE OF ENTRY	ENRICH
XXX	(1)	(2)	(2)	(2)	(3)	(4)
	(1)	(2)	(2)	(2)	(3)	(4)
	(1)	(2)	(2)	(2)	(3)	(4)
YYY	(1)	(2)	(2)	(2)	(3)	(4)
XXX LEU TOTAL FOR MONTH				(5)		
XXX HEU TOTAL FOR MONTH				(5)		
XXX COMBINED TOTAL FOR MONTH				(5)		
YYY . . .						
TOTAL ID FOR MONTH				(6)		

Where:
(1) is defined as in Section 5.3
(2) maintains current definition
(3) is defined as in Section 5.2
(4) is defined as in Section 5.1
(5) when material type is 20, summarize each month, each RIS by enrichment; else, summarize total ID each month each RIS
(6) summarize total ID each month all RISs

FIGURE 8 - SAMPLE REPORT FORMAT FOR NEW REPORT

5.4.1.2 NRC/DOE-742

This form will not be used to submit ID component information. However, a licensee may occasionally voluntarily submit a supplemental sheet to the 742 in which component information could be provided. If this is the case, follow the preparation procedures outlined in Section 5.4.1.3.1.

5.4.1.3 DOE/NRC-740

This form may be prepared by UCC upon receipt of monthly reports by the region or prepared by UCC upon receipt of a licensee NRC/DOE-742.

5.4.1.3.1 Prepared from Monthly Regional Loss Letter

Upon receipt of a monthly loss letter from the region, UCC will prepare a DOE/NRC-740, extracting from the letter all currently extracted data, as well as the components of the ID when submitted for any material type. The submitted ID is still an "M" type transaction, indicating on-site inventory change. Each entry of component data for that ID entry will be an "I" type transaction, indicating explanation of ID.

Each component of ID will be entered as a separate line entry with the following data for each entry:

- RIS;
- Transaction number (should be same as corresponding ID entry);
- Material type;
- Element and isotope weights as appropriate;
- Appropriate use code from Table 12 (corresponds to DOE instructions, manual 5630).

5.4.1.3.2 Prepared from Licensee NRC/DOE-742

This enhancement will not impact the data preparation of this form.

5.4.2 Input

The significance of the "I", type transaction is that the entry does not change the NMMSS inventory for that RIS. This is consistent with

procedures currently employed by DOE contractors, minimizing the impact of this modification.

Minimum edit checks in addition to those currently required are:

- Every action code "I" transaction must have a transaction number which corresponds to an action code "M", use code 77 entry of the same material type, same RIS. If this check is violated, the transaction is not entered into NMMSS.
- For every type "M" transaction which has corresponding type "I" transactions, the "I" transactions must sum to equal the type "M" transaction in both element weight and isotope weight. If this condition is violated, the ID entry should be flagged.
- The use code must be a valid code per Table 12. If this condition is violated, the component entry should be flagged.

TABLE 12
USE CODE VALUES USED TO EXPLAIN USE CODE 77 ENTRIES

Use Code	Component of ID
84	Lower Warning Limit
85	Upper Warning Limit
86	Lower Alarm Limit
87	Upper Alarm Limit
88	Redetermination of Discrete Items on Inventory
89	Redetermination of Material in Process
90	Process Holdup Differences
91	Equipment Holdup Differences
92	Measurement Adjustments
93	Rounding
94	Recording & Reporting Errors
95	Shipper-Receiver Adjustments
96	Identifiable Item Adjustments
97	Actual Inventory Difference
99	MUF

Error messages and codes as required will be designed by UCC.

Actual physical record layout is projected to be no different than the current format of the Transaction Data File. There will probably be an average of between zero and five component entries for every entry of ID.

5.4.3 Output

The scope of the six reports listed in Section 1.4 will not encompass an enhancement to list the components of each entry of ID. Therefore, two new reports are being defined. The first report should have the following key features:

- Produce on request
- Apply to Inventory Difference data only
- Allow user options:
  - time interval ("from" month/year, "to" month/year)
  - material type
  - RIS

  where default = all
- Select on process date
- List all action code "M", use code "77" ID entries by material type by month in the selected time interval at the level of detail reported to NMMSS (per section 5.1.3, indication of material type 20 enrichment should be indicated, instead of displaying the actual field value). For every action code "M" entry, list the corresponding source code "I" entries coded by the use code value, flagging those cases in which the total of source code "I" is not equal to the source code "M" entry. Provide monthly ID totals.
- Provide tables of code values and their meaning.

The second report should have the same key features, but should select on action date. The report title should clearly announce this. If the user date specified will select data prior to the implementation of the modification addressed in 5.3, warn the report recipient that date contained on the report may not have actually occurred in the indicated time frame due to lack of rigor associated with ID action date prior to this time.

Detailed processing logic should be developed by UCC, consistent with similar report processing.

5.5 SUMMARY OF REPORT ENHANCEMENTS

Previous sections have discussed enhancements to current NMMSS reports. This section simply summarizes in concise format the enhancements to each report.

REPORT NUMBER	REPORT TITLE	CURRENT KEY FEATURES	ENHANCEMENTS
TJ-5	Facility-Transaction Journal No. 5; Onsite Gains and Losses	- Produced each month. - Shows fiscal year to date, using NMMSS process date as selection. - By material, by type of gain/loss by month. - Options: -List transactions for current month only. -List transactions for FY to date (at the 6 mo. closing). -All facilities in a DOE Field Office. -All facilities in a NRC Regional Office. -By facility	For ID Data only: - Allow option to select on action date. - When individual ID transactions are displayed, indicate enrichment category for each transaction. - Provide user option for a report summarized by enrichmeni category. - When individual transactions are displayed, indicate original data source of each transaction.

REPORT NUMBER	REPORT TITLE	CURRENT KEY FEATURES	ENHANCEMENTS
TJ-14A	Survey package; Facility Transaction Schedules	- Produced on request. - Only on-site gains and losses. - List all transactions in a given time interval, using NMMSS process date as selection. - By RIS, by material type, by category of receipt/removal. - Options: -Time interval. -Totals by 1 mo., 3mo., 6 mo., or 12 mo. -By material ownership. -Print comments on status of a transaction. -Specify material types.	For ID Data only: - Allow option to select on action date. - Indicate enrichment category for each transaction. - Provide user option for a report summarized by enrichment category. - Indicate original data source for each ID transation.

REPORT NUMBER	REPORT TITLE	CURRENT KEY FEATURES	ENHANCEMENTS
TJ-45	Transaction Journal	- Corresponds to categories of activity as summarized on NRC/DOE-742. - At same level of detail as reported to NMMSS. - Produced monthly or on request. - NMMSS process date used as selection date. - Options: - by RIS - by Field Office - contractor RISs - licensee RISs - time frame	For ID Data only: - Indicate enrichment category for each ID transaction. - Indicate original data source for each transaction.

REPORT NUMBER	REPORT TITLE	CURRENT KEY FEATURES	ENHANCEMENTS
M-70	Material Losses & Ending Inventories	- Summarize losses by RIS by material type for six-month interval for corresponding to semi-annual material balance report.	Provide user option for a report which displays inventory difference for a RIS by enrichment category.
M-742	Detailed Material Balance Report by Facility	- Format of NRC/ERDA-742 - Options: -Specified MATL type -Specified contractor/ licensee. -Time span.	For ID Data only: - Provide user option for a report which summarizes line 77 entries by enrichment category.

REPORT NUMBER	REPORT TITLE	CURRENT KEY FEATURES	ENHANCEMENTS
M-50	Concise Material Balance Report; by RIS	- For contractor, licensee, facility. - Concise; directly corresponds to line numbers of NRC/DOE-742 and COEI. - First half or last half of FY.	For ID Data only: · Provide user option for a report which summarizes the line 77 entries by enrichment category.

REFERENCES

Boeing Computer Services Company, "Enhancement of NMMSS Final Report," USNRC Report NUREG/CR-0806, April 1979. Available for purchase from National Technical Information Service, Springfield, Virginia 22161.*

Boeing Computer Services Company, "SSDM (Systematic Software Development and Maintenance)," BCS Document 10153, August 1976.

U.S. Department of Commerce/National Bureau of Standards," Guidelines for Documentation of Computer Programs and Automated Data Systems," FIPS PUB 38, February 1976.

U.S. Nuclear Regulatory Commission, "Draft Automated Administrative and Management Information Systems Documentation Handbook," USNRC Appendix 0903, August 1979. Available in NRC PDR for inspection and copying for a fee.

*Also available for purchase from the NRC/GPO Sales Program, U.S. Nuclear Regulatory Commission, Washington, DC 20555.

APPENDIX B

ENHANCEMENT OF THE NUCLEAR MATERIALS MANAGEMENT AND SAFEGUARDS SYSTEM

A SPECIFICATION DOCUMENT FOR ENHANCEMENTS RELATED TO AUTHORIZED POSSESSION LIMIT DATA IN NMMSS

DECEMBER 21, 1979

BOEING COMPUTER SERVICES COMPANY
A DIVISION OF THE BOEING COMPANY
FEDERAL SYSTEMS GROUP
7980-90 GALLOWS COURT
VIENNA, VIRGINIA 22180

PREPARED FOR

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
CONTRACT NO. NRC-02-79-050

ABSTRACT

The computerized system used by NRC to receive, store, analyze, and report information on the nuclear material possessed by each licensee is called the Nuclear Materials Management and Safeguards System (NMMSS). It is located at the DOE computer facility, Oak Ridge, Tennessee. In September 1978, a contract (NRC-02-78-083) was competitively awarded to, as one of the tasks, audit authorized possession limit (APL) data for licensees authorized to possess source material (SM) and special nuclear material (SNM). This task also validated the APL values in the NMMSS data base. Several recommendations were developed which, if implemented, would enhance and maintain the quality of the NMMSS data base.

To this end, NRC outlined a strategy of four concurrent approaches:

- Specific procedural changes must be implemented to reduce problems of data interpretation and data inconsistencies;
- NMMSS system changes must be designed and implemented to complement procedural changes;
- NMMSS procedures must be documented to facilitate an understanding of the meaning of the information available from NMMSS reports as well as limitations on the kinds of information NMMSS can provide; and
- Analysis of other selected NMMSS data is required to enhance and maintain the quality assurance of the data base.

It is in support of this second approach that three specific NMMSS APL enhancements will be implemented per this specification. These modifications are:

- Provide for maintaining historic data on SNM APLs.
- Provide for maintaining data on SM APLs.
- Expand the set of data elements maintained on APLs.

These modifications to NMMSS will result in enhancements to two existing NMMSS reports. In addition, five new reports will be produced, which will support the NRC safeguards analyst or regional inspector in performing his function.

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APPENDIX B
A SPECIFICATION DOCUMENT FOR ENHANCEMENTS
RELATED TO AUTHORIZED POSSESSION LIMIT DATA IN NMMSS

1.0 DESCRIPTION

This document comprises a specification for the implementation of three enhancements to NMMSS. This specification details the design objectives/functions (Section 2.0) of the enhancements, and addresses possible impacts to the performance requirements and operating environment currently associated with NMMSS APL data processing (Sections 3.0 and 4.0 respectively). Then for each of the individual modifications, Section 5.0 addresses the arrival and preparation of the associated data at Oak Ridge, and describes minimum edits and error processing required. Report enhancements are also discussed in Section 5.0 by modification. Section 5.4 is a special section which simply contains a summary of the report enhancements by report.

In order to maintain compatibility with current NMMSS processing of APL data, Union Carbide Corporation (UCC) will have latitude in the method of actual physical implementation of the three modifications.

The remainder of Section 1.0 lists in concise form the three modifications, the input forms and output reports which will be impacted or enhanced as a result, and the new reports which may be made available.

1.1 LIST OF NMMSS MODIFICATIONS

These three NMMSS modifications will be implemented, per this specification, to enhance the quality of the NMMSS APL file.

- Provide for maintaining historic data on SNM APLs;
- Provide for maintaining data on SM APLs;
- Expand the set of data elements currently maintained on SNM APLs.

1.2 NRC/DOE FORMS

There do not currently exist any official NRC/DOE forms for submission of APL data to NMMSS.

1.3 SUMMARY OF OTHER METHODS BY WHICH APL DATA ARRIVE AT NMMSS

APL data may arrive at NMMSS by one of the following methods:

- I&E sends APL updates to NMMSS for those licensees/RISs of interest on an as-needed basis.
- ONMSS updates licensee name/address/RIS in NMMSS as well as information for new licenses issued. They may be sending APL updates occasionally as well.

1.4 NMMSS REPORTS

Following is a list of current NMMSS reports which will be enhanced to provide the newly implemented NMMSS capability.

SM-1	Transaction Data Analysis
I-80A	Inventory/Possession Limit Monitor

1.5 NEW NMMSS REPORTS

Five new NMMSS reports have been defined. These reports will:

- Provide a history of SNM APL violations for a facility;
- Provide a SNM license APL history for a facility;
- Provide a history of SM APL violations for a facility;
- Provide a SM license APL history for a facility;
- Provide a license expiration trigger report.

2.0 DESIGN OBJECTIVES/FUNCTIONS

The function of the three NMMSS modifications is presented in terms of external and internal design objectives. External design objectives are those enhancements, in terms of capability, which are visible to the user. Internal design objectives have to do with the way in which that capability is provided by NMMSS.

2.1 EXTERNAL DESIGN OBJECTIVES

The external design objectives of these modifications are:

- To provide a report option (by specifying a time-frame) to obtain historical SNM APL-book inventory comparisons.
- To produce reports which more completely characterize each APL. Specifically, to indicate for each APL its expiration date, the material enrichment authorized, whether it is sealed or unsealed, and the date on which this entry was entered into the system (if an entry was late being entered, previous exception reports may not have been accurate; this would flag interested analysts who could request exception reports rerun).
- To provide similar APL-book inventory comparisons and exception reporting for SM.

2.2 INTERNAL DESIGN OBJECTIVES

The internal design objectives of these modifications are:

- To provide for recording of these data so that the external design objectives can be met.
- To meet these external design objectives in a way compatible with current NMMSS processing of APL data; to not significantly impact the processing or turnaround requirements currently specified by NRC.
- To design sufficient edit checks to ensure that data entered are valid (e.g., numeric fields are numeric) and consistent (e.g., "expiration date" is later than "effective date" for the same APL entry).

3.0 PERFORMANCE REQUIREMENTS

Accuracy requirements, response time, and flexibility requirements are unchanged from those performance requirements currently associated with APL data processing.

The length of time that historical APL data should be maintained in the system depends on the availability of NMMSS transaction and book inventory data. That is to say, if transaction and inventory data are available in NMMSS for a particular time frame, the corresponding APL for that time frame should also be accessible.

4.0 OPERATING ENVIRONMENT

The current Oak Ridge hardware and operating system will be used. Current NMMSS security features are adequate. Actual physical implementation, such as interface with current software, use of internal storage areas, program controls, and the decision to maintain SM APL data as part of or separate from the SNM APL file, is at the discretion of UCC.

Before proceeding to Section 5.0, which discusses each of the modifications, it is important to describe at this point the top-level data flow. When a license is issued to a licensee, it is filed in the NRC docket room and assigned a docket number. The license number or the docket number uniquely identify the license. The license will specify the date on which it was issued, the license expiration date, the RIS for which it was issued, and the authorized amount (and sometimes enrichment and composition) of each authorized material. Any given RIS may potentially have both an SNM and an SM license. The distinction is in the material types they authorize. In general, one license will apply to only one RIS. One RIS may have multiple licenses which apply to it.

Licenses may be "amended" to change information related to authorized material or licensee (name, address, etc.) information. There will be an issuance or amendment date associated with it, similar to the issuance date of the original license. The expiration date of the license generally will not change.

Licenses may be "renewed" to extend the expiration date. They are also frequently "amended" at this time.

Currently, there exist no procedures governing the frequency and method of submittal of SNM APL data to NMMSS. When SNM APL updates arrive, they update the Authorized Possession Limit Background Data File. SM APLs are not currently maintained in NMMSS. Because of this lack of rigorously defined data submittal procedures, there are few data preparation and input constraints placed on Oak Ridge personnel. Once this new capability is available, more formal procedures may be established.

The data currently maintained in the APL file are:

- docket number;
- license number;
- RIS;
- authorized possession limits for:
  - U235
  - U233
  - Plutonium

For a discussion of edit requirements, anticipated data volumes, and other design characteristics associated with these modifications to the APL file, see Section 5.0.

5.0 DESIGN CHARACTERISTICS

The implementation of the NMMSS modifications listed in Section 1.1 is addressed in a single specification due to the overlap in NMMSS reports impacted by these enhancements, as well as a similarity in objective that may render it beneficial to consider them simultaneously.

This section characterizes three aspects of each of these modifications:

- Procedures. Data preparation and input personnel must be able to assess the way in which data to support these modifications will arrive at NMMSS, and what impact this will have on current data preparation procedures.
- Input. NMMSS systems analysts and programmer personnel must understand what minimum edits and error processing will be required to effect the enhancement.
- Output. NMMSS systems analysts, programmers, and operations personnel must be aware of what report generating requirements are expected utilizing the enhanced NMMSS capability.

5.1 PROVIDE FOR MAINTAINING HISTORIC DATA ON SNM APLS

The thrust of this modification is simply to make any changes in the data currently recorded for SNM APLs so that an APL history for a RIS may be maintained. This will be accomplished by recording three additional pieces of information about each SNM APL entry:

- effective date of the APL;
- license expiration date;
- indication that the entry is an NRC/UCC-submitted change entry.

5.1.1 Procedures

In whatever fashion SNM APL data may arrive at NMMSS (unless they arrive already in card image format of APL file) all data currently extracted and prepared for input to NMMSS should be extracted, plus the effective date of the new license or license amendment and the license/amendment expiration date. Every license amendment to one of the licenses stored in the APL file will constitute a new entry. Corrections to any entry in the file (except those resulting from the edits) are also entered as separate entries for historical record purposes. Note that a correction entry is an entry made by NRC or UCC personnel because an APL entry did not correctly reflect license conditions. An official amendment

issued to reflect a change in the license is treated as an APL license entry.

The format for both of these additional date fields is MMDDYY. The method used to reflect that an entry is a change entry is to be determined by UCC.

This modification will not affect the number of license/RIS pairs that are currently maintained by NMMSS. Nor will it alone impact the frequency of arrival of updates to the SNM APL file.

5.1.2 Input

The license number and RIS combination will be used as the key identifiers in the file. For every SNM APL entry, minimum edit checks, in addition to those currently performed, to maintain an accurate historical record of APL for a RIS include:

- The license number must be specified. If this condition is violated, the update should be rejected.
- If the docket number is not specified, the entry should be flagged.
- If a docket number is specified, and the associated license number is equal to a license number already in the file, the docket number should not be different from the docket number already associated with that license number in the file. If this condition is violated, the entry should be flagged.
- The RIS must be specified. If this condition is violated, the update should be rejected.
- The "effective date" and "expiration date" of the update entry must be specified. If this condition is violated, the update should be rejected.
- Both date fields should be valid dates, e.g., MM must be numeric between 1 and 12. If this condition is violated, the update should be rejected.
- The expiration date should be later than the effective date for the same entry, else the update should be rejected.
- The effective date should not be earlier than any previous effective date entered for that license/RIS pair, else the update should be rejected.

Error messages and codes as required will be designed by UCC.

Actual physical record layout is at the discretion of UCC. The two additional date fields are estimated at 6 characters each. The indication that the entry is a change entry is estimated at one character. This modification will not impact the number of license/RIS pairs that are currently maintained in the NMMSS APL file. An average of one to two amendments will have to be stored for each license/RIS pair per year.

5.1.3 Output

This enhancement to the APL file will indirectly affect the two reports listed in Section 1.4. In addition, two new reports are being defined. Report layout decisions are left to UCC.

The reports listed in Section 1.4 address solely current cumulative inventory (SM-1) or current monthly inventory (I-80A) vs. current APL. They must be modified, however, to incorporate the selection of "current APL" as impacted by this modification. Current APL is that APL entry for the license #/RIS pair that has the most recent issuance date. This entry must then be updated by any "change" entries made to that APL entry.

Also, when a facility is flagged on either of these two reports as having violated its APL, print all data pertinent to that current APL. For every license #/RIS pair that was added together for that facility, display:

- RIS;
- license number;
- docket number;
- all materials, amounts, and enrichments authorized by the license;
- issuance date;
- expiration date.

A new report is being defined to provide to a safeguards analyst the history of APL violations for a facility. The key features of this report are:

- Produce on request;
- By facility, for all RIS within that facility;
- Provide user options:
  - facility
  - time period

- Starting with the beginning date of the specified time, flag every APL violation that occurred during that time frame. When a violation is flagged print, in addition to the inventory at the time, all data pertinent to the APL in effect at that time. Note that the APL in effect at any time is the APL entry updated by any "change" transactions against that entry.

A second new report of interest to a safeguards analyst will simply display all license amendments and changes and will have the following key features:

- Produce on request;
- For each facility, for each RIS within that facility list all APL amendments and changes that occurred in the specified time frame.
- Provide user options:
  - specify facility
  - specify time period

5.2 PROVIDE FOR MAINTAINING DATA ON SM APLS

Source material license information is not currently available in NMMSS. This enhancement will provide for maintaining historical and current data on SM APLs. The NMMSS SM materials of interest will be:

- Thorium;
- Natural Uranium;
- Depleted Uranium.

5.2.1 Procedures

SM APL information is not currently sent to NMMSS. No procedures have been established for receiving and preparing this data. However, in whatever fashion the data may arrive, the data to be captured from a submitted SM APL form are specified in Table 1.

If any of these materials are not authorized by the SM license, simply leave the APL for these materials blank. The format for the APL field for Thorium is 999999.99, and for Normal and Depleted Uranium is 99999999.99.

An additional date field for each entry, the NMMSS system capture date, may either be entered by the data preparation personnel at the time of submission, or be system generated. The format is MMDDYY.

TABLE 1
CHARACTERISTICS OF SM APL DATA

DATA	FIELD LENGTH	FIELD TYPE
license number	*	*
docket number	*	*
RIS	*	*
expiration date of license	*	*
effective date of license (or of license amendment)	*	*
authorized possession limit for Thorium[1]	8	Numeric
authorized possession limit for Normal Uranium[1]	10	Numeric
authorized possession limit for Depleted Uranium[1]	10	Numeric
material enrichment	*	*

*Same as for SNM APL counterpart.

[1]Must also be able to distinguish material type, either by material type code (est. 2 characters, field type numeric) or by position in file, or another suitable method.

Since historical tracking capability is required for SM APL information, there should also exist a code with each submitted correction entry. Note that a correciton entry is an entry made by NRC or UCC personnel because an entry in the NMMSS APL file did not accurately reflect the license conditions; a license amendment to change an APL license entry is considered as a new APL entry.

The estimate of frequency of arrival is less than one update/year for each of about 450 license/RIS pairs.

5.2.2 Input

Edit checks are projected to be the same as those for SNM APLs.

Error messages and codes as required will be designed by UCC.

Actual physical record layout is at the discretion of UCC. An average of less than one amendment will have to be stored for each license/RIS pair per year.

5.2.3 Output

Both of the reports listed in Section 1-4 can be enhanced as a result of this new capability. Specifically, the reports may be expanded to monitor inventories and posssession limits of SM. Source materials are:

- Thorium;
- Depleted Uranium;
- Normal Uranium.

Since it is possible that a source material license may be issued authorizing unlimited quantities of source material, when a facility has an inventory of one of the above materials for which no possession limit is given, flag it as a potential violation as well.

All other processing of these reorts, as modified per Section 5.1.3, will remain unchanged. The report frequency is the same as for SNM monitors.

The APL violation history report described as a new report in Section 5.1.3 should also be expanded to include SM.

The license history report for a facility described as a second new report in Section 5.1.3 should be expanded to include SM.

5.3 EXPAND THE SET OF DATA ELEMENTS MAINTAINED ON APLS

This enhancement will expand the set of data maintained in NMMSS for a SNM license. These additional data are:

- expiration date of license;
- NMMSS capture date;
- material enrichment;
- indication of sealed or unsealed.

The first additional piece of data, the expiration date of the license, was also addressed in Section 5.1. This is because the purpose there was to specify all data elements that would be necessary to maintain an APL history for a RIS, whereas in this section, the expiration date would be of interest whether or not historical records are kept. It is the same piece of date, however, and should be stored only once for an entry.

5.3.1 Procedures

In whatever fashion SNM APL data may arrive at NMMSS, all data currently extracted and prepared for input to NMMSS should be extracted, plus, when available:

- expiration date of the license;
- material enrichment associated with the APL for any given material;
- indication of whether the material authorized is sealed or unsealed; the method of making this distinction is at the discretion of UCC.

In addition, the data preparation personnel will enter the NMMSS capture date at the time of submission of the entry, or this date could be system generated.

The format for both of these date fields is MMDDYY. The material enrichment is estimated to be three characters in length. The indication of sealed or unsealed is estimated at one character.

5.3.2 Input

For every SNM APL entry, minimum edit checks in addition to those currently performed are:

- The expiration date should be a valid date and should be greater than any previous expiration date associated with that license/RIS pair. If this check is violated or if the field is blank, the entry should be flagged. (NOTE: If the modification described in Section 5.1 is implemented, the more stringent edits specified there for this field will take precedence.)
- The material enrichment should be numeric between 0 and 100. If this check is violated, the entry should be flagged. If the field is blank, no action need be taken.

5.3.3 Output

One new report is being defined which takes advantage of this expanded set of data elements. The key features of this report are:

- produced monthly;
- list all current licenses which will expire in the next six months*;
- sort this list three ways:
  - by RIS;
  - by license number;
  - by docket number.
- list all of the data maintained for this license:
  - RIS
  - license number
  - docket number
  - all materials, amounts, and enrichments authorized by the license
  - issuance date
  - expiration date
  - capture date.

5.4 SUMMARY OF REPORT ENHANCEMENTS

Prior sections discussed report enhancements to current NMMSS reports. This section summarizes in concise fashion the enhancements to each report.

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*Note that the most current license for a license #/RIS pair is the one with the latest issuance date that is not a "change" entry (see Section 5.1.1), updated by all "change" entries against it.

REPORT NUMBER	REPORT TITLE	CURRENT KEY FEATURES	ENHANCEMENTS
SM-1	Safeguards Data Monitor; Possession Limits Monitor	- Several independent monitors under control of one executive program (one monitor is possession limits monitor). - Triggers message whenever specified parameters have been exceeded; parameters are a function of material type, material composition, nuclear facility. - Options: -Facility. -Time interval. -Exception monitor. - The possession limit monitor computes current book inventories for all materials for a RIS; uses RIS correlation matrix to sum from RIS to facility level; issues a message if a) current facility book inventory exceeds APL, or if b) facility is not currently authorized that material. - Can sort all execption messages by field office, regional office, facility.	For APL Monitor: - Print details about an APL. - Expand to monitor SM APL.
I-80A	Book Inventories and Comparisons	- Based on book inventories derived on a monthly basis by updating latest inventory with subsequent transactions. - Only total inventory figures are used. - Monitors inventories and possession limits of SNM. - Produced monthly.	(- It is not the purpose of I-80A to produce historical options). - Print details about an APL. - Expand to monitor SM APL.

REFERENCES

Boeing Computer Services Company, "Enhancement of NMMSS Final Report," USNRC Report NUREG/CR-0806, April 1979. Available for purchase from National Technical Information Service, Springfield, Virginia 22161.*

Boeing Computer Services Company, "SSDM (Systematic Software Development and Maintenance)," BCS Document 10153, August 1976.

U.S. Department of Commerce/National Bureau of Standards," Guidelines for Documentation of Computer Programs and Automated Data Systems," FIPS PUB 38, February 1976.

U.S. Nuclear Regulatory Commission, "Draft Automated Administrative and Management Information Systems Documentation Handbook," USNRC Appendix 0903, August 1979. Available in NRC PDR for inspection and copying for a fee.

*Also available for purchase from the NRC/GPO Sales Program, U.S. Nuclear Regulatory Commission, Washington, DC 20555.

APPENDIX C

ENHANCEMENT OF THE NUCLEAR MATERIALS MANAGEMENT AND SAFEGUARDS SYSTEM

A TEST FOR ACCEPTANCE OF ENHANCEMENTS RELATED TO INVENTORY DIFFERENCE DATA AND AUTHORIZED POSSESSION LIMIT DATA IN NMMSS

JANUARY 14, 1980

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PREPARED FOR

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
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APPENDIX C
A TEST FOR ACCEPTANCE OF ENHANCEMENTS RELATED TO INVENTORY DIFFERENCE DATA AND AUTHORIZED POSSESSION LIMIT DATA IN NMMSS

1.0 GENERAL INFORMATION

This document should be considered part of an evolving record of the implementation of Enhancements to the Nuclear Materials Management and Safeguards System (NMMSS) in the area of Inventory Difference (ID) data, and Authorized Possession Limit (APL) data, as specified in the Specifications Documents prepared under this contract. The significance of maintaining an evolving record is that backup be readily available as documentation of the history of and basis for acceptance of the capability by NRC.

Section 2.0 of this document describes the test plan which will be followed as the basis for acceptance. This test plan is designed to provide a plan by which NRC can assure themselves that their needs as detailed in the Specifications Documents have a high probability of being met. Sections 3.0 and 4.0 contain the test documentation.

2.0 TEST PLAN

Presented in this section is the plan for acceptance testing of ID and APL enhancements to NMMSS. Acceptance will be based on how well the documented requirements have been met as tested by a known set of test data and compared against expected results.

Section 2.1 provides an overview of the approach. Section 2.2 describes the materials which were prepared to give structure to the acceptance testing process. Section 2.3 discusses the actual testing, and Section 2.4 provides guidelines on documenting the test results.

2.1 OVERVIEW OF APPROACH

In acceptance testing, the stated requirements establish a base for testing the implemented capability. The degree of testing is dependent on the detail of the specifications (requirements). In this case, the Specifications Documents were written at the user requirements level; the tests are designed accordingly, constructed so as to provide NRC assurance that their data input handling and data output processing requirements may be met.

Testing includes verification of the input/edit processing and data load. After all data have been successfully loaded, UCC will be requested to produce selected reports using submitted "test" parameters. Results will be compared against expected results, and documented.

2.2 TEST MATERIALS

Preparation of the test includes:

- documenting the requirements;
- preparing the test data;
- defining the test procedure and documenting the expected results.

This section discusses each of these three areas of acceptance test documentation.

2.2.1 Documenting the Requirements

The requirements must be documented and be made available to those implementing the capability in order to establish a base for acceptance

testing. In this case, the requirements were documented in the form of a Specifications Document. This was the guideline used to make the enhancements to the NMMSS system, and contains three major categories of requirements:

- performance requirements (eg, response time);
- design characteristics (eg, file length and type);
- output (eg, report enhancements and new reports).

2.2.2 Preparing the Test Data

Test data are a set of known, controlled data which are submitted as input to NMMSS to produce results which will be measured against some expected result. Test data must be identified before acceptance testing begins.

A set of test data has been prepared which is designed to test each of the requirements discussed in the Specifications Document. No attempt has been made to test system capability beyond that which is discussed in the Specifications Document. That is, capability which was in effect before the enhancements were implemented is assumed to be available still.

2.2.3 Preparing Test Procedure and Documenting the Expected Results

The test procedure is outlined as a series of executable steps which have expected results. Expected results are based on the requirements, the known test data, and the selected test parameters. Expected results include:

- data which should be stored in the file after update;
- data which are flagged or rejected during update;
- report requests accepted;
- output on requested reports.

Documentation of expected test results provides an unbiased basis of comparison for the actual test results.

2.3 CONDUCTING AND ANALYZING THE TEST

The test will be conducted in a mode of "business as usual." That is, the update test data will be subjected to all edit criteria and update processes to be used on subsequent submitted licensee data. When the test update is complete, and all error and exception reports have been

produced, a dump of the file will be requested. The test results will then be compared with the expected results, and conclusions documented.

After the update process has been completed, the test report parameters will be submitted, again in the same manner as current requests are processed. The test results will then be compared with the expected results, and conclusions documented.

This procedure should indicate that the enhanced capability can be provided in a way compatible with current NMMSS processing; that the processing and turn-around requirements currently specified by NRC will not be significantly impacted.

2.4 DOCUMENTING TEST RESULTS

All analysis of the test results should be documented. The documentation should include:

- date the "test" data were submitted for NMMSS update;
- brief descriptive summary of the update process, and problems encountered;
- list of file contents after update, error listings produced, etc.;
- date report requests were submitted;
- date requested reports were received;
- summary of problems encountered, clarification required to produce requested reports;
- list of reports and any exception reports produced;
- comments on report layout, etc;
- comparison of the results with the expected results.

2.5 RESPONDING TO REQUIRED CHANGES

NRC should evaluate the documented test results and decide which of the reported deficiencies (if any) are test action items. In order to maintain the record of acceptance which this document should provide, NRC might want to make any changes in conformance with current NMMSS change control procedures, and make a record of the change request and subsequent results.

3.0 ACCEPTANCE TEST DOCUMENTATION -- ID ENHANCEMENTS

This section describes all of the backup documentation for the ID enhancements acceptance test. The documentation referenced is:

- Documentation of the requirements;
- Test data;
- Test procedure and expected results.

3.1 DOCUMENTATION OF ID REQUIREMENTS

The documentation of requirements, "A Specification Document for Enhancements Related to Inventory Difference Data in NMMSS," was delivered on 12/21/79 to NRC.

3.2 ID TEST DATA

The test data were prepared for keypunch on forms DOE/NRC-740 and were delivered to NRC on 6/30/80. A few comments should be made concerning the data on these forms:

- It was envisioned that ID data for two licensee RISs would be required to demonstrate that all of the required capability is functional. It was not known, however, whether UCC had "dummy" or "test" RISs available in the system, or whether new and unique RISs would have to be created. In lieu of choosing two RISs at random, the designations "A" and "B" were used on the 740 sheets to distinguish data for each of two RISs. UCC should assign the RISs as appropriate at the time of the test.
- The codes for indicating source of an ID entry are defined as:
  - R; Regional submission
  - L; Licensee submission
  - O; Oak Ridge reconciliation entry

  This code will require a new field or redefinition of an old field in the transaction data base. At this time, UCC has not yet selected the exact field. As such, the source of each test entry was not coded onto the 740s. Instead, the source (R, L, or O) was hand written at the top of each sheet. When the field has been selected, the source given at the top of the page should be keypunched in the appropriate position.
- All other data required for an entry of ID (action code M, use code 77) or an entry of ID components (action code I) are entered in the appropriate positions on the forms DOE/NRC-740.

These data are, as appropriate: transaction number, processing code, action code, action date, total number of lines of detail, line number, use code, material type code, element and isotope weights, and weight percent isotope.

Sections 3.3 through 3.12 describe the procedure to be followed with this set of test data, from input of the data into the data base to production of the new/enhanced reports.

3.3 ID TEST 1 -- INPUT/EDIT OF INCOMING DATA

Test 1 involves accurately updating the data base with the test data provided on forms DOE/NRC-740 and discussed in Section 3.2. This section states the objective of the test, and details the step-by-step procedure to be employed in performing the test. Expected results of the test are presented for comparison of actual test results.

3.3.1 Test Objective

The objectives of Test 1 are:

- To verify that the additional data elements required to enhance the ID data are incorporated into the NMMSS transaction records.
- To demonstrate that the proper edit criteria are applied to the new data elements by the Edit Programs.
- To provide test data for use in the following tests which demonstrate report modification.

To accomplish this objective, test data entries were created to test each one of the new requirements placed on incoming ID entries. These requirements are listed in Table 3-1 and are cross-referenced to the specific transaction number(s) of the entries designed to test each requirement.

3.3.2 Test Procedure

In general, the Test 1 procedure is to keypunch and submit to the system all of the data provided on forms DOE/NRC-740. All of the valid entries should enter the system with no keypunch errors and be allowed to update the data base. All entries in error should be flagged as such, and when corrected should accurately update the data base.

TABLE 3-1 -- NEW ID REQUIREMENTS
AND CORRESPONDING TEST ENTRIES

Requirement	Test Entry Transactions
• When material type is 20 and use code is 77, the "weight % isotope" field must be used to indicate enrichment of an enriched uranium ID. When this is violated, the entry is in error. Conversely, when material type is other than 20, there is no requirement placed on the "weight %" field.	800301 800514 800515 800516
• When the "weight %" field is used, it must be positive numeric. When this is violated, the entry is in error.	800302 800303 800304 800305
• The code for the source of the ID entry must be one of the three allowable values. When this is violated, the entry is in error.	800307 800308 800310 800311
• Every entry of ID must have an associated code for the source of the entry. When this is violated the entry is in error.	800306 800309
• Every action code I entry must correspond to an action code M entry of the same transaction number, same RIS, same material type. When this is violated the entry is in error.	800317 800318 800319
• The element and isotope values of every action code I entry must sum equal to its corresponding action code M entry. When this is violated the entry is in error.	800312 800316
• The use codes for the action code I entries must be valid as defined in the Specification Document. When this is violated the entry is in error.	800313 800314 800315
• When the above conditions are not violated, the system should allow the entries to update the data base.	Transaction numbers 800400 through 800715

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* For documentation purposes, all entries in error have an action date of March. All valid entries have an action date of April through July, and were created so as to test each of the new/enhanced report production requirements discussed in Sections 3.4-3.12.

Step 1

Submit the keypunched ID entries to NMMSS, initiating the editing procedure. This should consist of the same input editing which actual incoming transactions will undergo (i.e., enhanced Transaction Data Edit, Transaction Data File Update, and Transaction Data File Compatibility Edit Programs).

Examine the TJ-1 which is produced by the Transaction Data Edit Program. This is simply a listing of all transactions submitted to the system. Compare the TJ-1 with the expected results. Document any exceptions. This will ensure that the subsequent tests are performed correctly.

Correct any keypunch errors and resubmit those transactions.

Step 2

Ensure that the record-level edits performed by the Transaction Data Edit Program have identified all of the transactions in error based on record field specifications. An error report, probably the TJ-2, should have been produced by the Transaction Data Edit Program. Compare the (TJ-2) report with the expected results. Note any discrepancies.

Step 3

All transactions that were submitted to NMMSS for input editing, except those appearing on the record-level error report (TJ-2), Step 2, should be passed to the Transaction Data File Update Program. Ensure that the compatibility edits performed by this program identify all of the transaction data sets which are incompatible. These will be displayed on an error report, probably the TJ-3A. Compare the (TJ-3A) report with the expected results. Note any discrepancies.

Step 4

To complete the edit/correction loop, correct the transactions which were in error. As shown in Table 3-2, replace the field in error on the specified transaction with the correct value.

Resubmit the corrected entries to NMMSS.

Examine the TJ-1 produced by the Transaction Data Edit Program. Compare the TJ-1 with the expected results.

Correct any keypunch errors and resubmit those transactions. Document any exceptions.

TABLE 3-2 -- CORRECTIONS TO ERROR TRANSACTIONS

RIS	Trans. No.	Action Code	Line No.	Field In Error	Correct Value
A	800301	M	1	Weight % Isotope	21
A	800302	M	1	Weight % Isotope	19
A	800303	M	1	Weight % Isotope	19
A	800306	M	1	Source of Entry	R
A	800307	M	1	Source of Entry	L
A	800308	M	1	Source of Entry	R
A	800309	M	1	Source of Entry	L
A	800310	M	1	Source of Entry	R
A	800311	M	1	Source of Entry	0
A	800312	I	1	Element Weight	60
A	800312	I	1	Isotope Weight	6
A	800313	I	1	Use Code	97
A	800314	I	1	Use Code	97
A	800315	I	1	Use Code	97
A	800316	I	1	Element Weight	25
A	800316	I	1	Isotope Weight	5
A	800316	I	2	Element Weight	75
A	800316	I	2	Isotope Weight	5
A	800330	I	-	Transaction Number	800317
B	800318	I	-	RIS	A
A	800319	I	1	Material Type	50

Step 5

Request a TJ-23 which will display all of the ID entries at the level reported to NMMSS for each of the two test RISs. Compare the TJ-23 with the expected results. Note any discrepancies.

3.3.3 Expected Results

The expected results of Test 1 are documented in this section for each of the five steps.

Step 1

The TJ-1 should display each of the transactions shown in Table 3-3. Although the display format will probably be different, the given fields with the given values should appear.

TABLE 3-3 -- LIST OF INITIAL ID TEST ENTRIES

RIS	Trans No.	MT	Action Code	Action Date	Use Code	Line No.	Wt. %	El	Iso	Source Of Entry
A	800301	20	M	3/01/80	77	1		100	50	R
A	800302	20	M	3/02/80	77	1	-19	50	5	0
A	800303	20	M	3/03/80	77	1	L	60	6	L
A	800304	50	M	3/04/80	77	1	-21	100		R
A	800305	50	M	3/05/80	77	1	H	100		L
A	800306	20	M	3/06/80	77	1	19	40	4	
A	800307	20	M	3/07/80	77	1	20	150	15	V
A	800308	20	M	3/08/80	77	1	21	200	100	5
A	800309	50	M	3/09/80	77	1		100		
A	800310	50	M	3/10/80	77	1		100		I
A	800311	50	M	3/11/80	77	1		50		1
A	800312	20	M	3/12/80	77	1	19	60	6	L
A	800312	20	I	3/12/80	93	1		20	2	
A	800313	20	M	3/13/80	77	1	20	150	15	L
A	800313	20	I	3/13/80	77	1		150	15	
A	800314	20	M	3/14/80	77	1	21	200	100	R
A	800314	20	I	3/14/80	R	1		200	100	
A	800315	20	M	3/15/80	77	1	20	150	15	R
A	800315	20	I	3/15/80		1		150	15	
A	800316	20	M	3/16/80	77	1	20	150	15	L
A	800316	20	I	3/16/80	93	1		25	7	
					97	2		125	8	
A	800316A	20	M	3/31/80	77	1	20	-150	-15	L
A	800316B	20	M	3/31/80	77	1	20	100	10	L
A	800317	20	M	3/17/80	77	1	19	30	3	R
A	800330	20	I	3/17/80	97	1		30	3	
A	800318	20	M	3/18/80	77	1	20	250	25	L
B	800318	20	I	3/18/80	97	1		250	25	
A	800319	50	M	3/19/80	77	1		50		R
A	800319	20	I	3/19/80	97	1		50		
A	800415	20	M	4/15/80	77	1	19	200	20	L
						2	21	20	10	
A	800501	20	M	5/01/80	77	1	21	100	50	R
A	800502	20	M	5/02/80	77	1	21	200	100	0
A	800503	20	M	5/03/80	77	1	19	50	5	R
A	800504	20	M	5/04/80	77	1	19	60	6	L
A	800505	20	M	5/05/80	77	1	20	500	50	R
A	800506	20	M	5/06/80	77	1	20	150	15	L
A	800507	20	M	5/07/80	77	1	19	40	4	L
						2	21	300	150	
A	800508	20	M	5/08/80	77	1	19	30	3	R
						2	20	250	25	

TABLE 3-3 -- LIST OF INITIAL ID TEST ENTRIES (continued)

RIS	Trans No.	MT	Action Code	Action Date	Use Code	Line No.	Wt. %	El	Iso	Source Of Entry
A	800509	20	M	5/09/80	77	1	20	100	10	L
						2	21	400	200	
A	800510	20	M	5/10/80	77	1	19	20	2	R
						2	20	300	30	
						3	21	500	250	
B	800511	20	M	5/11/80	77	1	21	500	300	R
B	800512	20	M	5/12/80	77	1	20	1500	150	L
B	800513	20	M	5/13/80	77	1	19	1000	100	R
A	800514	50	M	5/14/80	77	1		100		L
A	800515	50	M	5/15/80	77	1		100		R
A	800516	50	M	5/16/80	77	1		50		0
A	800617	20	M	6/17/80	77	1	21	50	25	R
A	800618	20	M	6/18/80	77	1	19	100	10	R
A	800619	20	M	6/19/80	77	1	20	50	5	0
A	800620	20	M	6/20/80	77	1	19	50	5	L
						2	21	150	75	
A	800710	20	M	7/10/80	77	1	21	80	40	R
A	800710	20	I	7/10/80	90	1		20	10	
					91	2		20	10	
					92	3		20	10	
					93	4		20	10	
A	800715	50	M	7/15/80	77	1		160		L
A	800715	50	I	7/15/80	94	1		40		
					95	2		40		
					96	3		40		
					97	4		40		

Note: Process date will be equal to the month and year in which the transactions were entered into the system. Replace RIS 'A' and 'B' with the respective license RISs chosen for this test.

Step 2

The transactions which have field entry errors are shown in Table 3-4. These and only these transactions and their identified errors should appear on the (TJ-2) error report produced for Step 2. Table 3-4 also ties the error to the requirement which was violated to generate the error.

Step 3

The transactions which constitute part of an incompatible data set are shown in Table 3-5. These and only these transactions and their identified errors should appear on the (TJ-3A) error report for incompatibility produced for Step 3. Table 3-5 also ties the error to the requirement which generated the error.

Step 4

The TJ-1 should display each of the transactions shown in Table 3-6. Although the display format will probably be different, the given fields with the given values should appear.

Step 5

All transactions for both RISs should appear on the TJ-23 produced in Step 5. Specifically, RIS 'A' should have entries of ID with the following transaction numbers:

800301-800311
800312-800316
800312-800316, Action Code I
800316A
800316B
800317-800319
800317-800319, Action Code I
800415
800501-800510
800514-800516
800617-800620
800710
800710, Action Code I
800715
800715, Action Code I

RIS 'B' should have entries of ID with the following transaction numbers:

800511-800513

TABLE 3-4 -- TEST TRANSACTIONS CONTAINING FIELD ENTRY ERRORS

RIS	Trans No.	Action Code	Field in Error	Stated Requirement
A	800301	M	Weight % Isotope	When MT = 20, Use Code = 77, the weight % isotope field must be used.
A	800302	M	Weight % Isotope	When the weight % isotope field is used, it must be positive numeric.
A	800303	M	Weight % Isotope	
A	800306	M	Source of Entry	Every ID entry must have source.
A	800307	M	Source of Entry	The code for source of ID entry must be one of the allowable values.
A	800308	M	Source of Entry	
A	800309	M	Source of Entry	Every ID entry must have source.
A	800310	M	Source of Entry	The code for source of ID entry must be one of the allowable values.
A	800311	M	Source of Entry	
A	800313	I	Use Code	The use codes for action code I entries must be one of the allowable values.
A	800314	I	Use Code	
A	800315	I	Use Code	

TABLE 3-5 -- TEST TRANSACTIONS CONTAINING COMPATIBILITY ERRORS

RIS	Trans No.	Action Code	Field in Error	Stated Requirement
A	800312	I	Element/Isotope Weights	Element/Isotope values of action code I entries must sum to action code M.
A	800316	I	Element/Isotope Weights	
A	800330	I	Transaction Number, RIS, or Material Type	Every action code I entry must correspond to an action code M of same transaction number, same RIS, same material type.
B	800318	I	Transaction Number, RIS, or Material Type	
A	800319	I	Transaction Number, RIS, or Material Type	

TABLE 3-6 -- LIST OF CORRECTED ID TEST ENTRIES

RIS	Trans No.	MT	Action Code	Action Date	Use Code	Line No.	Wt. %	El	Iso	Source Of Entry
A	800301	20	M	3/01/80	77	1	21	100	50	R
A	800302	20	M	3/02/80	77	1	19	50	5	O
A	800303	20	M	3/03/80	77	1	19	60	6	L
A	800306	20	M	3/06/80	77	1	19	40	4	R
A	800307	20	M	3/07/80	77	1	20	150	15	L
A	800308	20	M	3/08/80	77	1	21	200	100	R
A	800309	50	M	3/09/80	77	1		100		L
A	800310	50	M	3/10/80	77	1		100		R
A	800311	50	M	3/11/80	77	1		50		O
A	800312	20	I	3/12/80	93	1		60	6	
A	800313	20	I	3/13/80	97	1		150	15	
A	800314	20	I	3/14/80	97	1		200	100	
A	800315	20	I	3/15/80	97	1		150	15	
A	800316	20	I	3/16/80	93	1		25	5	
					97	2		75	5	
A	800317	20	I	3/17/80	97	1		30	3	
A	800318	20	I	3/18/80	97	1		250	25	
A	800319	50	I	3/19/80	97	1		50		

3.4 ID TEST 2--TJ-5 REPORT

3.4.1 Test Objective

The objective of Test 2 is to show that a TJ-5 Report can be produced that incorporates the ID data enhancements which are:

- To identify ID transactions for material type 20 as HEU, LEU, or combined HEU/LEU.
- To group and summarize transactions by these categories upon request.
- To report the source of the ID transaction as defined on the input transaction.
- To select transactions based on their action date.

A prerequisite for Test 2 is that all steps of Test 1 have been successfully completed.

3.4.2 Test Procedure

Step 1

Request a TJ-5 Report with the following parameters specified:

- RIS'A';
- Report End Date equal to month and year in which test is run;
- Use Code 77;
- Material Types 20 and 50.

Step 2

Request a TJ-5 Report with the following parameters specified:

- RIS'A';
- Report End Date equal to month and year in which test is run;
- Use Code 77;
- Material Types 20 and 50;
- Option to group and summarize ID transactions by enrichment category.

Step 3

Request a TJ-5 Report with the following parameters specified:

- RIS'A';
- Report End Date of June 1980;
- Option to select transactions based on Action Date;
- Use Code 77;
- Material Type 20;
- Option to group and summarize ID transactions by enrichment category.

Step 4

Request a TJ-5 Report with the following parameters specified:

- RIS "YLM";
- Report End Date equal to November 1979 (process date);
- Use Code 77;
- Material Type 20;
- Option to group and summarize ID transactions by enrichment category.

3.4.3 Expected Results

Step 1

The TJ-5 Report for Step 1 should maintain current processing capability to:

- Include all the M transactions for test RIS'A' as defined on the TJ-23 report produced successfully during ID Test 1, Step 5.
- List the transactions in order of transaction number within process month for each material type (process month for all transactions is expected to be the same).
- Include material type 20 and 50 transactions on separate pages.
- Sum the total material type 20 inventory difference for the process month (assuming process month for all transactions is the same). Sum the total material type 50 inventory difference for the process month.

The TJ-5 Report for step 1 should have been modified to:

- Include, for each transaction, a code for source of the entry that agrees with the code input.
- Include, for each material type 20 transaction, an enrichment category translated from the value input in the weight percent field according to Table 3-7.
- Include a table at the end of the report that defines the code for source of the entry as:

  'L' - Transaction submitted by Licensee.
  'R' - Transaction submitted by NRC Regional Office.
  'O' - Adjustment transaction submitted at Oak Ridge.

TABLE 3-7
SELECTION LOGIC FOR ENRICHMENT CATEGORY

IF WEIGHT % ISOTOPE IS	THEN ENRICHMENT CATEGORY IS
- any positive number less than 20	- LEU
- any number greater than 20	- HEU
- "20"	- Combined HEU/LEU
- none of the above	- Combined HEU/LEU

Step 2

The TJ-5 Report for Step 2 should:

- Include the same material type 20 transactions as for Step 1, with the same data elements displayed, but grouped and summarized by enrichment category within the process month (assumed same for all transactions).
- Material type 50 display is unchanged from Step 1.
- Include a table at the end of the report that defines the code for source of the entry as:

  'L' - Transaction submitted by Licensee.
  'R' - Transaction submitted by NRC Regional Office.
  'O' - Adjustment transaction submitted at Oak Ridge.

Step 3

The TJ-5 Report for Step 3 should:

- Group and summarize all M transactions as defined on the TJ-23 report produced successfully during Test 1 for Test RIS'A' with action dates of March, April, May, and June separately (should not include ID transactions with any other action date).
- Group and summarize transactions by enrichment category within each action date month. Transactions should be grouped and summarized in an order similar to Table 3-8.

  Note: Table 3-8 shows how entries are to be grouped and is not intended to represent the report format.
- Include no material type 50 ID transactions.
- Indicate in report heading that transaction selection is based on action date rather than process date.
- Include, for each transaction, a code for source of the entry that agrees with the code input.
- Include, for each transaction, an enrichment category translated from the value input in the weight percent field according to Table 3-7.

Step 4

The TJ-5 Report for Step 4 should maintain current processing capability, as well as be modified to:

- Accept and display, for each transaction, a blank for source of the entry.
- Accept and display a blank for each transaction for the enrichment category.
- Have a warning notice that action date does not have any specific meaning prior to date of implementation of these enchancements.

TABLE 3-8
GROUP AND SUMMARIZE TRANSACTIONS BY ENRICHMENT CATEGORY
WITHIN EACH ACTION DATE MONTH

TRANS	SC	DATE	ENRICH	EL WT.	ISO WT.
800501	M	05/01/80	HEU	100	50
800502	M	05/02/80	HEU	200	100
800507	M	05/07/80	HEU	300	150
800509	M	05/09/80	HEU	400	200
800510	M	05/10/80	HEU	500	250
	HEU TOTAL			1500	750
800503	M	05/03/80	LEU	50	5
800504	M	05/04/80	LEU	60	6
800507	M	05/07/80	LEU	40	4
800508	M	05/08/80	LEU	30	3
800510	M	05/10/80	LEU	20	2
	LEU TOTAL			200	20
800505	M	05/05/80		500	50
800506	M	05/06/80		150	15
800508	M	05/08/80		250	25
800509	M	05/09/80		100	10
800510	M	05/10/80		300	30
	COMBINED HEU/LEU			1300	130
	MAY 1980 TOTAL			3000	900
800617	M	06/17/80	HEU	50	25
800620	M	06/20/80	HEU	150	75
	HEU TOTAL			200	100
800618	M	06/18/80	LEU	100	10
800620	M	06/20/80	LEU	50	5
	LEU TOTAL			150	15
800619	M	06/19/80		50	5
	COMBINED HEU/LEU			50	5
	JUNE 1980 TOTAL			400	120

3.5 ID TEST 3--TJ-14A REPORT

3.5.1 Test Objective

The objective of Test 3 is to show that a TJ-14A Report can be produced that incorporates the ID data enhancements which are:

- To identify ID transactions for material type 20 as HEU, LEU, or combined HEU/LEU.
- To group and summarize transactions by these categories upon request.
- To report the source of the ID transaction as defined on the input transaction.
- To select transactions based on their action date.

A prerequisite for Test 3 is that all steps of Test 1 have been successfully completed.

3.5.2 Test Procedure

Step 1

Request a TJ-14A Report with the following parameters specified:

- RIS'A';
- Report Period 3/1/80 thru month and year in which test is run;
- Use Code 77;
- Material Types 20 and 50.

Step 2

Request a TJ-14A Report with the following parameters specified:

- RIS'A';
- Report Period 5/1/80 thru month and year in which test is run;
- Use Code 77;
- Material Types 20 and 50;
- Option to group and summarize ID transactions by enrichment category.

Step 3

Request a TJ-14A Report with the following parameters specified:

- RIS'A';
- Report Period 5/1/80 thru 6/30/80;
- Option to select transactions based on Action Date;
- Use Code 77;
- Material Type 20;
- Option to group and summarize ID transactions by enrichment category.

Step 4

Request a TJ-14A Report with the following parameters specified:

- RIS "YLM";
- Report Period 10/1/79 thru 12/31/79.
- Use Code 77;
- Material Type 20;
- Option to group and summarize ID transaction by enrichment category.

3.5.3 Expected Results

Step 1

The TJ-14A Report for Step 1 should maintain current processing capability to:

- Include all the M transactions for test RIS'A' as defined on the TJ-23 report produced successfully during ID Test 1, Step 5.
- List the transactions in order of transaction number within process month for each material type (process month for all transactions is expected to be the same).
- Include material type 20 and 50 transactions on separate pages.
- Sum the total material type 20 inventory difference for the process month (assuming process month for all transactions is the same). Sum the total material type 50 inventory difference for the process month.

The TJ-14A Report for step 1 should have been modified to:

- Include, for each transaction, a code for source of the entry that agrees with the code input.
- Include, for each material type 20 transaction, an enrichment category translated from the value input in the weight percent field according to Table 3-7.
- Include a table at the end of the report that defines the code for source of the entry as:

  'L' - Transaction submitted by Licensee.
  'R' - Transaction submitted by NRC Regional Office.
  'O' - Adjustment transaction submitted at Oak Ridge.

Step 2

The TJ-14A Report for step 2 should:

- Include the same material type 20 transactions as for Step 1 with the same data elements displayed, but grouped and summarized by enrichment category within the process month (assumed same for all transactions).
- Material type 50 display is unchanged from Step 1.
- Include a table at the end of the report that defines the code for source of the entry as:

  'L' - Transaction submitted by Licensee.
  'R' - Transaction submitted by NRC Regional Office.
  'O' - Adjustment transaction submitted at Oak Ridge.

Step 3

The TJ-14A Report for Step 3 should:

- Group and summarize all M transactions as defined on the TJ-23 report produced successfully during Test 1 for test RIS'A' with action dates of May and June separately (should not include ID transactions with any other action date).
- Group and summarize transactions by enrichment category within each action date month. Transactions 800501 through 800620 should be grouped and summarized in an order similar to Table 3-8.

  Note: Table 3-8 shows how entries are to be grouped and is not intended to represent the report format.

- Include no material type 50 transactions.
- Indicate in report heading that transaction selection is based on action date rather than process date.
- Include, for each transaction, a code for source of the entry that agrees with the code input.
- Include, for each transaction, an enrichment category translated from the value input in the weight percent field according to Table 3-7.

Step 4

The TJ-14A Report for Step 4 should maintain current processing capability, as well as be modified to:

- Accept and display, for each transaction, a blank for source of the entry.
- Accept and idsplay a blank for each transaction for the enrichment category.
- Have a warning notice that action date does not have any specific meaning prior to date of implementation of these enhancements.

3.6 ID TEST 4--TJ-45 REPORT

3.6.1 Test Objective

The objective of Test 4 is to show that a TJ-45 report can be produced that incorporates the ID data enhancements which are:

- To identify enrichment category for ID transactions for material type 20.
- To report the source of the ID transactions as defined on the input transaction.

A prerequisite for Test 4 is that all Steps of Test 1 have been successfully completed.

3.6.2 Test Procedure

Request a TJ-45 Report with the following parameters specified:

- RIS'A';
- Report Period May 1, 1980 thru June 30, 1980.
- Material Types 20 and 50.

3.6.3 Expected Results

The TJ-45 Report should:

- Display, for each Line 77 entry, a code for source of the entry that agrees with the code input.
- Display, for each Line 77 entry for material type 20, an enrichment category translated from the value input in the weight percent field according to Table 3-9.
- Include a table at the end of the report that defines the code for source of the entry as:

  "L" - Transaction submitted by Licensee
  "R" - Transaction submitted by NRC Regional Office
  "O" - Adjustment Transaction submitted at Oak Ridge

TABLE 3-9
ENRICHMENT DISPLAY LOGIC FOR TJ-45

IF WEIGHT % ISOTOPE IS	THEN ENRICHMENT CATEGORY IS
- any positive number less than 20	- LEU
- any number greater than 20	- HEU
- "20"	- Combined HEU/LEU
- none of the above	- Combined HEU/LEU

3.7 ID TEST 5--M-50 REPORT

3.7.1 Test Objective

The objective of Test 5 is to show that a M-50 Report can be produced that has an option to display for material type 20 ID data, Line 77 broken out by enrichment category as defined in Table 3-7.

3.7.2 Test Procedure

Step 1

Request a M-50 Report specifying:

- RIS 'A';
- That transaction data be included.

Step 2

Request a M-50 Report specifying:

- RIS 'A';
- That transaction be included;
- The option to display ID Data, Line 77, for material type 20, by enrichment category is specified.

3.7.3 Expected Results

Step 1

The M-50 Report produced for Step 1 will include Test RIS "A" with material type 20 and material type 50 Line No. 77 entries. Each line 77 will show total ID values.

Step 2

The M-50 report produced for Step 2 will be similar to the Step 1 Report except that each Line 77 will be expanded to three lines as follows:

```
S  Date  A  20  077  HEU
S  Date  A  20  077  LEU
S  Date  A  20  077  COMB
```

3.8 ID TEST 6--M-70 REPORT

3.8.1 Test Objective

The objective of Test 6 is to show that a M-70 Report can be produced that has an option to display ID data, for material type 20, broken out by enrichment category as defined in Table 3-7. Since the method of modifying the M-70 to accomplish the objective was left to the discretion of the programmer, a detailed format cannot be specified.

3.8.2 Test Procedure

Step 1

Request a M-70 Report specifying RIS 'A' material type 20.

Step 2

Request a M-70 Report specifying RIS 'A' and the option to display ID data, for material type 20, broken out by enrichment category.

3.8.3 Expected Results

Step 1

The M-70 Report for Step 1 will show a total quantity of ID for Test RIS 'A'. The total quantity shown will depend on how much of the material type 20 test data for Test RIS "A" was included in the report.

Step 2

The M-70 Report for Step 2 will breakout the ID quantity shown in the Step 1 Report into three quantities as:

HEU
LEU
Combined HEU/LEU.

3.9 ID TEST 7--M-742 REPORT

3.9.1 Test Objective

The objective of Test 7 is to show that a M-742 Report is produced that has an option to display, for material type 20, ID data (Line 77) broken out by enrichment category as defined in Table 3-7.

3.9.2 Test Procedure

Step 1

Request a M-742 Report specifying RIS 'A' material type 20.

Step 2

Request a M-742 Report specifying RIS 'A' and the option to display ID data, for material type 20, broken out by enrichment category.

3.9.3 Expected Results

Step 1

The M-742 Report for Step 1 will show a total quantity for Line 77 Inventory Difference, for Test RIS 'A'. The total quantity shown will depend on how much of the material type 20 test data for Test RIS 'A' was included in the report.

Step 2

The M-742 Report for Step 2 will breakout the ID quantity shown in the Step 1 Report into three quantities as:

77.	**Inventory Difference**	**HEU**
		LEU
		COMB

3.10 ID TEST 8-- FACILITY ID REPORT

3.10.1 Test Objective

The objective of Test 8 is to demonstrate that a new report will display the ID data for all RIS's that are assigned to one facility as defined in the specifications. The primary features of the report are:

- To display ID gain and losses only;
- To select and sort transactions on action date;
- To generate for all RIS's for a facility;
- To provide monthly ID totals for facility.

The user options for the new Facility ID Report are:

- Specify date time frame for report;
- Specify facility;
- Specify material type.

A prerequisite for Test 8 is that the NMMSS file be modified to indicate that RIS 'A' and RIS 'B' are for the same facility.

3.10.2 Test Procedure

Step 1

Request a new Facility ID Report with the following parameters specified:

- Facility for RISs 'A' and 'B';
- Report time frame May 1, 1980 through May 30, 1980;
- Material Type 20.

Step 2

Request a new Facility ID Report with the following parameters specified:

- Facility for RISs 'A' and 'B';
- Report time frame May 1, 1980 through May 30, 1980.

3.10.3 Expected Results

Step 1

The new Facility ID Report should contain the transactions from 800501 through 800513 in a format similar to Table 3-10.

Step 2

The new Facility ID Report should contain the transactions from 800501 through 800513 exactly as in Step 1. It should, on a separate page, contain the transactions from 800514 through 800516 in the same format.

3.11 ID TEST 9--ID COMPONENTS REPORT

3.11.1 Test Objective

The objective of Test 9 is to demonstrate that a new report will display transactions that define the components of an ID transaction as per the specifications. The primary features of the report are:

- Display ID gains and losses only;
- For each action code 'M', use code 77 transaction, display any action code 'I' transaction with the same transaction number;
- The level of detail on the report will be the same as the enhancement to the TJ-5 report as defined in the specifications. This detail includes:
  - List transactions by material type;
  - List transactions by process date and then transaction number;
  - Display enrichment category for material type 20;
  - Display monthly totals by enrichment category.
- Provide a table to define the allowable use codes for 'I' transactions;
- Provide options to selectively prepare report by specifying:
  - Material Type;
  - Time interval ('from' date, 'to' date) based on process date;
  - RIS.

TABLE 3-10
TYPICAL FACILITY ID REPORT

RIS	ACTION DATE	TRANSACTION NUMBER	ELEMENT WEIGHT	ISOTOPE WEIGHT	SOURCE OF ENTRY	ENRICH
A	5/01/80	800501	100	50	R	HEU
A	5/02/80	800502	200	100	O	HEU
A	5/03/80	800503	50	5	R	LEU
A	5/04/80	800504	60	6	L	LEU
A	5/05/80	800505	500	50	R	COMB
A	5/06/80	800506	150	15	L	COMB
A	5/07/80	800507	40	4	L	LEU
A	5/07/80	800507	300	150	L	HEU
A	5/08/80	800508	30	3	R	LEU
A	5/08/80	800508	250	25	R	COMB
A	5/09/80	800509	100	10	L	COMB
A	5/09/80	800509	400	200	L	HEU
A	5/10/80	800510	20	2	R	LEU
A	5/10/80	800510	300	30	R	COMB
A	5/10/80	800510	500	250	R	HEU
B	5/11/80	800511	500	300	R	HEU
B	5/12/80	800512	1500	150	L	COMB
B	5/13/80	800513	1000	100	R	LEU
A	LEU TOTAL FOR MAY		200	20		
A	HEU TOTAL FOR MAY		1500	750		
A	COMB TOTAL FOR MAY		1300	130		
B	LEU TOTAL FOR MAY		1000	100		
B	HEU TOTAL FOR MAY		500	300		
B	COMB TOTAL FOR MAY		1500	150		
	TOTAL ID FOR MAY		6000	1450		

3.11.2 Test Procedure

Request an ID Component Report with the following options.

- RIS 'A';
- Report period May 1980 through month and year in which test is run.

3.11.3 Expected Results

The ID Component Report should:

- Include all the transactions for test RIS 'A' as defined on Table 3-11;
- Include the "I" transaction associated with M transaction as shown in Table 3-11.

3.12 ID TEST 10--ID COMPONENTS (ACTION DATE) REPORT

3.12.1 Test Objectives

The objective of Test 10 is to demonstrate that a new report will display transactions that define the components of an ID transaction as per the specifications. This report is identical with the previous report except that processing is based on transaction action date rather than process date. The primary features of the report are:

- Display ID gain and loss only;
- For each action code 'M', use code 77 transaction, display any action code 'I' transaction with the same transaction number;
- The level of detail on the report will be the same as the enhancement to the TJ-5 report as defined in the specifications. This detail includes:
  - List transactions by material type;
  - Display enrichment category for material type 20;
  - Display monthly totals by enrichment category.
- Provide a table to define the allowable use codes for 'I' transactions.
- Provide options to selectively prepare report by specifying:
  - Material Type;
  - Time interval ('from' date 'to' date) based on action date;
  - RIS.

TABLE 3-11
ID COMPONENTS

TRANSACTION NUMBER	SC	USE CODE	ACTION DATE	ENRICH	EL WT.	ISO WT.
MATERIAL TYPE 20						
800312	M	77	03/12/80	LEU	60	6
800312	I	93	03/12/80		60	6
800313	M	77	03/13/80	COMB	150	15
800313	I	97	03/13/80		150	15
800314	M	77	03/14/80	HEU	200	100
800314	I	97	03/14/80		200	100
800315	M	77	03/15/80	COMB	150	15
800315	I	97	03/15/80		150	15
800316	M	77	03/16/80	COMB	150	15
800316	I	93	03/16/80		25	5
800316	I	97	03/16/80		75	5
800316A	M	77	03/31/80	COMB	-150	-15
800316B	M	77	03/31/80	COMB	100	10
800317	M	77	03/17/80	LEU	30	3
800317	I	97	03/17/80		30	3
800318	M	77	03/18/80	COMB	250	25
800318	I	97	03/18/80		250	25
800710	M	77	07/10/80	HEU	80	40
800710	I	90	07/10/80		20	10
800710	I	91	07/10/80		20	10
800710	I	92	07/10/80		20	10
800710	I	93	07/10/80		20	10
MATERIAL TYPE 50						
800319	M	77	03/19/80		50	
800319	I	97	03/19/80		50	
800715	M	77	07/15/80		160	
800715	I	94	07/15/80		40	
800715	I	95	07/15/80		40	
800715	I	96	07/15/80		40	
800715	I	97	07/15/80		40	

3.12.2 Test Procedure

Produce an ID Component (Action Date) Report with the following options:

- RIS 'A';
- Material Type 20;
- Report Period (Action Date) July 1980 through August 1980.

3.12.3 Expected Results

The ID Component (Action Date) Report produced should include only the data for Transaction 800710 in a format identical to the report produced in Test 9.

4.0 ACCEPTANCE TEST DOCUMENTATION -- APL ENHANCEMENTS

This section describes all of the backup documentation for the APL enhancements acceptance test. The documentation referenced is:

- Documentation of the requirements;
- Test data;
- Test procedure and expected results.

4.1 DOCUMENTATION OF APL REQUIREMENTS

The documentation of the requirements, "A Specification Document for Enhancements Related to Authorized Possession Limit Data in NMMSS," was delivered to NRC on 12/21/79.

4.2 APL TEST DATA

All of the historic APL information current through 01/10/79 was documented during the previous contract. A subset of this set of data was selected as the test data and delivered to NRC on 6/30/80. All information required for a SM or SNM APL entry is recorded on the data capture form, one form per docket/license/RIS. This information is: docket number, license number, RIS, date of issuance of the initial license and of each amendment/renewal, SNM or SM authorized, sealed source and enrichment. Also recorded on the forms are the licensee name and address, which are not maintained in the APL file.

Sections 4.3 through 4.7 describe the procedure to be followed with this set of test data, from input of the data into the background file to production of the new/enhanced reports.

4.3 APL TEST 1--INPUT/EDIT OF INCOMING DATA

Test 1 involves accurately updating the data base with the test data provided on the data capture forms and discussed in Section 4.2. This section states the objective of the test, and details the step-by-step procedure to be employed in performing the test. Expected results of the test are presented for comparison of actual test results.

4.3.1 Test Objective

The objectives of Test 1 are:

- To verify that the additional data elements required to enhance the SNM APL data are incorporated into the NMMSS APL background file.
- To verify that the capability to store SM APL data is incorporated into the NMMSS APL background file.
- To demonstrate that the proper edit criteria are applied to the new data elements by the edit programs.
- To provide test data for use in the following tests.

To accomplish this objective, test data entries were selected from the historical APL data collected under the ENRAS contract. Some of the data contain known errors, designed to test each one of the new requirements placed on incoming APL entries. These requirements are listed in Table 4-1 and are cross-referenced to the specific APL entries designed to test each requirement.

4.3.2 Test Procedure

In general, the Test 1 procedure is to keypunch and submit to the system all of the data provided on the data capture forms. All of the valid entries should enter the system with no keypunch errors and should update the APL background file. All entries in error should be flagged as such, and when corrected should accurately update the file.

Step 1

Submit the keypunched test entries to NMMSS. The data should be subjected to the same input editing which future updates to the SNM/SM APL background file will undergo. Compare the resulting error listing with the expected results. Note any discrepancies.

Step 2

To complete the edit/correction loop, correct the entries which were in error, making the changes as shown in Table 4-2.

Resubmit the corrected entries to NMMSS.

Step 3

Request a dump of the SNM/SM APL file. Compare with the expected results. Note any discrepancies.

TABLE 4-1 -- NEW APL REQUIREMENTS
AND CORRESPONDING TEST ENTRIES

Requirement	Test Entry Number
• License number must be specified.	1,22
• Docket number must be specified.	2,23
• When the license number input is equal to a license number already in the file, the docket number should equal the docket number in the file.	4,5,25,26
• RIS must be specified.	3,24
• The effective and expiration dates must be specified.	3,8,9,24,27,28
• The effective and expiration dates must be valid dates.	10,11,12,13 29,30,31,32
• Expiration date must be greater than effective date for a particular entry.	14,33
• Effective date must be greater than previous effective dates for the same license/RIS pair.	15,16,34,35
• Material enrichment must be between 0 and 100, or blank.	15,17,18, 34,36,37
• RIS can have multiple licenses.	6,7
• Sealed source or material enrichment may be specified for any or all of the authorized materials.	19
• Change transactions must be accepted.	20,21

Table 4-2
CORRECTIONS TO ERROR ENTRIES

Entry Test #	Docket Number	License Number	RIS	Field in Error	Correct Value
1	70-1456		XFX	License Number	SNM-1414
2		SNM-1427	XMZ	Docket Number	70-1467
3	70-1622	SNM-1476		RIS	XHE
5	70-0015	SNM-1446	XDD	Docket Number	70-1500
8	70-1494	SNM-1454	YEN	Effective Date	01/15/74
9	70-1507	SNM-1456	XRY	Expiration Date	01/31/79
10	70-1703	SNM-1513	XJG	Effective Date	02/18/75
11	70-1717	SNM-1504	XRS	Effective Date	12/03/74
12	70-1718	SNM-1531	XMA	Expiration Date	05/31/80
13	70-1721	SNM-1492	ZDV	Expiration Date	09/30/79
14	70-1733	SNM-1489	XDB	Effective Date	08/28/74
				Expiration Date	08/31/79
16	70-1757	SNM-1490	ZJN	Effective Date	12/23/74
17	70-1734	SNM-1570	XKS	Enrichment	
18	70-1752	SNM-1493	ZBZ	Enrichment	
22	40-4996		ZSF	License Number	SUD-541
23		SUD-556	ZQG	Docket Number	40-4826
24	40-3079	SUB-386		RIS	YTV
26	40-1729	STB-393	YUP	Docket Number	40-2917
27	40-2833	SUD-120	ZXH	Effective Date	04/21/61
28	40-2791	STB-256	YPR	Expiration Date	05/31/64
29	40-2259	SUA-672	XQV	Effective Date	12/14/62
30	40-2225	SMB-448	YBP	Effective Date	10/03/61
31	40-659	STB-53	YPJ	Expiration Date	12/31/62
32	40-564	STB-433	YPY	Expiration Date	09/30/64
33	40-534	SMB-191	ZPQ	Effective Date	05/01/61
				Expiration Date	04/30/62
35	40-531	SMB-689	YUJ	Effective Date	06/04/64
36	40-185	STB-281	ZVE	Enrichment	
37	40-147	SUD-309	ZND	Enrichment	

4.3.3 Expected Results

The expected results of Test 1 are documented in this section for each of the three steps.

Step 1

The entries which contained errors are shown in Table 4-3. These and only these entries and their identified errors should appear on the error report produced for Step 1. Table 4-3 also ties the error to the requirement which was violated to generate the error.

Step 2

There should be no entries identified as being in error as a result of Step 2.

Step 3

The SNM/SM APL file should now contain at least the entries shown in Table 4-4. (There may be other entries which were in the file prior to the implementation of the enhancements.)

Before the subsequent tests are run, the APL file should contain all of the historical APL data which were submitted under the previous ENRAS contract (the test data were actually a selected subset of the historical data).

4.4 APL TEST 2--EXISTING REPORT ENHANCEMENTS

4.4.1 Test Objective

The objective of Test 2 is to show that the existing reports (I-80 and SM-1) dealing with APL's utilize the enhanced APL data.

4.4.2 Test Procedure

Step 1

Request a I-80 Report for all facilities.

Table 4-3
TEST ENTRIES CONTAINING ERRORS

Entry Test No.	Field in Error	Stated Requirements
1	License Number	License number must be specified.
2	Docket Number	Docket number must be specified.
3	RIS	RIS must be specified.
5	Docket Number	When license number input is equal to a license number already in the file, the docket number should equal the docket number in the file.
8	Effective Date	The effective and expiration dates must be specified.
9	Expiration Date	
10	Effective Date	The effective and expiration dates must be valid dates.
11	Effective Date	
12	Expiration Date	
13	Expiration Date	
14	Effective, Expiration Dates	Expiration date must be greater than effective date for a particular entry.
16	Effective Date	Effective date must be greater than previous effective dates for the same license/RIS pair.
17	Enrichment	Material enrichment must be betweeen 0 and 100, or blank.
18	En. ichment	
22	License Number	License number must be specified.
23	Docket Number	Docket number must be speicfied.
24	RIS	RIS must be specified.
26	Docket Number	When license number input is equal to a license number already in the file, the docket number should equal the docket number in the file.

Table 4-3 (Continued)

Entry Test No.	Field in Error	Stated Requirements
27	Effective Date	The effective and expiration dates must be specified.
28	Expiration Date	
29	Effective Date	
30	Effective Date	The effective and expiration dates must be valid dates.
31	Expiration Date	
32	Expiration Date	
33	Effective, Expiration Dates	Expiration date must be greater than effective date for a particular entry.
35	Effective Date	Effective date must be greater than previous effective dates for same license/RIS pair.
36	Enrichment	Material enrichment must be between 0 and 100, or blank.
37	Enrichment	

Table 4-4 -- FINAL TEST ENTRIES CONTAINED IN FILE

Corr.	Docket Number	License Number	RIS	Effective Date	Expiration Date	Material Type	Amount	SS	Enrich
	70-1456	SNM-1414	XFX	10/03/73	09/30/75	50	15 g		
	70-1467	SNM-1427	XMZ	11/03/73	10/31/78	50	5 g		
	70-1622	SNM-1476	XHE	06/20/74	06/30/79	20	340 g		
	70-1500	SNM-1446	XDD	12/10/73	12/31/78	50	2 g		
	70-1500	SNM-1446	XDD	08/28/74	12/31/78	50	13 g		
	70-1623	SNM-1471	ZCT	04/30/74	04/30/79	50	8 g		
	70-1017	SNM-973	ZCT	08/07/69	07/31/74	50	438 g	X	
						50	1 g		
						20	8 mg		
	70-1494	SNM-1454	YEN	01/15/74	01/31/79	50	2 g		
	70-1507	SNM-1456	XRY	01/15/74	01/31/79	50	11 g		
	70-1703	SNM-1513	XJG	02/18/75	03/31/80	20	1582 g		
	70-1717	SNM-1504	XRS	12/03/74	12/31/79	50	13 g		
	70-1718	SNM-1531	XMA	05/21/75	05/31/80	50	10 g		
	70-1721	SNM-1492	ZDV	09/19/74	09/30/79	83	3 g		
	70-1733	SNM-1484	XDB	08/28/74	08/31/79	50	18 g		
	70-1757	SNM-1490	ZJN	09/10/74	09/30/79	50	25 g		
	70-1757	SNM-1490	ZJN	12/23/74	09/30/79	50	36 g		
	70-1734	SNM-1570	XKS	10/07/75	09/30/80	50	16 g		
	70-1752	SNM-1493	ZBZ	09/19/74	09/30/79	83	122 mg		
	70-1359	SNM-1405	XBC	08/31/73	08/31/78	50	95 g	X	
						20	1200 g	X	4
						20	70 g	X	
	70-1496	SNM-1779	XPZ	10/13/77	10/31/80	50	2 g		
X	70-1496	SNM-1779	XPZ	10/31/77	10/31/82	50	2 g		
	40-4996	SUD -544	ZSF	02/23/62	12/31/64	10/81	2500 kg		
	40-4826	SUD -556	ZQG	03/14/62	03/31/65	10/81	2500 kg		
	40-3079	SUB -386	YTV	10/27/61	08/31/64	10/81	1818 kg		
	40-2917	STB -393	YUP	08/17/61	08/31/64	88	455 kg		
	40-2917	STB -393	YUP	09/23/64	09/30/67	88	455 kg		
	40-2833	SUD -120	ZXH	04/21/61	02/29/64	10/81	1164 kg		
						88	46 kg		
	40-2791	STB -256	YFR	05/23/61	05/31/64	88	11 kg		
	40-2259	SUA -672	XQV	12/14/62	12/31/65	10/81			
	40-2225	SMB -448	YBP	10/03/61	10/31/64	81	136 kg		

Table 4-4 -- FINAL TEST ENTRIES CONTAINED IN FILE (Continued)

Corr.	Docket Number	License Number	RIS	Effective Date	Expiration Date	Material Type	Amount	SS	Enrich
						10	136 kg		
						88	136 kg		
	40-659	STB -53	YPJ	02/01/61	12/31/62	88			
	40-564	STB -433	YPY	09/25/61	09/30/64	88	22727 kg		
	40-534	SMB -191	ZPQ	05/01/61	04/30/62	81	682 kg		
						10	682 kg		
						88	682 kg		
	40-531	SMB -689	YVJ	07/02/63	03/31/66	10/81	1023 kg		
						88	1023 kg		
	40-531	SMB -689	YVJ	06/04/64	03/31/66	10/81	1818 kg		
						88	1818 kg		
	40-185	STB -281	ZVE	05/26/61	05/31/64	88	773 kg		
	40-147	SUD -309	ZND	06/21/61	06/30/64	10/81	2500 kg		
	40-6329	SUD -157	ZDC	04/07/61	03/31/64	10/81	1500 kg	X	
X	40-6329	SUD -157	ZDC	04/07/61	03/31/64	10/81	2500 kg	X	

Step 2

Request a SM-1 Report for all facilities.

3.4.3 Expected Results

Step 1

The I-80 Report should:

- List the "current APL" as defined in the specification for all SM and SNM APL's printed in the report.
- For all APL violations listed, include the following data for every license/RIS pair that was added together for that facility:
  - RIS;
  - License number;
  - Docket number;
  - All materials, amounts and enrichments authorized by the license;
  - License issuance date;
  - License expiration date.

Step 2

The SM-1 Report should:

- Use the "current APL" as defined in the specification to determine that there was a SNM or SM APL violation.
- For all APL violations listed, include the following data for every license/RIS pair that was added together for that facility:
  - RIS;
  - License number;
  - Docket number;
  - All materials, amounts and enrichments authorized by the license;
  - License issuance date;
  - License expiration date.

4.5 APL TEST 3--APL VIOLATION HISTORY

4.5.1 Test Objective

The objective of Test 3 is to show that a new report will provide a history of APL violations. This report is based on the assumption that the identification of an APL violation is done by another program such as the I-80 or SM-1 report generator. This report program then collects all stored violation records for display.

There are three (3) prerequisites for this test:

1. That all steps of Test 1 have been successfully completed.
2. That the APL file contains all of the historical SNM and SM APL data which were submitted under the previous ENRAS contract.
3. That a program that compares book inventory to the APL, such as the I-80 or SM-1 report generator, has run at least once after the APL enhancements have been completed.

4.5.2 Test Procedure

Step 1

Request an APL Violation History Report with the following parameters specified:

- Report period starting with the date specified on the most recent run of an I-80 or SM-1 report thru month and year in which test is run.

Step 2

Request an APL Violation History Report with the following parameters specified:

- Each of four (4) RISs that appeared on the report produced as a result of Step 1;
- Report period starting with the date specified on the most recent run of an I-80 or SM-1 report thru month and year in which test is run.

4.5.3 Expected Results

Step 1

The APL Violation History Report should:

- Include all SM and SNM APL violations that were listed on the most recent I-80 or SM-1 report;
- For each APL violation listed on the report, include the following data elements:
  - RIS;
  - License number;
  - Docket number;
  - All material, amounts and enrichments, authorized by the license;
  - Effective or issuance date for APL;
  - Expiration date;
  - NMMSS capture date;
  - Material enrichment;
  - Indication of sealed or unsealed source;
  - Material inventory on hand.
- Include the above data elements for all SNM and SM licenses that apply to the facility.

Step 2

The APL Violation History Report should:

- Include data for only the four RIS's requested;
- Be similar in format and content to the Step 1 report.

Note: The completeness and accuracy of the data on all APL reports should be verified against the contents of the APL File.

4.6 APL TEST 4--APL LICENSE AMENDMENTS

4.6.1 Test Objective

The objective of Test 4 is to show that a new report will provide a listing of license amendments that affect the APLs for all licenses and materials at a facility. The report should have the user options to:

- Specify facilities in report;
- Specify time period for report.

4.6.2 Test Procedure

Request a APL License Amendment Report with the following parameters specified:

- Two (2) facilities with SNM licenses and several APL changes in the past three years;
- Two (2) facilities with SM licenses and APL changes in the past three years;
- One (1) facility with both SNM and SM licenses;
- Report Period January 1978 thru month and year in which test is run.

Note: Selection of RIS's is made from the listing of the enhanced APL file.

4.6.3 Expected Results

The APL License Amendments Report should:

- List APL amendments and changes for all RIS's and all material types for only the five facilities requested.
- List APL changes only within the time period requested.

Note: The completeness and accuracy of the data on the report should be verified against a listing of the APL File.

4.7 APL TEST 5--LICENSE EXPIRATION REPORT

4.7.1 Test Objective

The objective of Test 5 is to show that a new report will list all licenses that have an expiration date in the next six months from the date of the report.

4.7.2 Test Procedure

Request a new License Expiration Report.

4.7.3 Expected Results

The new report should:

- List all, but only, licenses which will expire in the next six months.
- Print the list three (3) ways sorted by:
  - RIS;
  - License number;
  - Docket number.
- For each license listed include:
  - RIS;
  - License number;
  - Docket number;
  - All materials, amounts, and enrichments authorized by the license;
  - Issuance date;
  - Expiration date;
  - Capture date.

Note: The report should be compared to the APL file listing to verify that all licenses that should be listed were listed.

APPENDIX D

ENHANCEMENT OF THE NUCLEAR MATERIALS MANAGEMENT AND SAFEGUARDS SYSTEM

A SPECIFICATION DOCUMENT FOR MODIFICATION AND ADDITIONS TO SAFEGUARDS MONITOR REPORT

MARCH 3, 1980

BOEING COMPUTER SERVICES COMPANY
A DIVISION OF THE BOEING COMPANY
FEDERAL SYSTEMS GROUP
7980-90 GALLOWS COURT
VIENNA, VIRGINIA 22180

PREPARED FOR

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
CONTRACT NO. NRC-02-79-050

ABSTRACT

The computerized system used by NRC to receive, store, analyze, and report information on the nuclear material possessed by each licensee is called the Nuclear Materials Management and Safeguards System (NMMSS). It is located at the DOE computer facility, Oak Ridge, Tennessee.

A technical assistance contract entitled "Enhancement of the Nuclear Materials Management and Safeguards System" was awarded to Boeing Computer Services (BCS) Company in September 1979. As a part of that contractual effort, an analysis of the Safeguards Monitor Report (SM-1) resulted in several recommendations that will improve the utility of that NMMSS report. This specification describes the modifications and additions to NMMSS that are required to implement the recommendations. Three new reports are defined in this specification.

The modifications to the SM-1 report provide for changing the threshold values of the individual monitors, reformating the output report, adding Inventory Difference transactions to the classes of data to be monitored, and assigning an identifier to each item for the Action Item List.

The Data Monitor is a new NMMSS report that will reduce the length of Safeguards Monitor Reports by including on that report only those entries that indicate a Safeguard (SG) problem. The Data Monitor (DM) Report will indicate inconsistencies or abnormalities in the reported data that should be corrected if the integrity of NMMSS is to be maintained. The DM Report will be produced with and have the same format as the Safeguards Monitor Report.

The new report "Action Item List" identifies each entry on either monitor report. This list provides positive feedback that each entry was investigated and can now be removed from the list, and indicates the status of entries still requiring action. The new Trend Analysis Report allows the cumulative values of both inventory differences and shipper-receiver differences to be monitored. It will also be an overview of the transactions on the monitor reports for each facility.

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APPENDIX D
A SPECIFICATION DOCUMENT FOR MODIFICATION
AND ADDITIONS TO SAFEGUARDS MONITOR REPORT

1.0 DESCRIPTION

This document is a specification for the implementation of modifications and additions to NMMSS to increase the effectiveness and scope of the Safeguards Monitor Report. Three new reports are defined to augment the function of the Safeguards Monitor Report. The design objectives/functions of the modifications are defined in Section 2.0 with the detailed design characteristics in Section 3.0. This specification will have a minimal impact on the NMMSS operating environments. There are no changes in licensee reporting requirements.

1.1 LIST OF NMMSS MODIFICATIONS

The NMMSS modifications to be implemented include changes to the Safeguards Monitor Report and the creation of three new reports. The purpose of the modifications is to increase the effectiveness of the Safeguards Monitoring function performed by NRC. The modifications to the Safeguards Monitor are:

- Provide the capability to adjust the exception thresholds for each monitor.
- Change report format to list exception reports according to the magnitude of the exception.
- Include Inventory Difference transactions greater than the limit of error in the Safeguards Monitor.

The new reports are:

- Data Monitor Report;
- Action Item List for Monitor Reports;
- Trend Analysis Report.

The requirements of the Data Monitor Report are:

- Provide a report similar in format to the Safeguard Monitor but listing exceptions estimated to be caused by data reporting problems.
- Include in the data monitor shipper-receiver documents open more than 30 days.

- Include in the data monitor transactions with reported SRD's of zero.

The function of the Action Item report is to identify every item on either monitor report and provide for feedback that each item was investigated and/or corrected .

The requirements of the Trend Analysis Report are:

- Monitor cumulative values of ID for each facility for trends in ID reporting.
- Monitor cumulative shipper-receiver differences for trends away from zero.
- Summarize the number of monitor items identified for each facility.

1.2 INPUT DATA AND FORMS

The modifications defined by these specifications do not require any additional licensee data or have any impact on the input procedures for material transactions. There is a requirement for NRC to be able to input the status or delete action items.

2.0 DESIGN OBJECTIVES/FUNCTIONS

The function of the NMMSS modifications is presented in terms of external and internal design objectives. External design objectives are those enhancements, in terms of capability, which are visible to the user. Internal design objectives have to do with the way in which that capability is provided by NMMSS.

2.1 EXTERNAL DESIGN OBJECTIVES

The external design objectives of these modifications are:

- To provide information that is useful to a Safeguards Analyst by identifying NMMSS data that has safeguards significance.
- To add Inventory Difference transactions to the Safeguards Monitor Report.
- To provide a report that is useful to a Data Analyst because it identifies inconsistencies or abnormalities in reported data.
- To include in the Data Monitor transactions open more than 30 days.
- To provide an Action Item report to follow up all Monitor Report items.
- To provide a Trend Analysis Report to monitor cumulative values of Inventory Difference, Shipper-Receiver Difference, and an overview of the monitor reports for each facility.

2.2 INTERNAL DESIGN OBJECTIVES

The internal design objectives of these modifications are:

- To make it easy to establish and change threshold values for reporting exceptions.
- To improve the usability of the monitor report by changing the format.
- To provide the capability to delete items and indicate status on the Action Item List.
- To provide the capability to calculate and store information related to cumulative and statistical data.

3.0 DESIGN CHARACTERISTICS

The requirements of the NMMSS modifications listed in Section 1.1 consist of changes to the current Safeguards Monitor Report and the requirements of the three new reports. Since there is no additional licensee data being recorded as the result of these modifications, there is no impact on the data input procedures or forms. These specifications will define the requirements in terms of the results desired on the report produced. The NMMSS internal data flow and operational changes required to produce the reports will be left to the discretion of UCC to define.

3.1 MODIFICATIONS TO THE SAFEGUARDS MONITOR REPORT (SM-1)

These modifications provide for changing the threshold values of the individual monitors, reformating the output report, adding Inventory Difference transactions to the classes of data to be monitored, and assigning an identifier for each item for the Action Item List.

3.1.1 Provide the Capability for NRC to Establish and Change Thresholds

Each of the monitors (possession limit, negative inventory, etc.) has fixed criteria for including data in the SM-1 report. The intent of this modification is to have the individual threshold values defined in such a manner that they can easily be changed at the request of NRC.

In effect, there are two sets of thresholds; one for the Safeguards (SG) Monitor and one for the Data Monitor. In some uses, the difference is the magnitude of the same parameter. Since the two sets of thresholds would be used together when reviewing transactions to determine in which report they would be listed, it is logical to group all of the thresholds together as part of the SG Monitor specifications.

3.1.1.1 Possession Limit Monitor Threshold

The Possession Limit thresholds determine if items are listed in the SG or Data Monitor Report.

- All reported Possession Limits exceeded by more than C1 grams will be listed in the SG Monitor.
- All reported possession limits exceeded by C1 grams or less will be listed in the Data Monitor.
- All occurrences of no license in NMMSS will be listed in the Data Monitor.

- All occurrences of no possession limit in NMMSS will be listed in the Data Monitor.
- All facilities with a non-numeric value for a possession limit will be bypassed as far as the monitor reports are concerned.

3.1.1.2 Negative Inventory Monitor

All occurrences of negative inventories will be listed in the Data Monitor.

3.1.1.3 Limit of Error Monitor

The Limit of Error thresholds will provide a parameter to limit the number of items on the Data Monitor, provide both default LE ranges and provide for changes to the "Table of Acceptable Limits of Error Ranges."

- All transactions identified by the Limit of Error Monitor will be listed in the Data Monitor.
- Establish a parameter "P1" that would limit the listing of transactions by the Limit of Error Monitor when there is no limit of error reported or the LE is less than the value determined from the lower limit in the "Table of Acceptable Limit of Error Ranges." "P1" should be interpreted as follows:

  P1=A List all transactions identified by the LE Monitor.
  P1=L List transaction with LE's less than the lower limit value but not those with no LE reported.
  P1=B List transactions with no reported LE but not those with LE's less than the lower limit value.
  P1=N Do not list transactions with either no LE reported or LE's less than the lower limit value.

- Establish values C2 and C3 as the default percentage values for element and isotope, of the upper limit of the acceptable limit of error when there is no value in the "Table of Acceptable LE Ranges" for the composition code in the transaction.
- Provide the capability to add additional composition codes and associated values to the "Table of Acceptable Limit of Error Ranges" or to adjust the value of a limit for any existing composition code.

3.1.1.4 Shipper-Receiver Difference Analysis (SRD)

The SRD thresholds determine if items are listed in the SG or Data Monitor Report.

- List in the Data Monitor rather than in the SG Monitor transactions with statistically significant SRD where the SRD is greater than C4 percent of the material weights.
- List in the Data Monitor transactions where receiver values are reported and the SRD is zero or less than C5 percent of the material weight.

3.1.1.5 Inventory Difference Monitor

This specification adds an Inventory Difference (ID) Monitor to the Safeguards Monitor Report. The thresholds associated with the ID monitor are defined in paragraph 3.1.3.

3.1.1.6 Open Transaction Monitor

This specification defines an Open Transaction Monitor to be included in the Data Monitor report. The thresholds associated with open transactions are defined in paragraph 3.2.2.

3.1.2 Modify the Format of the Safeguards Monitor Report

The intent of this modification is to make the SM-1 report easier to use by the SG analyst. The current report divides facilities or RIS's by NRC Region or DOE Field Office. For each RIS, all items or transactions are listed together. The new format will be:

- A separate section for each monitor, i.e., Possession Limit Monitor, Shipper-Receiver Difference Monitor, Inventory Difference Monitor.
- For each section, list the transactions in order of decreasing magnitude, i.e., largest possession limit violation first.
- For each section, provide as summary information the number of entries in this report and the number of entries from previous reports that are on the Action Item List.
- The SRD Monitor lists the transactions by line number. In many cases, there are multiple entries for each line number due to corrections or adjustments. The order of listing these transactions should be changed to list all entries associated with a line number grouped together and within the

line number by date. This will improve the ability of an analyst to understand the sequence of action for each transaction.

For some functions, it would be better to have all Safeguards Monitor items for a facility listed together as the current format provides. This capability should be maintained so that either or both reports could be produced.

The analysis of the SM-1 report suggests that the readability of the report would be improved if the format of the individual transactions listed were modified. Since the definition of the detailed report format is the responsibility of UCC, it is suggested that additional coordination be established between UCC and NRC Division of Safeguards to improve the report format.

3.1.3 Inventory Difference Monitor

The Inventory Difference (ID) Monitor will examine all ID transactions input during the report period. Any ID transaction where the reported value is greater than the limit of error for the ID will be listed on the SM-1 report, grouped as specified in Section 3.1.2. The following data elements should be included:

RIS, Facility Name
Transaction Number
Material Type
Action Code
Use Code
Action Date
Enrichment Category
Element Weight
Element Limit of Error
Isotope Weight
Isotope Limit of Error

Planned modification to NMMSS provides for the identification of components of ID through the use of an "I" type transaction with the ID component defined by use code (see Table 1). All "I" transactions associated with an ID transaction listed on the SM-1 report should also be listed. This specification provides for listing ID transactions with no reported limit of error on the data monitor report (see Section 3.2.1).

TABLE 1
USE CODE VALUES FOR COMPONENTS OF ID

Use Code	Component of ID
84	Lower Warning Limit
85	Upper Warning Limit
86	Lower Alarm Limit
87	Upper Alarm Limit
88	Redetermination of Discrete Items on Inventory
89	Redetermination of Material in Process
90	Process Holdup Differences
91	Equipment Holdup Differences
92	Measurement Adjustments
93	Rounding
94	Recording & Reporting Errors
95	Shipper-Receiver Adjustments
96	Identifiable Item Adjustments
97	Actual Inventory Difference
99	MUF

3.1.4 Assign Identifier For Each Item

The system should assign a unique identification to each entry on the SG Monitor Report to provide a link between the SG Monitor and the Action Item List (see Section 3.3). The identifier should be coded as an aid in organizing the Action Item list. One technique for coding the identifier would be:

- One-character code to indicate which monitor selected the item:
  - P for Possession Limit
  - N for Negative Inventory
  - E for Limit of Error
  - S for SRD Analysis
  - D for Inventory Difference
  - L for Open (Late) Transaction
- One-character code to indicate which report the item came from:
  - S for Safeguards Monitor
  - D for Data Monitor
- Two-digit code to indicate the month the transaction was identified.
- Two-digit sequential number assigned to each item starting at 01 for each month.

As part of the identification process the system should insure that a transaction is not assigned an identifier twice. Stated another way, a transaction should be listed on the SG Monitor only once.

3.2 DATA MONITOR REPORT

The Data Monitor is a new NMMSS report that is being created by these specifications. This report will reduce the length of Safeguards Monitor Reports by including on that report only those entries that indicate a Safeguard (SG) problem. The Data Monitor (DM) Report will indicate inconsistencies or abnormalities in the reported data that should be corrected if the integrity of NMMSS is to be maintained. The DM Report will be produced with and have the same format as the Safeguards Monitor Report. The content of the DM Report is defined by the thresholds included in the SG Monitor (see paragraph 3.1.1) and the requirement of a new monitor for "Open Transactions". The following paragraphs summarize the transactions to be listed on the DM Report and define the Open Transaction Monitor.

3.2.1 Criteria for Data Monitor Report

The following transactions will be listed on the DM Report:

- Possession Limits which are exceeded by a value that is equal to or less than parameter C1 grams;
- Reports of No License in NMMSS;
- Reports of no possession limits in NMMSS;
- Reports of negative inventories;
- Transactions identified by the Limit of Error (LE) Monitor unless excluded by the criteria for parameter "P1"; "P1" will exclude either or both transactions with no LE reported, or LE's less than the lower limit values.
- Transactions with large Shipper-Receiver Differences (SRD) compared to material weight (greater than parameter C4 percent);
- Transactions with zero or very small SRD's (less than parameter C5 percent);
- Inventory Difference transactions with no reported limit of error.

3.2.2 Open Transaction Monitor

The Open Transaction Monitor will list on the DM Report any shipment transaction of SNM in which the receiver has not acknowledged both the receipt and correct quantity of material within 30 days (i.e., an open transaction) which meets the following criteria:

- Element weight of transaction is greater than parameter C6 grams;
- Receiving facility is not a disposal site.

Each transaction listed by the DM Report will include the following data elements:

1. Shipper RIS.
2. Receiver RIS.
3. Transaction Series Number of SR pair.
4. Change Letter for Transaction Number.
5. Line Number on Nuclear Material Transaction Report.
6. Capture Date (month and day).
7. Material Type Code.
8. Use Code.
9. Financial (T1) Code, Input from Nature of Transaction Code.
10. Action Date (Date of Reported event).
11. Processing Date, year and month in which the transaction was reflected in book balances.
12. Project Number for DOE Transactions.
13. Composition Code.
14. Enrichment Category.
15. Element Weight of Material Reported.
16. Isotope Weight of Material Reported.
17. Comment Field, indicates that an interim transaction, not reflecting quantities, has been submitted by receiver. May be:
    - J Entry on File
    - N Entry on File
    - T Entry on File
    - U Entry on File

The Open Transaction Monitor will have two sections; transactions open more than 30 days and transactions open more than 60 days. Only transactions open more than 60 days will be included in the Action Item List (see paragraph 3.3).

The Open Transaction Monitor will provide two lines of summary information:

- Number of transactions open more than 30 days;
- Number of transactions open more than 60 days.

3.2.3 Assign Identifier For Each Item

The system should assign a unique identification to each entry on the Data Monitor Report to provide a link between the Data Monitor and the Action Item List (see Section 3.3). The identifier should be coded using the same technique used for the Safeguards Monitor (see Section 3.1.4).

3.3 ACTION ITEM LIST FOR MONITOR REPORTS

The new report "Action Item List" can be best described in terms of its function. Both the Safeguards Monitor and the new Data Monitor are exception reports. Only unusual or abnormal transactions or conditions are listed on the monitor reports.

Each entry on either monitor report is identified on the Action Item List (AIL). (Only transactions open more than 60 days will be on the Action Item List.) This list provides positive feedback that each entry was investigated and that it should be removed from the list, or indicates the status of entries still requiring follow-up. A secondary benefit of the AIL is to increase the effectiveness of the monitor reports. Once a transaction is on the AIL, there is no need for that transaction to be listed on the monitor report a second time. Thus, each Safeguards and Data Monitor report will contain new items to be investigated. A prerequisite to the AIL is the establishment by each monitor of a unique identifier for each entry. This identifier will be the link between the monitor report and the AIL (see Sections 3.1.4 and 3.2.3).

3.3.1 Main Features of the Action Item List

The main features of the Action Item List are:

- Produced on the same schedule as the monitor reports.
- Lists action items by identifier. The characterisitics of the identifier will list items in the following order:

  Monitor that Selected Item
  (Possesion Limit, SRD, etc.)
  Data Monitor Report Items
  Month Action Item Created
  Safeguards Monitor Report Items
  Month Action Item Created

- Contains no quantitative data, which will eliminate a security classification problem.
- Easy to delete items or indicate status.

3.3.2 Data Elements For Action Item List

The following data elements will be listed on the AIL for Possession Limit and Negative Inventory items:

Action Item Identifier
Date of Report
RIS
Facility Name
Material Type
Abbreviated Type Entry
  POSS EXCEED
  NO POSS
  NO LICENSE
  NEG. INV.
Date of Latest Status Update
Status Field

The following data elements will be listed on the AIL for NMMSS transactions:

Action Item Identifier
Date of Report
Transfer Series
  RIS
  RIS
  Number
Action Date
Action Code
Line Number
Material Type
Composition Code
Abbreviated Type Entry
  For Limit of Error Monitor
    NO LE
    UP EXCEED
    LOW EXCEED
  For SRD Monitor
    STAT SRD
    LARGE SRD
    LOW SRD

For ID Monitor
LARGE ID
NO ID LE
For Open Transaction Monitor
OPEN TR
Date Latest Status
Status Field

3.3.3 Action Item Status

The Action Item List subsystem will include the capability for NRC to conveniently delete items or update status. While an online terminal access for status update would be desirable, off line updates will satisfy the requirement if they are timely. The only information required to update the AIL will be the:

Action Item Identifier
Two character Status Code

The Status Code input will print a short previously defined comment (up to 20 characters) in the Status Field on the AIL or delete the item. NRC will have the capability to define new status codes as a two character code and the associated comment.

3.3.4 Action Item List Summary

For each AIL produced the following summary data will be calculated and reported.

- Total number of action items on this report broken down by type of monitor:

  Possession Limit
  Negative Inventory
  Limit of Error
  Shipper-Receiver Difference
  Inventory Difference
  Open Transactions

- Total number of new Action Items on this report broken down by type of monitor as above.

3.4 TREND ANALYSIS REPORT

The Trend Analysis Report will have three sections:

Cumulative Inventory Difference
Cumulative Shipper-Receiver Difference
Monitor Summary Report

3.4.1 Inventory Difference Trend Report

The Inventory Difference Trend Report will provide the Safeguards Analyst with a means of monitoring NMMSS data for indications that the loss of a significant amount of SNM could not be concealed or obscured through the repeated reporting of high values, but within acceptable limits of error, of Inventory Difference (ID). If ID is the result of inaccuracies or accidental errors in the measurement processes then a high value in one period should result in a compensating low value in some following period.

This report will give the cumulative ID and a limited amount of recent historical ID data so that a Safeguards Analyst might correlate the data with other information. For each requested facility and inventory type, the following information would be calculated, stored, and reported periodically.

Cumulative Amount of ID
Number of periods summed
Highest value ID recorded for a period
Lowest value ID recorded for a period
Arithmetic averages of all periods
Root Mean Square Average of all periods

Historical data for past 12 periods:

Total amount of ID reported each period
Arithmetic average for past 12 periods

Note: Period may be 1, 2, or 6 month depending on facility reporting requirements.

The planned enhancements to NMMSS will provide for the recording of components of ID as defined in Table 1. As this information becomes available, it should be included in the ID Trend Report. The same cumulative and statistical information defined above for total ID should be reported for the following grouping of components of ID.

Use Code	Component of ID
Group A	
88	Redetermination of Discrete Items on Inventory
89	Redetermination of Material in Process
90	Process Holdup Differences
91	Equipment Holdup Differences
Group B	
92	Measurement Adjustments
93	Rounding
94	Recording & Reporting Errors
Group C	
95	Shipper-Receiver Adjustments
96	Identifiable Item Adjustments
Group D	
97	Actual Inventory Difference
99	MUF

3.4.2 Shipper-Receiver Difference Trend Report

The repeated reporting of low values for receipts of materials, or high values for quantities shipped, (all within the allowable limits of error (LE)) would tend to obscure the possession of larger amounts of SNM than the book balance would indicate. The Shipper-Receiver Difference Trend Report will provide NRC with a means of monitoring the NMMSS data to ensure that this phenomenon is not occurring at any facility. This report will give cumulative SRD's based upon both shipments and receipts for facilities with a significant number of shipments each month. A limited amount of recent historical SRD data will be included in the report for possible correlation with other information by a Safeguards Analyst. For each requested facility and inventory type, the following information will be calculated, stored, and reported periodically.

For transactions with facility as shipper:

Cumulative SRD for past months
Numbers of months summed
Number of shipments this month
Cumulative value of SRD this month
Cumulative value of SRD this month as percent
Largest SRD this month as percent
Smallest SRD this month as percent

Historical data for past 12 months:

Number of shipments each month
Cumulative value of SRD each month
Cumulative value of SRD each month as percent

For transactions with facility as receiver:

Report same data as above for shipments

3.4.3 Monitor Summary Report

The Monitor Summary section of the Trend Report will provide an overview to indicate those facilities that are having NMMSS transactions appear on the Data Monitor or SG Monitor. The number of entries on the Data Monitor could be used as an indicator of the data quality reported to NMMSS. The following information would be reported for each facility:

Number of Transactions on both the current Data and Safeguards Monitor Report.

Total Number of Transactions on Monitor Reports this fiscal year for each of the monitors. The monitors identify exceptions related to:

Possession Limits Exceeded
Negative Inventory
Unacceptable Limit of Error Reported
Large Shipper-Receiver Difference
Large Inventory Difference
Open Transactions

3.5 SUMMARY OF THRESHOLDS

The following list summarizes the variable thresholds which have been defined in this specification.

C1 Value of possession limit exceeded in grams, which determine if item is listed in SG or Data Monitor.

C2 Default percentage value for elemer alue of upper limit of acceptable limit of error.

C3 Default percentage value for isotope value of upper limit of acceptable limit of error.

C4 Upper limit of SRD as percentage which determines if item is listed in SG or Data Monitor.

C5 Upper limit of low (near zero) SRD percentage which would be listed in the Data Monitor.

C6 Lower limit of element weight of open transaction that would be listed in the Data Monitor.

P1 Parameter to limit listing low or missing "Limit of Error Values" in the Data Monitor Reports.

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The Nuclear Regulatory Commission (NRC) awarded a competitive contract to Boeing Computer Services Company to implement specific recommendations developed under the Enhancement of the Nuclear Materials Management and Safeguards System (ENRAS) Contract, NRC-02-78-083, and to perform analysis in other specified areas of safeguards concern. The results of the activities of this contract were the production of program specifications for enhancements to the Nuclear Materials Management and Safeguards System (NMMSS) in the areas of inventory difference and authorized possession limit data; the production of acceptance test procedures for testing the implemented capability; an analysis of the NMMSS Safeguards Monitor (SM-1) report and recommendations for its improvement; the production of program specifications for enhancements to the NMMSS SM-1 report based on selected recommendations; an analysis of NMMSS shipper-receiver difference data processing; the production of a safeguards user's manual containing NMMSS reports related to analysis performed under this contract. This activity is part of NRC's effort to continously enhance their nuclear materials accounting system.

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