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7. Abstract

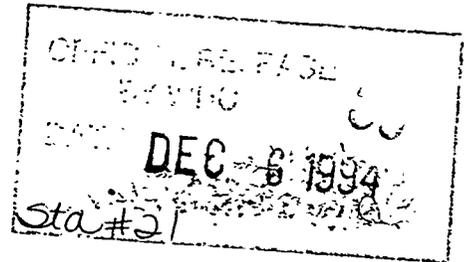
This document is a study which describes the NMSS replacement alternatives and provides recommended solutions. It also describes a NMSS Paradox prototype.

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Feasibility / Alternatives Study

for

the

Planned Replacement

of

Nuclear Material Safeguards System (NMSS)

by

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and

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Document Prepared For

Safeguards and Security
Westinghouse Hanford Company

October 4, 1994

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1.0 INTRODUCTION

1.1 Purpose

The Hanford cleanup and restoration mission in part depends on the Nuclear Material Safeguards System (NMSS). NMSS performs nuclear material accountability for Department of Energy nuclear material managed by Westinghouse Hanford Company (WHC). Presently, the NMSS has a high risk of not performing in the future and needs to be replaced as soon as possible. No recommendation can be made that suggests that the NMSS replacement be postponed for a long time frame.

This study was requested so that NMSS replacement alternatives be identified and analyzed so that a recommendation could be made to WHC Safeguards and Security (S&S) management. This document is intended for WHC S&S, organizations providing NMSS funding support, organizations providing technical support, or to any DOE or contractor organization having an interest in process improvement innovations for applications similar to the NMSS.

1.2 Scope

This document:

- provides an overview of the NMSS replacement need and strategy
- cites sources that substantiate the replacement need and urgency
- includes a recommended course of action
- describes a prototype system that is one of the alternatives considered
- proposes the consideration of a contingency system for emergency backup of the NMSS

This document does not:

- specify a replacement strategy for systems other than the NMSS
- use or refer to vendor firm bid quotes other than those already available on site
- identify any funding monies or agencies that have committed to the replacement recommendation
- guarantee the availability of programmer resources to support the NMSS replacement solution
- provide detailed schedules for alternative implementation

1.3 Overview

This document is the first phase of the software development documentation per WHC-CM-3-10. Its purpose is to describe, refer to, or otherwise establish the basis for replacing the NMSS. Once a recommendation on replacement strategy has been accepted and funding identified, then development efforts can proceed using this concept documentation as a sound basis.

In accomplishing this objective, the remainder of this document does the following:

- provides the concept definition including a description of the need, the solution objectives, and the solution proposal,
- provides an executive summary of the findings and approach strategy,
- background information is provided on users' needs, the environment, and applicable constraints,
- the feasibility analysis is provided that includes feasible alternatives, alternatives analysis, and impact analysis,
- a solution recommendation is suggested, and
- references are cited.

2.0 CONCEPT DEFINITION

2.1 Statement of Need to Define the Current Environment

The following is a list of organizational goal:

- significantly reduce the risk of using old unsupported hardware
- a new system that is supportable and that meets current system requirements
- a replacement system with more efficient operational screens and reports similar to the existing system
- a replacement system that is capable of storing, retrieving, and backing up data at least equal to the existing system
- a replacement system that has access control processes functionally equivalent to the existing system, if actually required
- a replacement system that can be programmed to provide audit trail tracking capability

- readily available and maintainable hardware (e.g. PC Workstations)
- implementation software having a broad base of locally available software programmers
- software having a proven user friendly interface and environment
- hardware and software that is relatively low cost
- hardware that can operate in a normal office environment thus reducing the continuing costs for operating, heating, and cooling
- a replacement system that will be created with supporting documentation according to WHC-CM-3-10
- supports International Atomic Energy Agency (IAEA) requirements at NMSS or locally at the NMSS
- complies with generally accepted accounting principles
- TID database for data cross-checks

2.2 Scope of Need

The NMSS is a dual database system that maintains the official inventory and transaction records of all WHC managed Nuclear Materials (NM). This system provides data to the Oak Ridge, Tennessee, database and various reports to RL and WHC.

The need for the primary function of nuclear material accountability is cited in DOE Order 5633.3A, paragraph II.2 (Accounting Systems): "Each facility shall have a system for tracking nuclear material inventories, documenting nuclear materials transactions, issuing periodic reports, and assisting with the detection of unauthorized system access, data falsification, and material gains or losses. The accounting system shall provide a complete audit trail on all nuclear materials from receipt through disposition ..."

NMSS or a replacement system may be required to support the following interfaces:

- VSIS for backup
- NMMSS, Oak Ridge, TN, by tape and SACNET (essentially magnetic tape reports)
- CAS via a MUX Loop for alarm signals
- Operations Alarm Panel for alarms

2.3 Urgency of Need

Risks for continued operation, maintenance, and support of NMSS are high. The WHC document, *Replacement Analysis for Safeguards and Security Systems of Hanford Protected Areas* (WHC-SD-CP-ES-161 Rev. 0), states the risk for the NMSS as follows: "Evaluation of the NMSS ... revealed significant risks in the areas of vendor and company-supplied hardware and software maintenance. ... The primary computer vendor is no longer in business and the successor company is experiencing financial difficulties. Onsite personnel interviews revealed that critical-skill personnel are seeking employment elsewhere, replacements are difficult to find and require extensive training."

2.4 Solution Objectives

As already described, the NMSS needs to be replaced so that the current high risk is reduced to an acceptable level. Any replacement system needs to:

- (1) provide essentially the same functionality with the same distinctive features as the current NMSS
- (2) operate with a resultant performance that will be adequate (as good or better than the existing system)

Target solution objectives are as follows:

- significantly reduce the current NMSS operational risk
- provide a significant cost savings
- use site available expertise to implement
- be relatively low cost to implement
- minimize training

2.5 Solution Proposals

The following alternatives for NMSS replacement resolution have been identified:

- DO NOTHING
- IMPLEMENT AND USE A MANUAL PROCESS
- MODIFY DOE LANMAS FOR USE
- ACQUIRE PC NETWORK AND RUN PARADOX
- ACQUIRE SUN NETWORK AND RUN ORACLE (SYBASE, ETC.)

3.0 EXECUTIVE SUMMARY

3.1 Schedules

Detailed implementation schedules are not provided in this document because detailed implementation requirements have not yet been identified and documented and a project plan developed. General implementation time ranges are provided in Attachment A.

3.2 Sponsoring Organizations

WHC Safeguards and Security is the managing organization for any effort to improve NMSS and will be coordinating all sponsor related activities. A number of programs will be approached to obtain required funding.

3.3 Costs

Based on detailed cost analysis found in Section 5.2.1 and attachment A of this document, it was found that three of the alternatives under consideration should cost about the same as the current alternative, "Do Nothing." Two alternatives are anticipated to cost 20% to 40% more than the others.

3.4 Strategic Direction

DOE/RL-93-08, *Hanford Mission Plan*, Volume 1, Site Guidance states the following:

"The nuclear facilities mission is to achieve excellence in the management, surveillance, and maintenance of nuclear facilities and manage nuclear materials in a safe and secure manner."

"Nuclear materials will be treated, as necessary, and stored onsite in long-term interim safe storage pending development and implementation of a national policy regarding their final disposition. Those nuclear materials for which a

beneficial use has been identified offsite will be shipped offsite. Uranium and SNM will be converted to a form suitable for storage and transport. Irradiated fuel and cesium and strontium capsules will be disposed of as waste; however, safe storage for irradiated fuel is assumed at the K Basins for up to 20 years. The Plutonium Finishing Plant (PFP) will continue to store SNM for the foreseeable future until final disposition is determined. The capability to support future stabilization activities and terminal cleanout of the facility will be maintained."

The implementation of this concept (NMSS replacement) supports the above strategy as cited.

3.5 Risk Analysis

Risk analysis and conclusions for the NMSS have been performed and documented (see WHC-SD-CP-ES-161 Rev. 0, *Replacement Analysis for Safeguards and Security Systems of Hanford Protected Areas*, February 1994). A comparison of risks for each of the alternatives considered is in Section 5.2.4 of this document.

4.0 BACKGROUND DEFINITION

4.1 User's Needs

4.1.1 Background

The NMSS is a dual database system that maintains the official inventory and transaction records of all WHC nuclear materials. NMSS is used to provide data to the Oak Ridge, Tennessee database and various reports to RL and WHC.

Prior to the 1987 contractor consolidation, multiple contractors processed, managed, and accounted for NM for DOE at Hanford. In 1987, Westinghouse Hanford Company assumed nuclear material accountability for all the NM that had previously been managed by Rockwell Hanford Company, United Nuclear Inc., and Westinghouse Hanford Company. Today, after an extended time, NM company wide is accounted for by a single system at the Plutonium Finishing Plant (PFP), the Nuclear Material Safeguards System (NMSS). NM accountability is the responsibility of WHC's Safeguards and Security organization.

The NMSS has performed well since it was acquired and installed in 1979. PRIME Computer, the manufacturer has gone out of business and maintenance (both hardware and software) is getting more and more difficult and costly to acquire. Also of concern is the increasing difficulty to retain qualified programmers to work on outdated hardware and software. Its continued operation is rated as high risk.

The current NMSS system configuration and system components are shown in Figures 1 and 2.

SAFEGUARDS SYSTEM

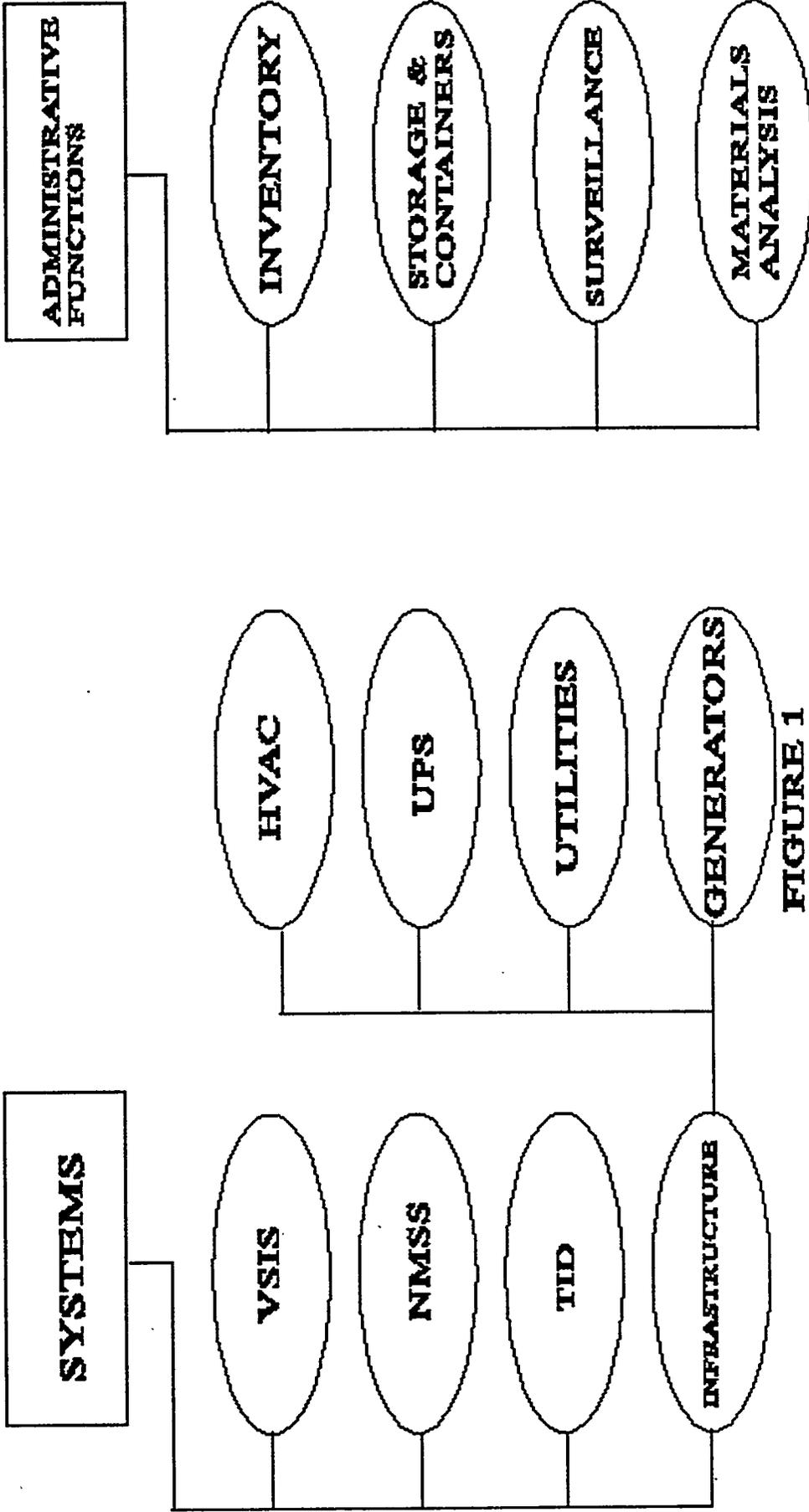


FIGURE 1

SAFEGUARDS SYSTEM COMPONENTS

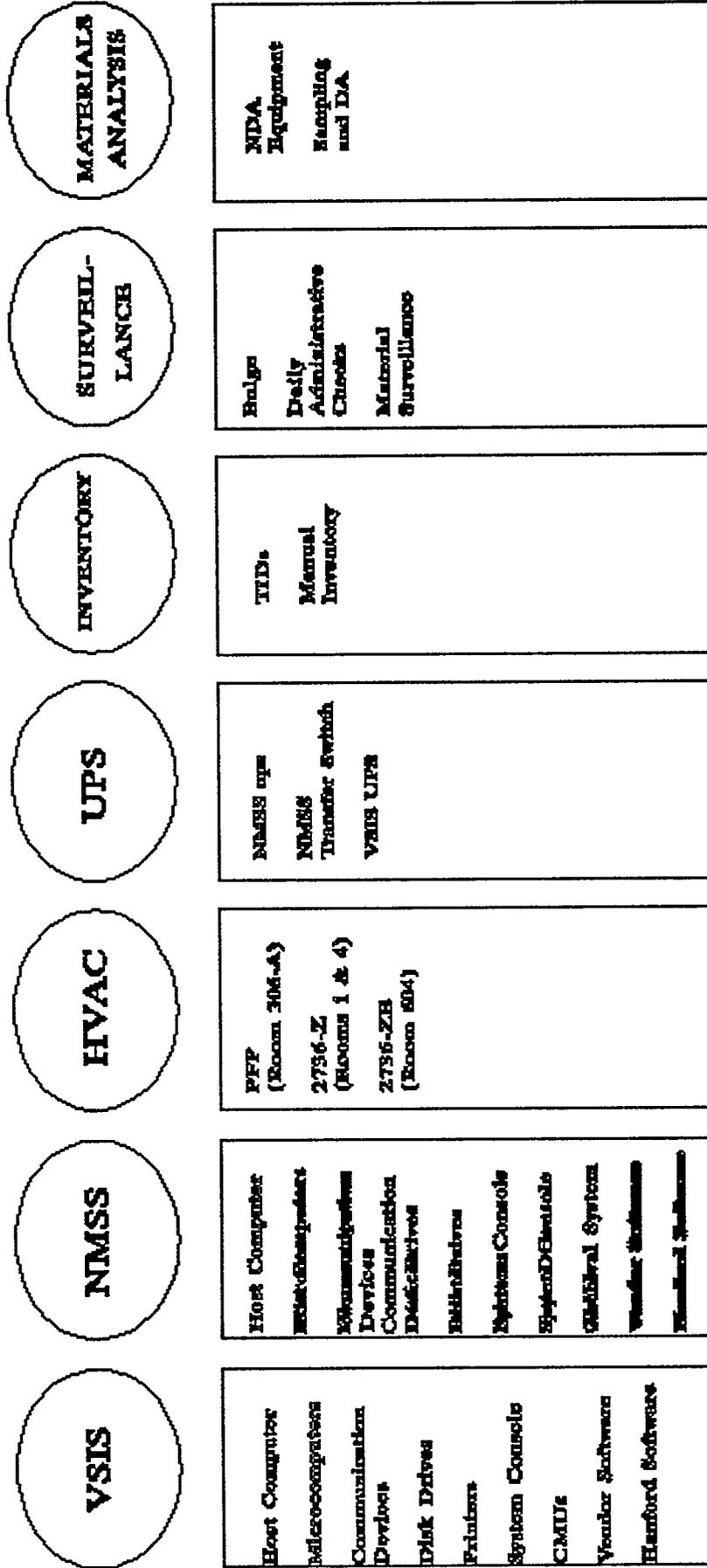


Figure 2

4.1.2 User Identification

WHC Safeguards and Security staff and NM custodians are direct users of the NMSS. Other organizations receiving reports and data from the NMSS are:

- NMMSS at Oak Ridge Tennessee (data is exported using floppy diskettes and the SAC-NET classified data link)
- DOE-RL Safeguards and Security (accesses routine reports and issues ad-hoc queries for data)
- WHC Material Management (MM) (data is usually prepared in a PARADOX format to be exported to WHC MM via floppy diskette)
- WHC NM custodians

Information produced by this system is classified as "Confidential". Even if the NM data in the NMSS is de-classified, it is unlikely that this information will ever be released to the public.

4.1.3 User Characteristics

The users as described earlier in this document use NM data from different perspectives. Some look at more technical aspects of the NM such as decay and impurity effects. Other users are more interested in strictly accounting aspects. The user perspective is varied and is expected to continue in a similar manner.

Customers and users will use the data to account for existing inventories and also to identify sources of available NM to fill whatever national and international needs arise. In all cases, the NM must be accurately accounted for and data must be available in a timely manner to meet existing and future routine and special needs and requests as well as meet DOE order requirements (5633 series).

4.2 Constraints

Two constraints that would significantly impact the resolution of the replacement of the NMSS are:

- the current DOE directive precluding the acquisition of computer hardware and software for all but critical systems
- the availability of funding will be identified to support problem resolution recommendations in the Safeguards area

4.2.1 Regulations, Procedures, and Policies

DOE Order 5633.3A, paragraph II.2 (Accounting Systems): "Each facility shall have a system for tracking nuclear material inventories, documenting nuclear materials transactions, issuing periodic reports, and assisting with the detection of unauthorized system access, data falsification, and material gains or losses. The accounting system shall provide a complete audit trail on all nuclear materials from receipt through disposition ..."

Notes: DOE 5633.5 Series, WHC 3-10, WHC QA, DOE 5639.6,
WHC-IP-1019, DOE 5632.1c Series

4.2.2 Interfacing Functions

Interfaces that NMSS makes with other systems are:

- Vault Safety and Inventory System: NMSS and VSIS computers are PRIME units. They communicate with each other via a PRIME proprietary Ethernet network. Files are routinely downloaded from the NMSS to the VSIS. In case of a NMSS computer failure, the VSIS can access the NMSS disk drives and run NMSS functions as a backup. VSIS files are also copied to the NMSS, but the NMSS cannot backup VSIS real-time functions. There is also the NMSS Inventory Records file that the VSIS uses to prepare some routine reports. The expectation is that a NMSS replacement system would be implemented to satisfy these requirements. However, because a new US/IAEA agreement may develop in the future requiring that the link between the NMSS and the VSIS be discontinued.
- Alarm Monitoring System: There are some alarm outputs provided to the Alarm Monitoring System by the NMSS. Examples are alarms generated if the user terminal staff try to log onto administrative terminals or if a user makes too many attempts at logon with an incorrect password. The expectation is that a NMSS replacement system would be implemented to satisfy these requirements.
- Operations Alarm Panel: If NMSS fails or if the temperature in the NMSS computer facility gets outside preset limits alarms are sent to PFP operations alarm monitoring equipment. The expectation is that a NMSS replacement system would be implemented to satisfy these requirements.

4.2.3 Existing Limitations

No existing limitations other than funding limitations and restrictions on purchasing computer hardware or software are apparent that would indicate that a replacement option can not be done using available alternatives.

4.2.4 Development, Operations, and Maintenance

Some of the requirements needed for a problem resolution are:

- Development Phase

In development, the current NMSS must continue to be operated. This is true up until the new process has satisfied all testing and has been accepted for routine use. Depending on the funding available, if network cabling can be installed so that the two systems can operate concurrently for an extended time (up to six months), this is the preferred approach. Even after the existing system has been replaced, it is expected that for a few months the old NMSS hardware and software will be maintained in a standby mode.

- Operations

Essential requirements for any replacement system during the operational phase are known as follows:

The existing NMSS data base files must be duplicated functionally on any replacement system. This will be verified and validated during the parallel phase-in operation time for the new NMSS.

Response times must be such that current transactions and routine reports will be acceptable to the user.

Data integrity and accuracy are essential in the replacement solution.

The replacement system must be capable of continuous operation; however, day shift will be the predominant usage time. Required information (e.g. NMSS data bases such as PRE and NMI) must be available and must be backed up routinely. No real time needs (i.e., data acquisition, data entry, data validation) have been identified.

- Maintenance

One of the primary reasons for considering a replacement system was to identify alternatives that would significantly decrease hardware and software maintenance. PC workstation and file server hardware can be supported by local maintenance staff for a significant cost savings. These types of workstations and file servers are relatively inexpensive to acquire and their replacement parts (e.g. system boards, disk storage units, floppy diskettes, etc.) are easy to replace. There are a large number of vendors. Hardware maintenance can be performed as needed on a priority basis.

Also, for industry standard software packages (e.g. PARADOX, ORACLE, etc.) there are a relatively large number of on-site programmers who can provide maintenance support. This type of software generally requires much less maintenance support than the older generation of software products for mini-computer systems.

4.2.5 Acceptance Criteria

Acceptance Criteria for a NMSS replacement approach are:

- Demonstrated Performance: Up to six months successful parallel operation with required accuracy and performance of the existing NMSS.
- Supporting Documentation: Software QA supporting documentation (e.g. concept (this document), requirements, design, testing, user guide, etc.) to be recorded using the WHC document control procedures
- Functional Requirements: A replacement system that successfully performs required data base, data storage, data backup, screen display, and reports performed by the existing NMSS (unused or unnecessary functions may be phased out).
- A Security Plan: A replacement system must be accepted for operation by the U.S. Department of Energy formally through an approved security plan.

5.0 FEASIBILITY ANALYSIS

5.1 Description of Alternatives

Alternative descriptions are as follows:

- **DO NOTHING**

This means that the NMSS will continue to be supported with no changes being made other than customer requested software changes and such changes which are necessary to maintain the current system in operation.

- **IMPLEMENT AND USE A MANUAL PROCESS**

This approach requires that the following be done:

- Hard copy forms will be designed to enter all information on material transfers and other accountability required functions.
- Two additional exempt staff must be hired and trained to support manual accountability functions.
- This alternative assumes that the NMSS automated system will be taken out of service after it is demonstrated that the manual process is functioning successfully for up to six months in parallel operation.
- WHC NM accountability will be performed manually.

- **MODIFY DOE LANMAS FOR USE**

At present, DOE is sponsoring the development of a generic NM accountability system that may be used DOE site-wide. Using this approach, hardware and software would be acquired compatible with the DOE site-wide LANMAS. A copy of the LANMAS software will then be transferred to WHC and installed on a PC workstation based limited access network. Software changes will be made to customize the LANMAS software so that it will meet DOE-RL and WHC requirements (e.g. support NMSS functionality). The new system will be tested in parallel for up to six months to assure proper functionality. The existing NMSS will then be taken out of operation. Users will need to be trained on the use of the new system.

- **ACQUIRE PC NETWORK AND RUN ON PARADOX PLATFORM**

Additional PC workstation and file server hardware will be acquired as needed. NMSS functionality will be implemented on a PARADOX platform and will be serviced by a limited access (HLAN access will not be supported because of the classification of data) file server. The new system will be tested in parallel for up to six months to assure NMSS functionality is retained. The existing NMSS will then be taken out of operation. Users will need to be trained on the use of the new system.

- **ACQUIRE SUN NETWORK AND RUN ORACLE (SYBASE, ETC.)**

This alternative relies on the acquisition of six SUN workstations and one file server. Database software such as ORACLE will also be required as will utility software to support the network based system. This system will be tested in parallel for up to six months with the current NMSS in full operation to assure proper functionality. The existing NMSS will then be taken out of operation. Users will need to be trained on the use of the new system.

5.2 Alternatives Analysis

The approach here is to compare the identified alternatives in five different ways (which are: tangible, intangible, advantages/disadvantages, risk, and political factors).

Except for tangible factor comparison (expressed in terms of hard numbers, cost, etc.), the comparison of alternatives is accomplished by looking at all other comparisons requiring staff judgements.

5.2.1 Comparison by Costs

Alternatives are compared by looking at cost estimates. In summary, there are five alternatives that costs were estimated for and comparisons made. In order to gain a better perspective of implementation scenarios, cost estimates over a five year time span were made (FY95 through FY99). The following table provides a five year summary of the costs and shows the resulting ranking.

COST ANALYSIS RESULTS

<u>ALTERNATIVE</u>	<u>Five Year Total Estimate</u>	<u>RANK</u>
DO NOTHING	\$960,000	3
MANUAL PROCESS	\$952,500	2
DOE LANMAS	\$1,227,500	4
PC NETWORK / PARADOX	\$885,000	1
SUN NETWORK / ORACLE	\$1,440,000	5

Details for each of the cost estimates per alternative are included in Attachment A.

Assumptions and clarifying statements to support the estimates are as follows:

DO NOTHING

- a high probability exists that the programmer analyst supporting NMSS will retire requiring up to a six month training period for the replacement programmer at an estimated cost of \$55,000
- at least two programmer turnovers will be experienced over the next five years
- the NMSS will be maintainable for at least five years, and that enhancements will continue to be made on the system

MANUAL

- two years will be required to obtain funding, develop the approach, perform training, and perform parallel operation with the NMSS to assure accuracy, reliability, and performability of a manual process
- the NMSS would continue to operate for two years
- at least \$10,000 per year would be required to perform training of staff for turnover or for changes to the operational mode

LANMAS

- a useable, well documented product will be developed
- LANMAS will not be available for use before FY96
- one to two years will be required to do LANMAS customization and run in parallel with NMSS
- LANMAS will run on a PC based platform
- considerable time will be required to become familiar with LANMAS and to customize it for use at Hanford

PARADOX

- one to two years will be required to develop the system and run in parallel with NMSS for up to six months
- PARADOX will support up to six concurrent users with a reasonable response time

SUN

- a three year period will be required to obtain funding and to acquire and install hardware and develop software and run in parallel with NMSS for up to six months
- SYBASE and/or ORACLE programmers will be available to support the development
- training will be a significant effort

ALL ALTERNATIVES

- all cost estimates are based on current dollars and have not been corrected for inflation influences
- the assumption is made that the PFP facility will continue to store and control NM for at least the next five years
- no funding will be available until at least March 1995
- program development costs assume two analysts performing development activities in addition to the analyst maintaining the current NMSS
- two computer networks (e.g., PRIMENET and PC network/SUN network, etc.) will be concurrently maintained during system development and parallel testing

5.2.2 Comparison by Intangibles

For intangible analysis, points are assigned and tallied for overall comparison as follows:

- alternative meets requirements 2 points
- alternative exceeds requirements +1 "
- alternative greatly exceeds requirements 0 "
- alternative doesn't or won't meet minimum requirements -1 "
- alternative is expected to be seriously deficient -2 "

Each of the alternatives is scored according to the following criteria:

- suitable support staff availability
- efficient use of staff
- continuing hardware maintenance
- continuing software maintenance
- security concerns
- data accuracy
- procedural impact
- probability of meeting DOE requirements
- training requirements

Note that more points (+2) are assigned for meeting requirements than for exceeding them. It is viewed as costly to exceed requirements and therefore wise use of funding is to satisfy what is needed not to exceed requirements. Comparison details to support results of intangible comparisons are show in Attachment B and show that staff concurrence favors ranking as shown. The following table contains a summary of the intangible analysis results.

INTANGIBLE ANALYSIS RESULTS

ALTERNATIVE	POINT SCORE	RANK
DO NOTHING	+0	4
IMPLEMENT USING A MANUAL PROCESS	-4	5
MODIFY DOE LANMAS	+11	2
ACQUIRE PC NETWORK AND RUN USING PARADOX	+17	1
ACQUIRE SUN NETWORK AND RUN USING ORACLE	+9	3

5.2.3 Comparison by Advantages and Disadvantages

This is another way of looking at intangible comparisons using a pre-selected set of advantages (+s) and disadvantages (-s). Each alternative is looked at to see which of the +'s and -'s apply and then a tally is made. The alternatives are then ranked in order of the sum of the +'s and -'s. The accepted set of advantages and disadvantages are as follows:

Advantages:

- + alternative expected to meet NMSS functionality
- + alternative expected to meet DOE reporting requirements
- + alternative expected to improve operational performance
- + alternative expected to be easy to learn
- + alternative expected to be maintainable (hardware and software)
- + alternative expected to be easy to obtain support staff
- + alternative expected to meet performance testing requirements

Disadvantages:

- alternative poses significant risk to performing accountability functions
- alternative offers increasing difficulty in obtaining support staff
- alternative does not readily support routine requests for information such as the NMMSS and WHC Material Management needs
- alternative does not readily support ad-hoc queries for information such as (e.g. an emergency inventory at WHC's or RL request)
- alternative is not expected to meet requirements if the number of transactions increases significantly
- alternative does not provide adequate interfacing as required (see Section 2.2 of this document)

The following table lists each alternative and the number of advantages and disadvantages associated with it. A detailed listing for the alternatives and their advantages and disadvantages are found in Attachment C.

ADVANTAGES and DISADVANTAGES RESULTS

<u>ALTERNATIVE</u>	<u>NUMBER OF +'s</u>	<u>NUMBER OF -'s</u>	<u>SUM</u>	<u>RANKING</u>
DO NOTHING	3	4	-1	4
IMPLEMENT USING A MANUAL PROCESS	2	5	-3	5
MODIFY DOE LANMAS	4	1	+3	2
ACQUIRE PC NETWORK AND RUN USING PARADOX	6	1	+5	1
ACQUIRE SUN NETWORK AND RUN USING ORACLE	5	2	+3	2

5.2.4 Comparison by Risk

For the purposes of this study, risk is viewed as having three levels of severity: high, medium, and low. A primary assumption of this study is that no factors were considered that would merit zero risk.

Relative comparisons for risk assessment are as follows:

- low risk receives a point score of 1,
- medium risk receives a point score of 2,
- high risk receives a point score of 3.

A total risk score for each of the alternatives was computed by summing the risk score for each of the eight system/management components. If all system/management components received a low risk rating, the total score for that alternative would be 8. If the same components received instead a high rating then the total risk score would be 24 (8*3). A risk range was established by dividing the range of 8 to 24 into three parts: low risk range is 8 to 13; medium risk range is greater than 13 and equal to or less than 18; and high risk range is anything greater than 18. An acceptable risk value is assigned to be 16 as it represents a midpoint between the high and low risk points. For this study, a risk score of 0 was not assigned because no alternatives were considered risk free.

Risk definitions are as follows:

- (1) A high risk is defined as a situation in which there is a significant potential that a system will not be able to continue operation. A point value of 3 is assigned to high risk parameters.
- (2) A medium risk is one where the system might continue operation at a significantly reduced performance level. Medium risk parameters are assigned a point value of 2.
- (3) Low risk is viewed as the situation where normal day-to-day operations are expected to continue without performance degradation or interruption. A value of 1 is assigned for this case (zero risk situations are viewed as unattainable for this operating environment).

A collection of system and management components for which risk is identified are:

Availability

This is the risk based on the availability of a technology or product. For NMSS replacement, a given alternative must be available for implementation within the next 1-2 years.

Vendor Software (e.g., operating systems and data base managers)

This is the software used to control use of the computer system. For the existing and proposed WHC Safeguard's accountability computers this software would be vendor supplied. Data bases are the software used to organize, store, and retrieve data when required by the user either as parameter query or for report generation. For the WHC Safeguard's accountability computers this software would be vendor supplied for every system except the alternative suggesting a manual implementation.

Application Software

This is the software that has been or that will be developed to satisfy user requirements for NMSS specific purposes. This is not vendor supplied software such as utilities or software languages. Applications software is the software code that acquires, stores, and computes NM data and generates reports, etc. It is the software that performs NM accountability functions. Historically, application software for NMSS has been developed using site staff.

Hardware

This is any applicable computer system and peripherals acquired and installed to support NM accountability.

Staffing (BCSR or WHC)

The issue here is identifying staff who would be willing to invest in their career by supporting software development and maintenance activities for a specific computer (or manual) environment. It is the general consensus of the computing professionals that experience gained while working with state-of-the-art hardware and software translates into future career opportunities and marketable experience profiles.

Training

Any computing professional (or WHC exempt staff) newly assigned will need training depending on the alternative considered for NM accountability. Training for computing professionals is required for applications as well as systems and special purpose (e.g. data base) software. The most important training resources needed are fully trained incumbent staff and commercial vendor courses and consultants.

The only resources available for WHC nuclear material accounting training are fully trained incumbent analysts and courses offered by the Central Training Academy.

Funding

Sponsoring programs are identified and interfaced with by WHC Safeguards management and staff. Funding support will be sought to support the recommendation made in this document. Even though the recommendation made has the potential to yield a significant and long term hard dollar savings, locating funding will be difficult because of the downsizing of the site Safeguards and Security functions.

DOE Requirements

This risk factor is based on the estimation whether a given alternative will be able to meet DOE requirements such as the three hour reporting requirement. This is based on DOE order 5633.3A.

Risk analysis is summarized in Figure 3.

5.2.5 Comparison by Political Factors

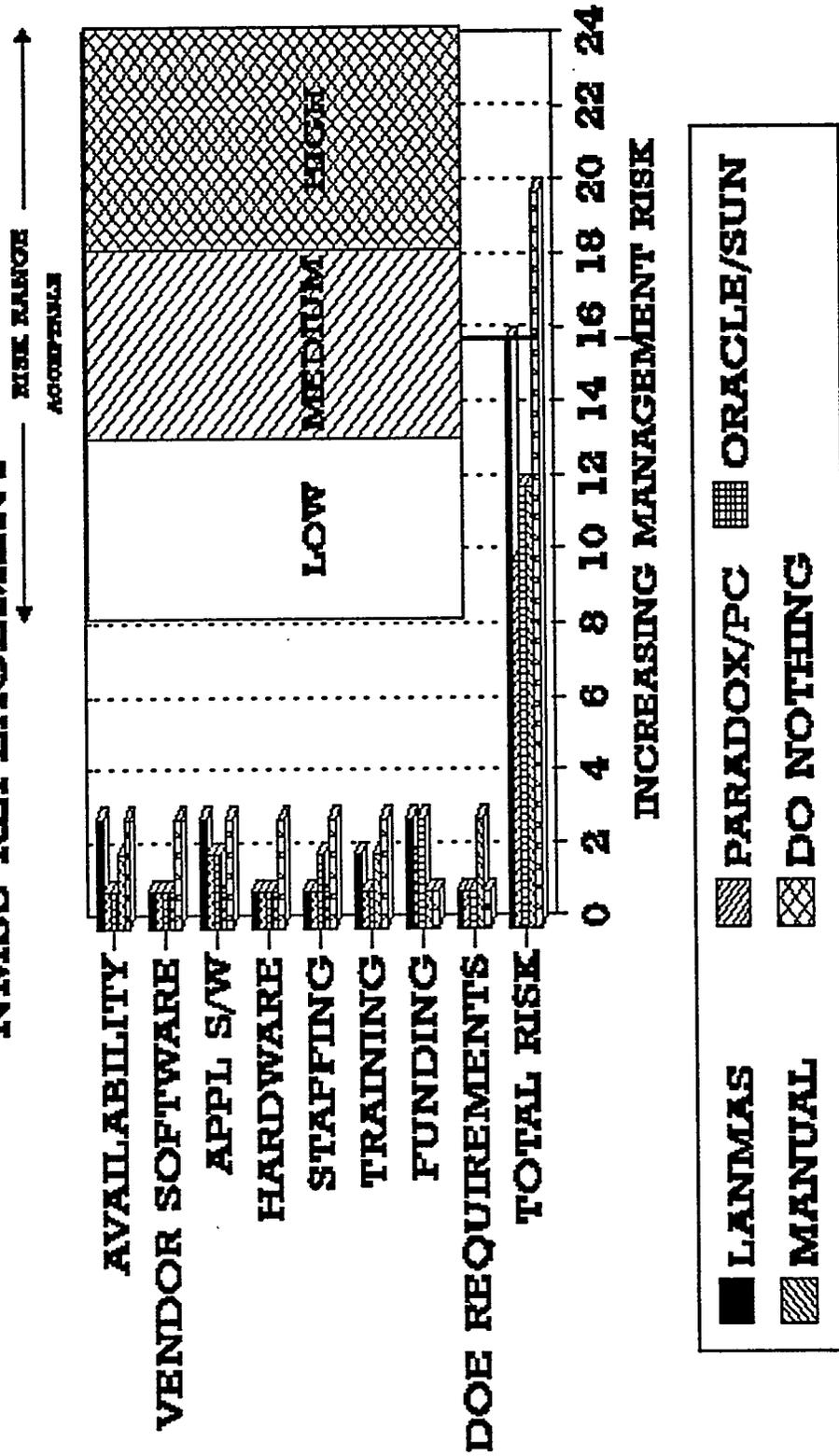
The analysis of alternatives using political factors is done using another set of intangible judgment factors based on perceived political impacts (positive or negative). This is an additional intangible analysis added to show the anticipated political effects of choosing each of the different alternatives for implementation. Political criteria used to look at the study alternatives are:

- Corporate technical expertise anticipated image
- Perceived efficiency in accomplishing the WHC mission
- Perceived capability to communicate and interface with the DOE community
- Perceived wise use of government resources (waste, fraud, and abuse)
- Perceived capability to perform NM accountability
- Perceived corporate leadership initiative

Each alternative was analyzed for the above political criteria using the following scoring system:

<u>Points</u>	<u>Assessment Description</u>
+2	alternative could greatly enhance corporate image
+1	alternative could enhance corporate image
+0	alternative has no perceived impact on corporate image
-1	alternative could have a negative impact on corporate image
-2	alternative could cause severe damage to corporate image

RISK ANALYSIS NMSS REPLACEMENT



L = 1, M = 2, H = 3

FIGURE 8

UNACCEPTABLE RISK > 18.0

The resultant scores for the study alternatives are summarized as follows:

ALTERNATIVE ANALYSIS USING POLITICAL IMPACTS

ALTERNATIVE	TOTAL SCORE (SUM OF ALL NUMERIC ASSIGNMENTS)	RANK
DO NOTHING	-4	4
MANUAL PROCESS	-7	5
MODIFY DOE LANMAS	+4	3
PC NETWORK AND PARADOX	+5	2
SUN NETWORK AND RUN ORACLE	+6	1

Detailed point scores and any explanations are included in Attachment D.

5.2.6 Ranking Summary

The following table shows all the alternatives, all the comparison criteria, and all of the rankings to summarize the analysis in one figure.

ALTERNATIVE RANKING SUMMARY TABLE

<u>ALTERNATIVES</u>	<u>COST</u>	<u>INTANGIBLES</u>	<u>+'s / -'s</u>	<u>RISK</u>	<u>POLITICAL</u>
DO NOTHING	3	4	4	5	4
MANUAL PROCESS	2	5	5	2	5
DOE LANMAS	5	2	1	4	3
PC NETWORK / PARADOX	1	1	1	1	2
SUN NETWORK / ORACLE	4	3	1	2	1

6.0 Recommendation

Per the analyses performed, there are several recommendations proposed, and those are:

- (1) recommend that the PC NETWORK / PARADOX system be implemented as the first choice
- (2) recommend that the SUN NETWORK / ORACLE system be implemented as the second choice
- (3) if funding is not available for (1) or (2) above, recommend a contingency backup single user PARADOX based system be developed and made ready (note: the next section explains how this would be done)

The current NMSS needs to be replaced soon, because of the high risk of continuing to operate the system. A manual process would not meet all DOE requirements and would generate a large volume of paper requiring support staff to retrieve and summarize historical data (data sorting for special report requests would be very difficult if not impossible within time limits). The DOE LANMAS is a generic system that would have to be customized to the Hanford environment. LANMAS development has been so slow in progress that its eventual delivery is questionable.

The SUN Network / ORACLE system and the PARADOX PC Network systems are the recommended problem solution paths. If funding cannot be obtained so that work may start on one of these options by early FY95, a contingency backup scaled down system is proposed. This backup system is described in the next section of this document.

7.0 Contingency Solution

A system to provide emergency backup capability is needed if funding cannot be found to implement recommended solution paths in a timely manner. The next sections describe the system, the requirements it will satisfy, the estimated cost to implement, and the advantages of this type of option. In Section 8.0 the current prototype is described.

A Paradox prototype has been developed as a response to the high level of risk to immediate or eventual system failure and the possibility of retraining new maintenance analysts. A NMSS PARADOX prototype contingency demonstration was developed following the NMSS user manual. This prototype shows that such a system can be developed in a relatively short time frame and placed in reserve in case of NMSS failure. There would be an initial cost of about \$60,000 to develop this contingent system, although it may not be compliant with all company requirements. It is assumed that exceptions would be required to operate the contingency backup system until a suitable replacement system can be developed and placed in operation.

As shown in a table below, there can be considerable cost savings having a contingency system available because the need for a full-time maintenance analyst would be greatly reduced. Initially the contingency system could be placed in service as an information tool for the users of the system. The time to make a change on the contingency system would be much less than on the current system. This would enable a gradual phasing in of a Paradox system over time at or below the current costs to maintain the system. A level of effort maintenance program could be implemented with time tables set up for the most critical documentation leading up to a parallel run, required for retirement of the current NMSS system.

7.1 System Description

This system can use one of the 486 workstations already in use at PFP. It will be a single user system and does not need to be connected to a new or any existing networks. A relatively small amount of equipment money (estimated at \$8,000) will be needed to:

- upgrade the RAM to at least 16 MB
- purchase 5-10 Gigabytes of disk storage capability
- purchase a dedicated laser printer
- purchase PARADOX and other utility and miscellaneous software

The system will be for emergency backup only. It will perform only the absolute minimum requirement set. Supporting software QA documentation will be at a minimum. The system will be developed using a PARADOX database platform. The system is single user and will be operated in a limited area.

7.2 Requirements

Current high level requirements for the contingency solution is as follows:

- (1) must meet NMSS database functions such as change seal, change location, change value(s), and change measurements
- (2) perform routine reports as documented in the user's guide (and verified by WHC Safeguards accountability staff) as well as NMMSS (Oak Ridge) reports
- (3) Database structure must meet DOE requirements.
- (4) must pass timing and capacity performance tests

7.3 Estimated Cost

Costs are estimated as follows:

- equipment costs \$ 8,000
- labor costs \$60,000
- Total Estimated \$68,000

7.4 Advantages of a Contingency Product

- + a relatively large number of PARADOX programmers are available at Hanford
- + disaster recovery - in theory, a backup of the software and database could be located at an alternate site that would provide NMSS minimum accountability functions at a relatively low cost if a PFP disaster occurs
- + a single user system operating in a limited area simplifies the approval process for an NMSS security plan revision
- + software procedures and modules developed for the contingency backup system can be used for the PC NETWORK / PARADOX full featured system at a later date if documented adequately or using reverse engineering tools

7.5 Disadvantages of a Contingency Product

Disadvantages of developing a contingency system are:

- may not be in compliance with WHC-CM-3-10
- not a full featured system
- not a multiuser solution

8.0 A PARADOX Prototype

This section provides documentation of the basic components of a PARADOX prototype developed to show examples of how a PARADOX NMSS system can "look and feel". BCSR has developed a wide variety of data base systems using PARADOX with good success (there are many site PARADOX based systems and a large number of competent PARADOX programmers). This is to show that the primary functions of NMSS can be converted to a PC workstation platform with excellent vendor and programmer resources and support.

The prototype for NMSS replacement demonstration has been developed as follows:

- to show how NMSS would run on a PC workstation (it is an example of what a NMSS replacement would look like)
- it has been designed using the current NMSS User's Guide with the following deviations:
 1. Screens have been adapted slightly to adapt to the Paradox dialogue box and Paradox Date Formats
 2. The prototype assumes full editing privileges for the Inventory, Impurity, and Analysis screens.
 3. The K Basin interface screen has not been included.
 4. Special functions, like movement between locations/MBA's are included.
 5. Only sample reports, easily generated from Paradox tables are included for illustration purposes.
 6. No shipping related or special function screens are included.
 7. No calculations are being performed.
 8. No monthly processing functions are included.
 9. Other limitations in order to complete a prototype in a timely fashion.
- it has been designed around normal PARADOX protocol (data base structures (table structures), menus, screens, reports, queries, etc.)
- company standard supporting software QA documentation has not been prepared (requirements, design, testing, installation, V&V, etc.), although this can be done as a follow-on effort
- it has been developed on a single user PC workstation, but it could readily be installed and run on a multiuser file server

Attachment E contains the PARADOX data table (data base structures). Attachment XX includes copies of working MENUS, and screens reports. This NMSS PARADOX prototype is a tested and working software package available for demonstration on request.

9.0 REFERENCES

WHC-SD-CP-ES-161 Rev. 0, Westinghouse Hanford Company, *Replacement Analysis for Safeguards and Security Systems of Hanford Protected Areas*, February, 1994.

DOE-RL-93-08, U. S. Department of Energy, *1993 Hanford Mission Plan (HMP), Volume I, Site Guidance*, 1993.

WHC-SD-CP-ES-130 Rev. 0, Westinghouse Hanford Company, *SCATS Phaseout Feasibility Study*, June 1990.

WHC-CM-3-010 Appendix A, Westinghouse Hanford Company, REV 0, *Software Practices - System Concept Documentation*, January 31, 1993.

WHC-CM-4-2, Westinghouse Hanford Company, Section 19.0, Rev. 1, *Quality Assurance Manual*, September 30, 1993.

ATTACHMENT A .. COST ESTIMATE DETAILS

Cost estimate details are provided here for each of the study alternatives, cost estimates based on equipment needs and labor required to implement the solution. A five year implementation cost schedule has been developed for each of the alternatives. Note that the cost of continuing to run, maintain, and support the current NMSS is shown for each alternative because for each alternative a new process and system has to be developed, established and tested prior to the phaseout and shutdown on the current NMSS. Costs have not been adjusted for inflation and are all shown in today's dollars.

Alternative Cost Estimates

1995	Do Nothing	Manual	LANMAS	PARADOX	SUN Workstation
Programmer Support	110000	110000	110000	110000	110000
Maintenance Contract	60000	60000	60000	65000	75000
Safeguards Analyst	0	0	0	0	0
Training	55000	125000	55000	55000	55000
Computer Hardware/Software	0	0	0	15000	70000
Applications Software Development	0	0	0	110000	110000
Network Cabling Setup, Etc.	0	0	0	20000	20000
Total Estimate	225000	295000	225000	375000	440000

1996	Do Nothing	Manual	LANMAS	PARADOX	SUN Workstation
Programmer Support	110000	27500	110000	82500	110000
Maintenance Contract	60000	30000	70000	70000	90000
Safeguards Analyst	0	140000	0	0	0
Training	0	10000	0	20000	0
Computer Hardware/Software	0	0	15000	0	0
Applications Software Development	0	0	220000	142500	220000
Network Cabling Setup, Etc.	0	0	0	0	0
Total Estimate	170000	207500	415000	315000	420000

1997	Do Nothing	Manual	LANMAS	PARADOX	SUN Workstation
Programmer Support	110000	0	82500	55000	82500
Maintenance Contract	60000	0	70000	10000	90000
Safeguards Analyst	0	140000	0	0	0
Training	55000	10000	30000	0	50000
Computer Hardware/Software	0	0	0	0	0
Applications Software Development	0	0	165000	0	147500
Network Cabling Setup, Etc.	0	0	0	0	0
Total Estimate	225000	150000	347500	65000	370000

1998	Do Nothing	Manual	LANMAS	PARADOX	SUN Workstation
Programmer Support	110000	0	110000	55000	75000
Maintenance Contract	60000	0	10000	10000	30000
Safeguards Analyst	0	140000	0	0	0
Training	0	10000	0	0	0
Computer Hardware/Software	0	0	0	0	0
Applications Software Development	0	0	0	0	0
Network Cabling Setup, Etc.	0	0	0	0	0
Total Estimate	170000	150000	120000	65000	105000

1999	Do Nothing	Manual	LANMAS	PARADOX	SUN Workstation
Programmer Support	110000	0	110000	55000	75000
Maintenance Contract	60000	0	10000	10000	30000
Safeguards Analyst	0	140000	0	0	0
Training	0	0	0	0	0
Computer Hardware/Software	0	0	0	0	0
Applications Software Development	0	0	0	0	0
Network Cabling Setup, Etc.	0	0	0	0	0
Total Estimate	170000	140000	120000	65000	105000

Year	Do Nothing	Manual	LANMAS	PARADOX	SUN Workstation
1995	225000	295000	225000	375000	440000
1996	170000	207500	415000	315000	420000
1997	225000	150000	347500	65000	370000
1998	170000	150000	120000	65000	105000
1999	170000	150000	120000	65000	105000
Total Cost over Five Years	960000	952500	122750	885000	144000
Average Annual Cost	192000	190500	245500	177000	288000

ATTACHMENT B ... INTANGIBLE ANALYSIS

Intangible Analysis:

Point assignment structure is as follows:

- alternative meets requirements 0 points
- alternative exceeds requirements +1 "
- alternative greatly exceeds requirements +2 "
- alternative doesn't or won't meet minimum requirements -1 "
- alternative is expected to be seriously deficient -2 "

Detailed analysis results based on a subjective input for intangible analysis are as follows:

System Codes:

- DN -- DO NOTHING
- MP -- MANUAL PROCESS
- LM -- DOE LANMAS
- PD -- PC NETWORK / PARADOX
- OR -- SUN NETWORK / ORACLE

<u>Intangible Criteria Description</u>	Assigned Points				
	DN	MP	LM	PD	OR
suitable support staff availability	-2	+2	+1	+2	-1
efficient use of staff	-1	-1	+1	+2	+1
continuing hardware maintenance	-2	+1	+1	+1	+1
continuing software maintenance	-2	+1	+1	+2	+1
security concerns	+2	-2	+1	+2	+2
data accuracy	+2	-1	+2	+2	+2
procedural impact	+2	-1	+2	+2	+2
probability of meeting DOE requirements	-1	-2	+1	+2	+2
training requirements	+2	-1	+1	+2	-1
Total Points	+0	-4	+11	+17	+9

ATTACHMENT C ... Alternative Comparison Based on Advantages and Disadvantages

Detailed analysis results based on advantages and disadvantages are as follows:

System Codes:

- DN -- DO NOTHING
- MP -- MANUAL PROCESS
- LM -- DOE LANMAS
- PD -- PC NETWORK / PARADOX
- OR -- SUN NETWORK / ORACLE

Advantages	Assigned Points				
	DN	MP	LM	PD	OR
Meet NMSS functionality	+1	+0	+1	+1	+1
Meet DOE reporting requirements	+1	+0	+1	+1	+1
Improve operational performance	+0	+0	+1	+1	+1
Expected to be easy to learn	+1	+0	+0	+1	+0
Expected to be maintainable (hardware and software)	+0	+1	+0	+1	+1
Easy to obtain support staff	+0	+1	+1	+1	+0
Meet performance testing requirements	+0	+0	+0	+0	+1
Disadvantages					
Poses significant risk to performing accountability functions	-1	-1	-0	-0	-0
Offers increasing difficulty in obtaining support staff	-1	-0	-1	-0	-1
Does not readily support routine requests for information such as: the NMSS and WHC Material Management needs	-0	-1	-0	-0	-0
Does not readily support ad-hoc queries for information such as (e.g. an emergency inventory at WHC's or RL request)	-1	-1	-0	-1	-1
Not expected to meet requirements if number of transactions increases significantly	-1	-1	-0	-0	-0
Does not provide adequate interfacing as required (see Section 2.2)	-0	-1	-0	-0	-0
Total Sum	-1	-3	+3	+5	+3

ATTACHMENT D ... COMPARISON BY POLITICAL FACTORS

Political criteria:

Each alternative was analyzed for the above political criteria using the following scoring system:

<u>Points</u>	<u>Assessment Description</u>
+2	alternative could greatly enhance corporate image
+1	alternative could enhance corporate image
+0	alternative has no perceived impact on corporate image
-1	alternative could have a negative impact on corporate image
-2	alternative could cause severe damage to corporate image

System Codes:

DN -- DO NOTHING
 MP -- MANUAL PROCESS
 LM -- DOE LANMAS
 PD -- PC NETWORK / PARADOX
 OR -- SUN NETWORK / ORACLE

<u>Political Criteria Description</u>	<u>Assigned Points</u>				
	DN	MP	LM	PD	OR
Corporate technical expertise	-1	-1	1	1	1
Perceived efficiency in accomplishing the WHC mission	-1	-1	1	1	1
Perceived capability to communicate and interface with the DOE community	0	-2	1	1	1
Wise use of government resources (waste, fraud, and abuse)	-1	-1	0	1	1
Perceived capability to perform NM accountability	0	-1	0	0	0
Perceived corporate leadership initiative	-1	-1	1	1	1
Total Points	-3	-7	4	5	5

ATTACHMENT E .. PARADOX PROTOTYPE TABLES

LOC Table: Loccode		
Number	Field Name	Field Type
1	Location Code	A2*
2	Location Description	A40
3	MBA Code	S
4	Building Name	A10

LOC Table: Mbas		
Number	Field Name	Field Type
1	MBA Code	A3*
2	MBA Description	A30
3	MBA Custodian	A30

LOC Table: Project		
Number	Field Name	Field Type
1	Project Code	A2*
2	Project Number	A10
3	Previous Project Number	A10
4	APF Flag	S
5	Description	A60

REP Table: Catscrep		
Number	Field Name	Field Type
1	Item ID	A20
2	Category Code	A4
3	Receipt Date	D
4	Physical Location Code	A2
5	Gross Weight w/ Outer	N
6	Container Number	A12
7	Reactor Code	A1
8	COEI Code	A3
9	Element Weight	N
10	Isotope Weight	N
11	Country Codes	A8
12	Element Weight Method	A2
13	Isotope Weight Method	A2
14	Estimated Value Indicat	A2
15	Weight % Pu-240 or U-235	N
16	Location Description	A40

REP Table: Coeiprep		
Number	Field Name	Field Type
1	Unique Material Type	A2
2	COEI Code	A3
3	Element Weight	N
4	Isotope Weight	N
5	Project Number	A10

REP Table: Coeirep		
Number	Field Name	Field Type
1	COEI Code	A3
2	COEI Description	A40
3	10	S
4	20	S
5	40	S
6	44	S
7	45	S
8	46	S
9	47	S
10	48	S
11	50	S
12	60	S
13	70	S
14	81	S
15	82	S
16	83	S
17	87	S
18	88	S

MAT Table: Coei		
Number	Field Name	Field Type
1	COEI Code	A3*
2	COEI Description	A40

MAT Table: Coeimat		
Number	Field Name	Field Type
1	COEI Code	A3*
2	Material Type Code	S*
3	Value	S

MAT Table: Gmattype		
Number	Field Name	Field Type
1	General Material Code	A2*
2	Material Type Descript	A20
3	Weight Units	A20

MAT Table: Scrap		
Number	Field Name	Field Type
1	Scrap Code	A2
2	Scrap ID	A2
3	Scrap Sub-ID	A1
4	Description	A30
5	Scrap Group Description	A30
6	Comments	A20

MAT Table: Umattype		
Number	Field Name	Field Type
1	Unique Material Type	A2*
2	General Material Type	A2
3	Low Range Value	N
4	High Range Value	N

REP Table: Matyrep		
Number	Field Name	Field Type
1	Unique Material Type	A2
2	General Material Type	A2
3	Low Range Value	N
4	High Range Value	N
5	Material Type Descript	A20
6	Weight Units	A20

REP Table: Mbatank		
Number	Field Name	Field Type
1	Tank Number	A8*
2	MBA Code	A4*
3	Tank Description	A30

REP Table: Scrinrep		
Number	Field Name	Field Type
1	Item ID	A20
2	Category Code	A4
3	Receipt Date	D
4	Physical Location Code	A2
5	Gross Weight w/ Outer	N
6	Container Number	A12
7	Reactor Code	A1
8	COEI Code	A3
9	Element Weight	N
10	Country Codes	A8
11	Element Weight Method	A2
12	Isotope Weight Method	A2
13	Estimated Value Indicat	A2
14	Weight % Pu-240 or U-235	N
15	Location Description	A40

REP Table: Sealhrep		
Number	Field Name	Field Type
1	Item ID	A20
2	Seal ID Number	A8
3	Seal Install Date	D
4	Removal Date	D
5	Source Document Number	A6
6	Location Description	A40

REP Table: Sealsrep		
Number	Field Name	Field Type
1	Item ID	A20
2	Seal ID Number	A8
3	Seal Install Date	D
4	Physical Location Code	A2
5	Row/Pedestal Location	A4
6	Container Number	A12
7	Source Document Number	A6

REP Table: Tanktrep		
Number	Field Name	Field Type
1	Item ID	A20
2	Date of Transfer	D
3	Tank Shipped From ID	A8
4	Tank Shipped To ID	A8
5	Tank Batch Transfer #	A10
6	Lab SN for First Anal	A6
7	Lab SN for Second Anal	A6
8	U Conc before Transfer	N
9	U Conc after Transfer	N
10	Pu Conc before Transfer	N
11	Pu Conc after Transfer	N
12	Np Conc before Transfer	N
13	Np Conc after Transfer	N
14	Specific Gravity before	N
15	Specific Gravity after	N
16	Board Temp of Material	N
17	Weight Factor Before	N
18	Weight Factor After	N
19	Total U Transferred	N
20	Total Pu Transferred	N
21	Metric Wt Np Transferred	N
22	% U-235 Transferred	N
23	% Pu-240 Transferred	N
24	% Pu-238 & Pu-242 Transf	N
25	Date Data Checked	D
26	Source Document Number	A6

TAB Table: Analrec		
Number	Field Name	Field Type
1	Item ID	A20
2	General Material Type	A2
3	Item Sub-ID	A3
4	RIS	A3
5	Physical Location Code	A2
6	Item Description	A30

TAB Table: Analsub		
Number	Field Name	Field Type
1	Item ID	A20*
2	General Material Type	A2*
3	Item Sub-ID	A3*
4	Element Analysis Item	A1*
5	Element Analysis Date	D
6	Element Net Weight/Vol	N
7	Element % Pu	N
8	Element Weight	N
9	Element Analysis Method	A2
10	Element Anal Device #	A4
11	Element Measurement ELCC	A4
12	Americium Analysis Date	D
13	Americium Anal Method	A2
14	Americium Anal Device #	A4
15	Weight % Am	A4
16	Isotope Analysis Date	D
17	Isotope Analysis Method	A2
18	Isotope Anal Device #	A4
19	Isotope Measurement ELCC	A4
20	Weight % Pu-238 or U-233	N
21	Weight % Pu-239 or U-234	N
22	Weight % Pu-240 or U-235	N
23	Weight % Pu-241 or U-236	N
24	Weight % Pu-242 or U-238	N
25	Heat in Watts for Item	N
26	Curies for Item	N
27	Process/Separation Date	D
28	Process/Separation Code	A2

TAB Table: Audhrec		
Number	Field Name	Field Type
1	Item ID	A30*

TAB Table: Audsub		
Number	Field Name	Field Type
1	Item ID	A20
2	General Material Type	A2
3	Item Sub-ID	A3
4	Date	D
5	Time	A4
6	Entry ID	A6
7	Source Document Number	A6
8	Action	A3
9	File	A3
10	Physical Location Code	A2
11	Project Code	A2
12	Gross Weight w/ Outer	N
13	Net Weight/Volume	N
14	Gross Weight	N
15	Label Weight	N
16	Element Weight Method	A2
17	Isotope Weight Method	A2

TAB Table: Audrec		
Number	Field Name	Field Type
1	Item ID	A20*
2	Function	A3
3	Category Code	A4
4	Seal ID Number	A8
5	Seal Install Date	D
6	Unique Material Type	A2
7	Receipt Date	D
8	Removal Date	D
9	Physical Location Code	A2
10	Row/Pedestal Location	A4
11	Gross Weight w/ Outer	N
12	Gross Weight	N
13	Net Weight/Volume	N
14	Item Description	A30
15	Container Number	A12
16	Container Type Code	A2
17	Original Project Code	A2
18	Batch ID for Item	A12
19	Reactor Code	A1
20	H/Fissile symbol or ratio	A4
21	Hydrogen Ion Concen	N
22	Thermal Heat of Item	S
23	Thermal Heat Year/Month	S
24	Separations Date	D
25	MBA Code	A3
26	First Sample Number	A6

TAB Table: Audrec		
Number	Field Name	Field Type
27	Second Sample Number	A6
28	Third Sample Number	A6
29	Impurity Mass Number	A6
30	Specific Gravity	N
31	Zirconium Indicator	A2
32	Date in Month Flag	A2
33	Delete in Month Flag	A2

TAB Table: Audsub		
Number	Field Name	Field Type
1	Item ID	A20*
2	General Material Type	A2*
3	Item Sub-ID	A3*
4	Project Code	A2
5	COEI Code	A3
6	Element Weight	N
7	Isotope Weight	N
8	Label Weight	N
9	Country Codes	A8

TAB Table: Audsub		
Number	Field Name	Field Type
12	Beginning Isotope Weight	N
13	Element Weight Method	A2
14	Isotope Weight Method	A2
15	Element Error Category	A2
16	Isotope Error Category	A2
17	Estimated Value Indicat	A2
18	Weight % Pu-238 or U-233	N
19	Weight % Pu-239 or U-234	N
20	Weight % Pu-240 or U-235	N
21	Weight % Pu-241 or U-236	N
22	Weight % Pu-242 or U-238	N
23	Element Concentration	N
24	Element Analysis Date	A4
25	Isotope Analysis Date	A4
26	Weight % Am	N
27	Am Weight % Date	A4
28	Function	A3

TAB Table: Imprec		
Number	Field Name	Field Type
1	Item ID	A30*

TAB Table: Impsub		
Number	Field Name	Field Type
1	Item ID	A30*
2	Element	A7*
3	Sign	A2
4	Impurity	N

TAB Table: Invrec		
Number	Field Name	Field Type
1	Item ID	A20*
2	Category Code	A4
3	Seal ID Number	A8
4	Seal Install Date	D
5	Unique Material Type	A2
6	Receipt Date	D
7	Removal Date	D
8	Physical Location Code	A2
9	Row/Pedestal Location	A4
10	Gross Weight w/ Outer	N
11	Gross Weight	N
12	Net Weight/Volume	N
13	Item Description	A30
14	Container Number	A12
15	Container Type Code	A2
16	Original Project Code	A2
17	Batch ID for Item	A12
18	Reactor Code	A1
19	H/Fissile symbol or ratio	A4
20	Hydrogen Ion Concen	N
21	Thermal Heat of Item	S
22	Thermal Heat Year/Month	S
23	Separations Date	D
24	MBA Code	A3
25	First Sample Number	A6
26	Second Sample Number	A6
27	Third Sample Number	A6
28	Impurity Mass Number	A6
29	Specific Gravity	N
30	Zirconium Indicator	A2
31	Date in Month Flag	A2
32	Delete in Month Flag	A2

TAB Table: Invrecs		
Number	Field Name	Field Type
1	Item ID	A20
2	Category Code	A3
3	Seal Number	A8
4	Seal Date	D
5	Form Code	A1
6	Receipt Date	D
7	Removal Date	D
8	Location Code	A2
9	Row/Pedestal	A4
10	Outer Gross Weight	N
11	Inner Gross Weight	N
12	Net Weight/Volume	N
13	Item Description	A30
14	Container Number	A12
15	Container Code	A2
16	Outer Project Code	A2
17	Batch ID	A12
18	Reactors	A1
19	H2F SRT	A4
20	Thermal Load	S
21	Thermal L?	S
22	Separation Date	D
23	Lab #1 Number	A6
24	Lab #2 Number	A6
25	Lab #3 Number	A6
26	Imp Lab Number	A6
27	Specific Gravity	N
28	H2 Ion Content	N
29	Zirconium ?	A2
30	MBA Code	S
31	Material Code	S

TAB Table: Invsub		
Number	Field Name	Field Type
1	Item ID	A20*
2	Unique Material Type	A2*
3	Item Sub-ID	A3*
4	Project Code	A2
5	COEI Code	A3
6	Element Weight	N
7	Isotope Weight	N
8	Label Weight	N
9	Country Codes	A8
10	Supporting Document No	A6
11	Beginning Element Weight	N
12	Beginning Isotope Weight	N
13	Element Weight Method	A2
14	Isotope Weight Method	A2
15	Element Error Category	A2
16	Isotope Error Category	A2
17	Estimated Value Indicat	A2
18	Weight % Pu-238 or U-233	N
19	Weight % Pu-239 or U-234	N
20	Weight % Pu-240 or U-235	N
21	Weight % Pu-241 or U-236	N
22	Weight % Pu-242 or U-238	N
23	Element Concentration	N
24	Element Analysis Date	A4
25	Isotope Analysis Date	A4
26	Weight % Am	N
27	Am Weight % Date	A4

TAB Table: Items		
Number	Field Name	Field Type
1	Item ID	A30*
2	Source Document Number	A6
3	Entry ID	A6
4	Date	D
5	Time	A4

TAB Table: Tankrec		
Number	Field Name	Field Type
1	Item ID	A20*
2	Date of Transfer	D
3	Tank Shipped From ID	A8
4	Tank Shipped To ID	A8
5	Tank Batch Transfer #	A10
6	Lab SN for First Anal	A6
7	Lab SN for Second Anal	A6
8	U Conc before Transfer	N
9	U Conc after Transfer	N
10	Pu Conc before Transfer	N
11	Pu Conc after Transfer	N
12	Np Conc before Transfer	N
13	Np Conc after Transfer	N
14	Specific Gravity before	N
15	Specific Gravity after	N
16	Board Temp of Material	N
17	Weight Factor Before	N
18	Weight Factor After	N
19	Total U Transferred	N
20	Total Pu Transferred	N
21	Metric Wt Np Transferred	N
22	% U-235 Transferred	N
23	% Pu-240 Transferred	N
24	% Pu-238 & Pu-242 Transf	N
25	Date Data Checked	D

VAL Table: Catcode		
Number	Field Name	Field Type
1	Category Code	A4*
2	Scrap Code	A2
3	Category Code Description	A30

VAL Table: Errorlim		
Number	Field Name	Field Type
1	Error Limits Categ Code	A2*
2	95% Random Error	N
3	95% Fixed Error	N
4	99% Random Error	N
5	99% Fixed Error	N
6	ELCC Description	A20

ATTACHMENT F ... PARADOX PROTOTYPE MENUS, SCREENS, REPORT EXAMPLES

Installation of the demonstration.

Paradox systems can be installed in a windows environment with a Windows ICON, a PIF file that sets up the work space, and an APF file to start the program. The main files required to start up a Network Paradox setup are all contained in the C:\NPDOX40 directory. There are about files identified by PARADOX.* with the exception of the PARADOX.SOM file. This file cannot be included. A DLL file called YODMP.DLL is also required. These files can be accessed from any copy of network paradox with the following command.

USE y: \\~server\pdox40, where ~server is where paradox is located. It appears a copy of paradox resides on WHC256 which can be used. Then copy the above files to each user's c: drive in the c:\npdoux40 directory.

When Paradox is started, it can be setup to run a script which will hook up the work area for the program up and then start the application. This is placed in a passworded script in c:\npdoux40 on each user's system.

Then all it takes to start the system is to click on the ICON from program manager.

To run paradox from DOS from outside windows, please do the following.

1. Connect to your user area
2. Run Set ~server = WHC256
3. Run NETPDOX3 and paradox will start.
4. Within Paradox, set the current directory to the user area
5. Play APP to start the application.

To start the Prototype, play the "APP" script. The Password entry screen will appear on the screen as shown below:

```
■ View Ask Report Create Modify Image Forms Tools Scripts Exit
```

Password Entry

Name: *****

Password: *****

F1 Help | Main |

If an incorrect name or password is entered, an appropriate feedback message will appear on the screen. When a correct password is entered, the following screen, called the NMSS Main Menu appears on the screen:

```
Inventory Records Reports Administrative Exit
```

[0] [1]

Nuclear Materials Safeguards System
Sample Prototype Application

Edit Inventory Records incl Impurity, Analysis, Audit Trail

To use this screen cursor over to the desired selection and make the selection. After a selection is made, a sub-menu will appear, as is shown on the following page or the appropriate screen or report prompting will appear on the screen. After processing is complete, the above screen will reappear pointing to the first selection.

When the "Inventory Records" selection is made from the Main Menu, the following screen will appear.

Select Item to Process				
ITEM ID	SOURCE DOC	ENTRY ID	DATE	TIME
Hello	39	abcd	1/01/11	33
Test	Someth	VKRuss	8/01/94	1200
xxxxx	xxxxx	VKRuss	8/10/94	0930
yo hoo	abcde	VKRuss	8/10/94	0900

Inventory
 Analysis
 Audit History
 Impurity
 Audit Check
 Tank-to-Tank

Here the user can select the screen associated with the item, displayed in the box area above. To select an item, move the cursor to the box and cursor up or down until the desired item is highlighted. To select a screen move the cursor to the () area by the desired screen. The default selection, which is shown, points to the "Inventory" screen. To get to the screen, click on the "OK" button.

If the "Inventory" screen is selected, the following screen will appear. A beep will indicate all processing is completed, and the user can proceed.

```

Inventory Record Data Input
*****TERCES*****
ITEM ID Hello          CAT CD10 SEAL# 1 SEAL DT 1/01/11 FORM 32
RCPT DT 1/01/11      RMVLDT1/01/11 LOC CD10 ROW/PEDxx01 OUTER GROSS58
INR GRS 4            NET WT3      DESC This it the Hello Item
CONTAINER Nox       CNTR CDab   OR PROJ58 BATCH IDX      RCTRN
H/FIS3 . H+1       THML LD2   THML DT795   SEP DT1/01/11      MBA CODE 211
1 LAB#11           2 LAB#12           3 LAB#13           IMP LAB#15           SPGR 1           ZR xx
MT SUB PJ COEI ELEM WT ISO WT LABEL CNTRY C# SDOCNO BEG EWT BG ISO
      0 0 0 0 0 0 0 0 0 0 0 0
      0 0 0 0 0 0 0 0 0 0 0 0
      0 0 0 0 0 0 0 0 0 0 0 0
      0 0 0 0 0 0 0 0 0 0 0 0
EL IS EL EL EV P238 & P239 & P240 & P241 & P242 & ELEM ANL DATE AMERICIUM
MT MT CE CI IN U233 U234 U235 U236 U238 CNC ELEM ISO WT PCT DATE
      0 0 0 0 0 0 0 0 0 0 0 0
      0 0 0 0 0 0 0 0 0 0 0 0
      0 0 0 0 0 0 0 0 0 0 0 0
      0 0 0 0 0 0 0 0 0 0 0 0
SOURCE DOC NO: 39      ENTRY ID: abcd      DATE: 1/01/11 TIME: 33
      Intra Move      Inter Move
  OK  Cancel  Next  Home  Add  Delete
  █  █  █  █  █  █  █  █  █  █  █  █
Previous *****TERCES***** End

```

F1 Help

Main

Please note the blank and zeroed out fields in the middle of the screen. You will need to do nothing and wait for these numbers to be updated as follows:

```

Inventory Record Data Input
*****TERCES*****
ITEM ID Hello          CAT CD10 SEAL# 1 SEAL DT 1/01/11 FORM 32
RCPT DT 1/01/11      RMVLDT1/01/11 LOC CD10 ROW/PEDxx01 OUTER GROSS58
INR GRS 4            NET WT3      DESC This it the Hello Item
CONTAINER Nox       CNTR CDab   OR PROJ58 BATCH IDX      RCTRN
H/FIS3 . H+1       THML LD2   THML DT795   SEP DT1/01/11      MBA CODE 211
1 LAB#11           2 LAB#12           3 LAB#13           IMP LAB#15           SPGR 1           ZR xx
MT SUB PJ COEI ELEM WT ISO WT LABEL CNTRY C# SDOCNO BEG EWT BG ISO
11 103 59 771 3      1      2      AABBCDD xxxxxx 1      1
11 104 59 771 3      1      2      AABBCDD xxxxxx 1      1
12 102 59 771
21 101 59 771 3      1      2      AABBCDD xxxxxx 1      1
EL IS EL EL EV P238 & P239 & P240 & P241 & P242 & ELEM ANL DATE AMERICIUM
MT MT CE CI IN U233 U234 U235 U236 U238 CNC ELEM ISO WT PCT DATE
XX XX a1 A1 XX 0      0      0      5      0      2      1109 1109 1      1111
XX XX a1 A1 XX 0      0      0      5      0      2      1109 1109 1      1111
XX XX a1 A1 XX 0      0      0      5      0      2      1109 1109 1      1111
SOURCE DOC NO: 39      ENTRY ID: abcd      DATE: 1/01/11 TIME: 33
      Intra Move      Inter Move
  OK  Cancel  Next  Home  Add  Delete
  █  █  █  █  █  █  █  █  █  █  █  █
Previous *****TERCES***** End Hello

```

F1 Help

Main

The cursor points to the first field. There are a lot of possible actions that can take place from this screen. Though they may be demonstrated in the prototype, they will not be discussed here. They will be discussed in another area of the prototype description. Press the Escape key or click on the "Cancel" button to return back to the previous screen. This instruction applies to any screen with a "Cancel" button on it.

There are several possible functions this screen can perform.

In theory one can attempt to change the values in any field that is blue in the main section of the screen. Blue fields with grey and black headers above them can also be changed. Since this is straight forward, and not fully tested, please do not demonstrate this.

The other fields can be changed using a help and fill dialogue box sequence.

For instance to change the Category Code (Indicated by CAT CD) on the screen), click on the CAT CD green pushbutton. The following screen will appear:

```
Category Code Form
***UNCLASSIFIED***

CATEGORY CODE TABLE

CATEGORY CODE      10
CATEGORY DESCRIPTION Anode Heels
SCRAP CODE         1

OK  Cancel  Next  Previous  Home  End

***UNCLASSIFIED***

F1 Help | Main
```

By pressing the Next or Previous key, other category codes can be viewed. The category code number that is on the screen when the OK button is selected will be placed in the field by the green CAT CD button on the previous screen.

There are several other examples that can be tried.

Here is the screen that appears from the LOC CD green button.

```
Physical Location Form
***UNCLASSIFIED***

LOCATION CODE TABLE

LOCATION CODE      10
LOCATION DESCRIPTION 234-5 Building, room 308
MBA CODE         211
BUILDING NUMBER   234-5Z

OK  Cancel  Next  Previous  Home  End

***UNCLASSIFIED***

F1 Help | Main
```

This one will actually change the LOC CD and MBA CODE green buttons on the screen based on the selection made here.

Another case is OR PROJ, and the following screen appears:

```
Project Code Record Input
***UNCLASSIFIED***

PROJECT CODE TABLE

PROJECT CODE      58
PROJECT NUMBER    H40100106F
PREVIOUS PROJECT  0000000000
APF FLAG         5
PROJECT DESCRIPTION
NRC Fuel Studies

OK  Cancel  Next  Previous  Home  End

***UNCLASSIFIED***
```

F1 Help

| Main

The MBA CODE screen selection appears as follows:

```
Select MBA for Form
***UNCLASSIFIED***

MBA CODE TABLE

MBA CODE      211
MBA DESCRIPTION Facility Services - Z Plant
MBA CUSTODIAN xxxxxx

OK  Cancel  Next  Previous  Home  End

***UNCLASSIFIED***
```

F1 Help

| Main |

There are two other possible buttons to select called:

"Intra Move" and "Inter Move", these are comparable to the Intra-MBA move (within a MBA) and the Inter-MBA Move (between MBA's). Other functions like processing Seals, Measurements, and values could be easily added.

The "Intra Move" screen appears as follows:

```

Move Material Within MBA
***UNCLASSIFIED***

LOCATION CODE TABLE

LOCATION CODE          10
PREVIOUS LOCATION CODE: 10

LOCATION DESCRIPTION    234-5 Building, room 308
PREVIOUS LOCATION DESCRIPTION: 234-5 Building, room 308

MBA CODE              211

BUILDING NUMBER       234-5Z
PREVIOUS BUILDING NUMBER: 234-5Z

OK  Cancel  Next  Previous  Home  End

***UNCLASSIFIED***

```

F1 Help

Main

Both this screen and the Intra-MBA screen shown next will update the location and MBA values as was described previously.

```

Move Material Within MBA
***UNCLASSIFIED***

LOCATION CODE TABLE

LOCATION CODE          1A
PREVIOUS LOCATION CODE: 1A

LOCATION DESCRIPTION    PUREX oxide conversion
PREVIOUS LOCATION DESCRIPTION: PUREX oxide conversion

MBA CODE              203

BUILDING NUMBER       202A
PREVIOUS BUILDING NUMBER: 202A

OK  Cancel  Next  Previous  Home  End

***UNCLASSIFIED***

```

F1 Help

Main

In addition items in the middle area can be corrected. There are three codes that can be updated here, MT, PJ, and COEI.

To do this move the cursor to the item of interest in the middle of the screen. Then click on the green pushbutton above it. The screen will appear, and when done, the changes will be processed.

The MT option has the following screen:

```

Edit Material Type Form
***UNCLASSIFIED***

MATERIAL TYPE CODE TABLE

UNIQUE MATERIAL TYPE CODE      12
GENERAL MATERIAL TYPE CODE      10
LOW RANGE VALUE                 .21
HIGH RANGE VALUE                .24
MATERIAL DESCRIPTION            Depleted Uranium
WEIGHT UNIT                     g(PRE)/kg(NMI)

OK  Cancel  Next  Home  Add  Delete
  █      █      █      █      █      █
Previous  End
  █      █      █      █      █      █

***UNCLASSIFIED***

```

F1 Help

| Main

The PJ code screen appears as follows:

```

Project Code Edit Form
***UNCLASSIFIED***

PROJECT CODE TABLE

PROJECT CODE      59
PROJECT NUMBER    HGE02310SS
PREVIOUS PROJECT  0000000000
APF FLAG          5
PROJECT DESCRIPTION
Special isotope separation studies

OK  Cancel  Next  Home  Add  Delete
  █      █      █      █      █      █
Previous  End
  █      █      █      █      █      █

***UNCLASSIFIED***

```

F1 Help

| Main |

and finally the COEI screen appears as follows:

```
COEI Edit Screen
***UNCLASSIFIED***

CATEGORY CODE TABLE

COEI CODE          771

COEI CODE DESCRIPTION
                    Samples and Standards

COEI CODE - MASTER TYPE CODE ACCEPTABILITY
10 20 40 44 45 46 47 48 50 60 70 81 82 83 87 88
1  1  1  0  1  1  1  1  1  1  1  1  0  1  1  1  0

OK  Cancel  Next  Home  Add  Delete
  █  █  █  █  █  █  █  █  █  █  █  █  █  █  █  █
  █  █  █  █  █  █  █  █  █  █  █  █  █  █  █  █
  █  █  █  █  █  █  █  █  █  █  █  █  █  █  █  █
Previous █

***UNCLASSIFIED***

F1 Help | Main
```

When processing is done for the record of interest on the screen, one can go to the next or previous record if desired. I originally set the system up to scroll the records within the middle of the screen also, but that function is not currently working.

By pressing the Next, Previous, Home, or End keys other existing Inventory items can be viewed.

There are two other buttons on this screen, Add and Delete. The intention of them were to Add or Delete inventory items. The functions might be working on the demonstration system, they were working at one time, but they are not advisable to try when showing a demonstration.

To return to the previous screen, press the Esc Key or click on the Cancel Pushbutton.

Make the selection with Inventory by clicking the button or typing ALT-I from the Item Selection Screen. The following screen will appear on the screen when OK is selected:

If the "Impurity" screen is selected the following screen will appear:

```

History Impurities Record Input
*****TERCES*****
Item Id: Hello

TOT IMP      SIGN AMOUNT      AG      SIGN AMOUNT      AL      SIGN AMOUNT      AM      SIGN AMOUNT
AS          342              B              BA          < 2222
BI              C              CA          CD
CL              CO              CR          CU
DY              EU              F           FE
GA              GD              GE          K
LI              MG < 55            MN > 3333    MO
N              NA              NB          NI
NP              P               PB          S 777
SI              SM              SN          TA
TI              TL              U           V
W              ZN              ZR          S04
ZRNB          EQ B

SOURCE DOC NO: 39      ENTRY ID: abcd      DATE: 1/01/11      TIME: 33

OK  Cancel  Next  *****TERCES*****  Previous  Home  End

```

This shows the isotope impurities for the selected inventory item. The user can simply move through the screen and make the desired changes. When done with the changes process with the OK button, our use the Next, Previous, Home, or End Keys to select another item.

Make the selection with Analysis by clicking the button or typing ALT-N from the Item Selection Screen. The following screen will appear on the screen when OK is selected:

If the "Analysis" screen is selected the following screen will appear:

```

Inventory Analysis Record Input
*****TERCES*****
ITEM ID Hello      MATL TYPE20 SUBID 1
RIS TNK           LOCATION CODE   DESC This it the Hello Item
-----ELEMENT-----AMERICIUM-----
L  DATE   NET WGT %PU(3) ELEM WT (2) MTD DEV ERR  DATE   MTD DEV WGT %
12/31/0  0      0      0          0          0      12/31/0
12/31/0  0      0      0          0          0      12/31/0
12/31/0  0      0      0          0          0      12/31/0
12/31/0  0      0      0          0          0      12/31/0
12/31/0  0      0      0          0          0      12/31/0

-----ISOTOPE----- P238 & P239 & P240 & P241 & P242 & WATTS CURIES PROC OR SE
DATE MD DEV ERR U234  U235  U236  U238  U239          DATE & COD
12/31/0  0      0      0      0      0      0      0      12/31/0
12/31/0  0      0      0      0      0      0      0      12/31/0
12/31/0  0      0      0      0      0      0      0      12/31/0
12/31/0  0      0      0      0      0      0      0      12/31/0
12/31/0  0      0      0      0      0      0      0      12/31/0
SOURCE DOC NO: 39      ENTRY ID: abcd      DATE: 1/01/11      TIME: 33

  OK   Cancel   Next   Home   Add   Delete
  █   █       █     █     █     █     █
Previous *****TERCES***** End     Hello

F1 Help | Main |
  
```

Please note the blank and zeroed out fields in the middle of the screen. You will need to do nothing and wait for these numbers to be updated as follows:

```

Inventory Analysis Record Input
*****TERCES*****
ITEM ID Hello      MATL TYPE20 SUBID 1
RIS TNK           LOCATION CODE   DESC This it the Hello Item
-----ELEMENT-----AMERICIUM-----
L  DATE   NET WGT %PU(3) ELEM WT (2) MTD DEV ERR  DATE   MTD DEV WGT %
2 2/04/22 3      6      3          ab gh  1/01/11  bd ad 1
1 2/04/22 3      6      3          ab gh  1/01/11  bd ad

-----ISOTOPE----- P238 & P239 & P240 & P241 & P242 & WATTS CURIES PROC OR SE
DATE MD DEV ERR U234  U235  U236  U238  U239          DATE & COD
4/06/78 ax sdf as 0      0      0      5      0      5      4      3/03/33 ax

SOURCE DOC NO: 39      ENTRY ID: abcd      DATE: 1/01/11      TIME: 33

  OK   Cancel   Next   Home   Add   Delete
  █   █       █     █     █     █     █
Previous *****TERCES***** End     Hello

F1 Help | Main |
  
```

This shows the results of chemical analysis for selected sub-items of the selected inventory item. The user can simply move through the screen and make the desired changes. When done with the changes process with the OK button, our use the Next, Previous, Home, or End Keys to select another item.

Make the selection with Audit Check by clicking the button or typing ALT-U from the Item Selection Screen. The following screen will appear on the screen when OK is selected:

If the "Audit Check" screen is selected the following screen will appear:

```

Audit Record Comparison Screen
*****TERCES*****
ITEM ID Hello          CAT CD10 SEAL# 1 SEAL DT 1/01/11 FORM 32
MOD Hello             1          1          1/01/11      32
RCPT DT 1/01/11      RMVLDT1/01/11 LOC CD10 ROW/PEDxx01 OUTER GROSS58
1/01/11              1/01/11      1A          xx01      58
INR GRS 4            NET WT3      DESC This it the Hello Item
4                    3          This it the Hello Item
CONTAINER NOx       CNTR CDab OR PROJ58 BATCH IDx      RCTRN
xxxxx              ab          11          x          N
H/FIS3 H+1          THML LD2 THML DT795 SEP DT1/01/11 MBA CODE211
3 1                2          795        1/01/11      211
1 LAB#11           2 LAB#12           3 LAB#13           IMP LAB#15           SPGR 1           ZR xx
11                12                13                15                1           xx
MT SUB PJ COEI ELEM WT ISO WT LABEL CNTRY C# SDOCNO BEG EWT BG ISO
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
EL IS EL EL EV P238 & P239 & P240 & P241 & P242 & ELEM ANL DATE AMERICIUM
MT MT CE CI IN U233 U234 U235 U236 U238 CNC ELEM ISO WT PCT DATE
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SOURCE DOC NO: 39 ENTRY ID: abcd DATE: 1/01/11 TIME: 33
OK Cancel Next *****TERCES***** Previous Home Hello
F1 Help | Main |

```

Please note the blank and zeroed out fields in the middle of the screen. You will need to do nothing and wait for these numbers to be updated as follows:

```

Audit Record Comparison Screen
*****TERCES*****
ITEM ID Hello          CAT CD10 SEAL# 1 SEAL DT 1/01/11 FORM 32
MOD Hello             1          1          1/01/11      32
RCPT DT 1/01/11      RMVLDT1/01/11 LOC CD10 ROW/PEDxx01 OUTER GROSS58
1/01/11              1/01/11      1A          xx01      58
INR GRS 4            NET WT3      DESC This it the Hello Item
4                    3          This it the Hello Item
CONTAINER NOx       CNTR CDab OR PROJ58 BATCH IDx      RCTRN
xxxxx              ab          11          x          N
H/FIS3 H+1          THML LD2 THML DT795 SEP DT1/01/11 MBA CODE211
3 1                2          795        1/01/11      211
1 LAB#11           2 LAB#12           3 LAB#13           IMP LAB#15           SPGR 1           ZR xx
11                12                13                15                1           xx
MT SUB PJ COEI ELEM WT ISO WT LABEL CNTRY C# SDOCNO BEG EWT BG ISO
10 2 59 771
11 102 59 771
EL IS EL EL EV P238 & P239 & P240 & P241 & P242 & ELEM ANL DATE AMERICIUM
MT MT CE CI IN U233 U234 U235 U236 U238 CNC ELEM ISO WT PCT DATE
SOURCE DOC NO: 39 ENTRY ID: abcd DATE: 1/01/11 TIME: 33
OK Cancel Next *****TERCES***** Previous Home Hello
F1 Help | Main |

```

This screen is for viewing purposes only. It shows the current and previous values for the selected Inventory Item and associated sub-item. When done viewing process with the OK button, our use the Next, Previous, Home, or End Keys to select another item.

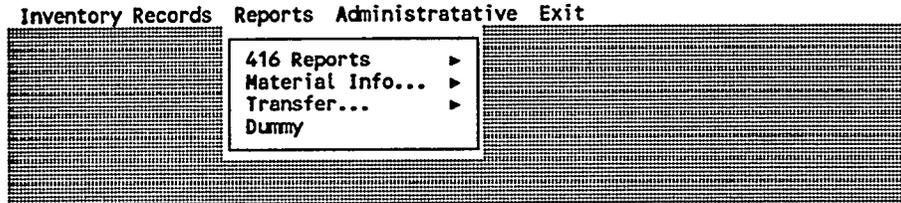
Make the selection with Audit History by clicking the button or typing ALT-H from the Item Selection Screen. The following screen will appear on the screen when OK is selected:

If the "Audit History" screen is selected the following screen will appear:

History Audit Trail Record Input										
*****TERCES*****										
ITEM ID Hello										
ITEM IDENTIFIER	MT	SUB ID	ENTRY DATE	ENTRY TIME	PAYROLL	SOURCE DOC	ACT FILE	LOC COD	PROJ CODE	
Hello	10	2	1/01/11	33	abcd	39	MO IN	28	59	
Hello	10	2	8/25/94	1350	abcd	39	MO IN	28	59	
Hello	10	2	8/25/94	1353	abcd	39	MO IN	28	59	
Hello	10	2	8/25/94	1356	abcd	39	MO IN	28	59	
Hello	10	2	8/25/94	1403	abcd	39	MO IN	28	59	
Hello	10	2	8/25/94	1404	abcd	39	MO IN	28	59	
GROSS WT	NET WT	ELEMENT WT		LABEL WT		EMD	IND			
5	4	3								
5	4	3								
50	4	3								
55	4	3								
56	4	3								
57	4	3								
SOURCE DOC NO: 39		ENTRY ID: abcd		DATE: 1/01/11		TIME: 33				
<u>OK</u>	<u>Cancel</u>	<u>Next</u>	*****TERCES*****		<u>Previous</u>	<u>Home</u>	<u>End</u>	Hello		

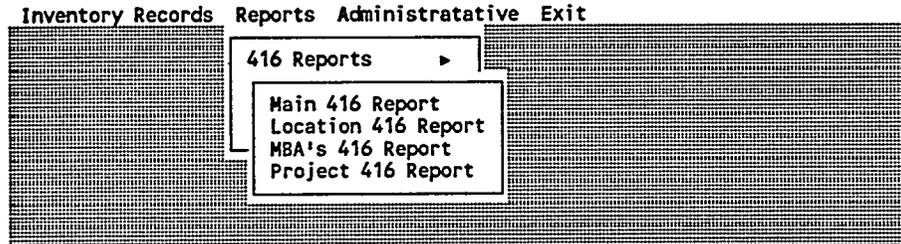
This screen is for viewing only and shows the audit history for the selected inventory sub-items. The user can simply move through the screen and make the desired changes. When done with the changes process with the OK button, we use the Next, Previous, Home, or End Keys to select another item.

When the "Reports" selection is made from the Main Menu, the following screen will appear.



Produce Pieces of the PRE-416 Report

When the "416 Reports" selection appears, the following sub-sub-selections appear on the screen. These represent reports within the "416 Reports" category.



Produce Main Piece of PRE-416 Report
Produce Location Piece of PRE-416 Report
Produce MBA's Piece of PRE-416 Report
Produce Project Piece of PRE-416 Report

When the "Table Info..." selection appears, the following sub-sub-selections appear on the screen. These represent reports within the "Table Info" category (arbitrarily defined).

Note: When any report is requested the following screens will appear as required.

Report Output Mode

Enter Method For Reporting:

- P) Send Report to The LPT1 Printer
- 2) Send Report to The LPT2 Printer
- 3) Send Report to The LPT3 Printer
- F) Send Report to a File
- S) Send Report to the Screen

Press <Esc> to Quit

If a screen or printer selection is chosen, then the report will be output. If a file is selected, the following screen appears.

Enter File Name Including Path.

Valid Paths Include: 1) C:\FILENAME.12 2) C:\SUBDIR\FILENAME
 3) U:\OUTPUT.ADS 4) A:\PARADOX\EPDS\ADS.RPT
 5) B:\REPORT.400 6) G:\EXAMPLE.TXT

The Path MUST Include The Drive to be Used And The Drive MUST be Ready. In The Above Examples Drives A: & B: MUST Have Floppies in Them And Drive G: MUST be Linked Via Network. Drives E:, S:, W:, Y:, & Z: CANNOT be Used to Receive Report Output.

The Path MAY Include Subdirectories to Which The File is to be Written. In Examples 2 & 4 The Subdirectories Would be SUBDIR & PARADOX\EPDS. Subdirectories Included in The Path MUST Exist on The Specified Drive.

Filenames & Subdirectories MAY Include Letters or Numbers & Are Limited to Eight Characters Each. A Filename MAY Include an Extension of up to Three Characters (Letters or Numbers). Any Filename Typed in With no Extension Will Automatically be Given The Extension ".RPT".

After the filename with subdirectory is entered, and replaced if desired, then the report is output to that file.

If the "416 Main" report is selected, a report similar to the following will be generated.

PRE-416
9/30/94
*****TERCES*****
Inventory Listing by MBA and Location
Page 1

MBA: 211 Facility Services - Z Plant Location: 10 234-5 Building, room 308 Custodian : xxxxxx

Row/ Ped	Container Number	Item ID	MT CD ID	Sub Weight	Element M	E Weight	Label Type	Cont Type	Seal Number	Net Wt/ Volume	Outer Gross Wt	Cat Code	Isotope Weight	Iso Percent	COEI Code	PJ Code	H/FS Rat
xx01	xxxxx	Hello	11 103	3.0	XX	2.0	ab	1		3.0	58.0	10	1.0	0.000	771	59	3
			11 104	3.0	XX	2.0							1.0	0.000	771	59	
			12 102														
			21 101	3.0	XX	2.0							1.0	0.000	771	59	
			24 104	3.0	XX	2.0							1.0	0.000	771	59	
			25 105	3.0	XX	2.0							1.0	0.000	771	59	
			45 101	3.0	XX	2.0							1.0	0.000	771	59	

MBA: 211 Facility Services - Z Plant Location: 30 2-9 crib mining Custodian : xxxxxx

Row/ Ped	Container Number	Item ID	MT CD ID	Sub Weight	Element M	E Weight	Label Type	Cont Type	Seal Number	Net Wt/ Volume	Outer Gross Wt	Cat Code	Isotope Weight	Iso Percent	COEI Code	PJ Code	H/FS Rat
xx01	xxxxx	Test	45 101	3.0	XX	2.0	ab	abcd		3.0	15.0	62	1.0	0.000	777	59	3

*****TERCES*****

The "416 Location" report is similar to the following:

***** T E R C E S *****

9/30/94 Inventory Listings by Location Page 1

Totals for Location 10	Items	1	Element Wt.	Isotope Wt.	Label Weight
Recapilulation for Material Type 11	Items	2	6.00	2.00	4.00
Recapulation for Project HGE02310SS	Items	2	6.00	2.00	4.00
Recapilulation for Material Type 12	Items	1			
Recapulation for Project HGE02310SS	Items	1			
Recapilulation for Material Type 21	Items	1	3.00	1.00	2.00
Recapulation for Project HGE02310SS	Items	1	3.00	1.00	2.00
Recapilulation for Material Type 24	Items	1	3.00	1.00	2.00
Recapulation for Project HGE02310SS	Items	1	3.00	1.00	2.00
Recapilulation for Material Type 25	Items	1	3.00	1.00	2.00
Recapulation for Project HGE02310SS	Items	1	3.00	1.00	2.00
Recapilulation for Material Type 45	Items	1	3.00	1.00	2.00
Recapulation for Project HGE02310SS	Items	1	3.00	1.00	2.00
Totals for Location 30	Items	1	Element Wt.	Isotope Wt.	Label Weight
Recapilulation for Material Type 45	Items	1	3.00	1.00	2.00
Recapulation for Project HGE02310SS	Items	1	3.00	1.00	2.00

***** T E R C E S *****

The "416 MBA's" report is similar to the following:

***** T E R C E S *****

9/30/94 Inventory Listings by MBA's Page 1

Totals for Material Balance Area 211			Element Wt.	Isotope Wt.	Label Weight
Recapilulation for Material Type 11	Items	2	6.00	2.00	4.00
Recapulation for Project HGE02310SS	Items	2	6.00	2.00	4.00
Recapilulation for Material Type 12	Items	1			
Recapulation for Project HGE02310SS	Items	1			
Recapilulation for Material Type 21	Items	1	3.00	1.00	2.00
Recapulation for Project HGE02310SS	Items	1	3.00	1.00	2.00
Recapilulation for Material Type 24	Items	1	3.00	1.00	2.00
Recapulation for Project HGE02310SS	Items	1	3.00	1.00	2.00
Recapilulation for Material Type 25	Items	1	3.00	1.00	2.00
Recapulation for Project HGE02310SS	Items	1	3.00	1.00	2.00
Recapilulation for Material Type 45	Items	1	6.00	2.00	4.00
Recapulation for Project HGE02310SS	Items	1	6.00	2.00	4.00

***** T E R C E S *****

The "416 Projects" report is similar to the following:

9/30/94

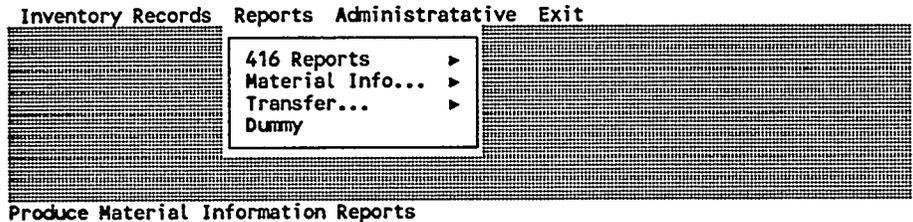
***** T E R C E S *****
Inventory Listings by Projects

Page 1

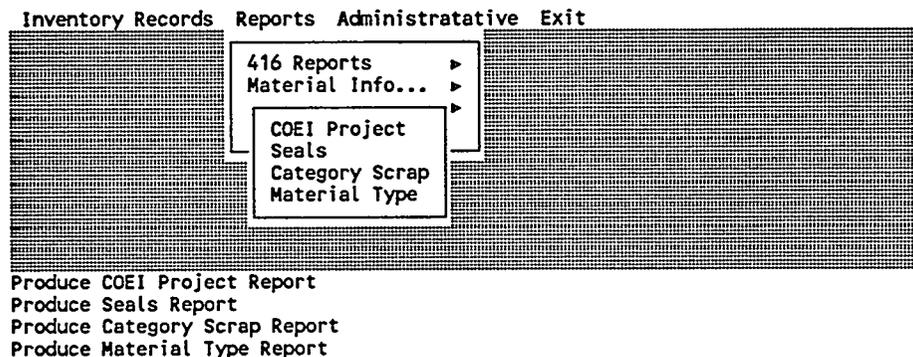
Summary of Material Type by Project		Element Wt.	Isotope Wt.	Label Weight
Recapilulation for Material Type 11	Items 2	6.00	2.00	4.00
Recapulation for Project HGE02310SS	Items 2	6.00	2.00	4.00
Recapilulation for Material Type 12	Items 1			
Recapulation for Project HGE02310SS	Items 1			
Recapilulation for Material Type 21	Items 1	3.00	1.00	2.00
Recapulation for Project HGE02310SS	Items 1	3.00	1.00	2.00
Recapilulation for Material Type 24	Items 1	3.00	1.00	2.00
Recapulation for Project HGE02310SS	Items 1	3.00	1.00	2.00
Recapilulation for Material Type 25	Items 1	3.00	1.00	2.00
Recapulation for Project HGE02310SS	Items 1	3.00	1.00	2.00
Recapilulation for Material Type 45	Items 1	6.00	2.00	4.00
Recapulation for Project HGE02310SS	Items 1	6.00	2.00	4.00

***** T E R C E S *****

The Material Information reports can be selected next.



When the "Material Info..." selection appears, the following sub-sub-selections appear on the screen. These represent reports within the "Material Info" category (arbitrarily defined).



If the "COEI Project" report is selected, a report similar to the following will be generated.

9/16/94 ***** T E R C E S ***** Page 1

COEI Listing by Project and COEI Line

Project Number	COEI Code	Specific Material Type	Element Weight	Isotope Weight
HGE02310SS	771	11		
HGE02310SS	771	11	3.00	1.00
HGE02310SS	771	21	3.00	1.00
HGE02310SS	771	24	3.00	1.00
HGE02310SS	771	25	3.00	1.00
HGE02310SS	771	45	3.00	1.00
HGE02310SS	777	45	3.00	1.00

***** T E R C E S *****

If the "Seals" report is selected, a report similar to the following will be generated.

9/16/94 ***** T E R C E S ***** Page 1

SEAL Number List

Seal Number	Seal Date	Item Identification	Source Document	Location Code	Row-Pedestal	Container Number
1	11-01-01	Hello	39	1A	xx01	xxxxx
abcd	11-01-01	Test	Someth	30	xx01	xxxxx

***** T E R C E S *****

If the "Category Scrap" report is selected, a report similar to the following will be generated.

9/16/94 ***** T E R C E S ***** Category Listing by Item Page 1

Cat. Scrap Cat. Code	Item Identification	RCTR SRCE	Container Number	E V I	Receipt Date	Plutonium Element Weight	Weight Percent Isotope	Actual Location	Loc. Code	Gross Weight	CNTR Code	COEI Code	MTD Code
20	Hello	N	XXXXX		1/01/11			PUREX oxide conversion	1A	58.00	AA	771	XXXX
20	Hello	N	XXXXX	XX	1/01/11	3.00	0.00	PUREX oxide conversion	1A	58.00	AA	771	XXXX
62	Test	N	XXXXX	XX	1/01/11	3.00	0.00	Z-9 crib mining	30	15.00	AA	777	XXXX

***** T E R C E S *****

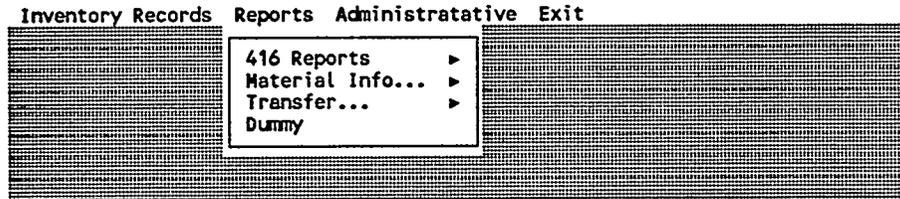
If the "Material Type" report is selected, a report similar to the following will be generated.

9/16/94 ***** T E R C E S ***** MTCOOT Table Listing Page 1

Unique Material Type	General Material Type	Low Range Value	High Range Value	Material Type Description	Weight Units
11	10	0.000	.210	Depleted Uranium	g(PRE)/kg(NMI)
12	10	.240	.240	Depleted Uranium	g(PRE)/kg(NMI)
13	10	.260	.260	Depleted Uranium	g(PRE)/kg(NMI)
17	10	.500	.600	Depleted Uranium	g(PRE)/kg(NMI)
18	10	.600	.711	Depleted Uranium	g(PRE)/kg(NMI)
21	20	.711	.900	Enriched Uranium	g
22	20	.900	1.150	Enriched Uranium	g
23	20	1.150	1.600	Enriched Uranium	g
41	40	20.000	60.000	Pu-242	g
45	45	0.000	100.000	Am-243	g
48	48	0.000	0.000	Californium	µg
51	50	100.000	4.000	Plutonium Element	g
52	50	4.000	7.000	Plutonium Element	g
57	50	19.000	100.000	Plutonium Element	g
61	60	0.000	55.000	Enriched Lithium	kg
62	60	0.000	100.000	Enriched Lithium	kg
71	70	0.000	5.000	U-233	g
81	81	0.000	100.000	Normal Uranium	g(PRE)/kg(NMI)
86	86	0.000	100.000	Deuterium	kg
87	87	0.000	100.000	Tritium	g to 100th
88	88	0.000	100.000	Thorium	g(PRE)/kg(NMI)

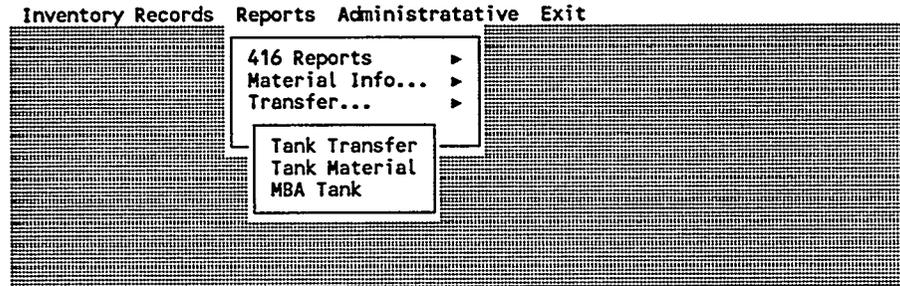
***** T E R C E S *****

The Transfer reports can be selected next.



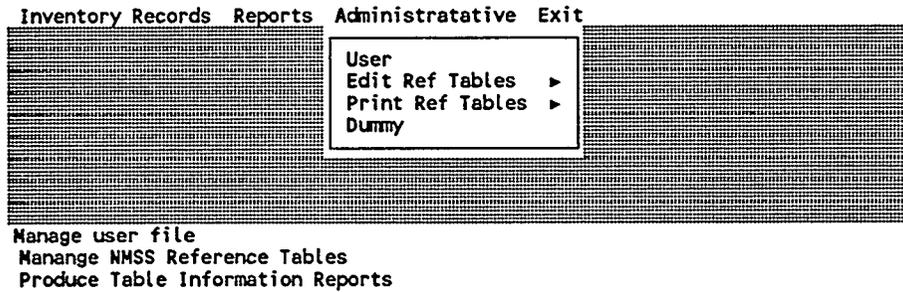
Produce Tank Transfer Reports

When the "Transfer..." selection appears, the following sub-sub-selections appear on the screen. These represent reports within the "Transfer" category (arbitrarily defined).



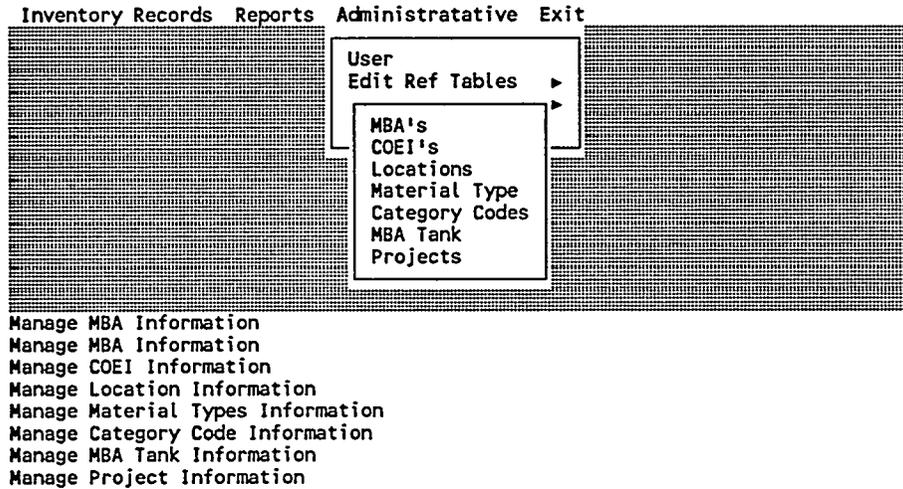
Produce Tank Transfer Report
Produce Tank Transfer Material Report
Produce MBA-Tank Report

When the "Administrative" selection is made from the Main Menu, the following screen will appear.



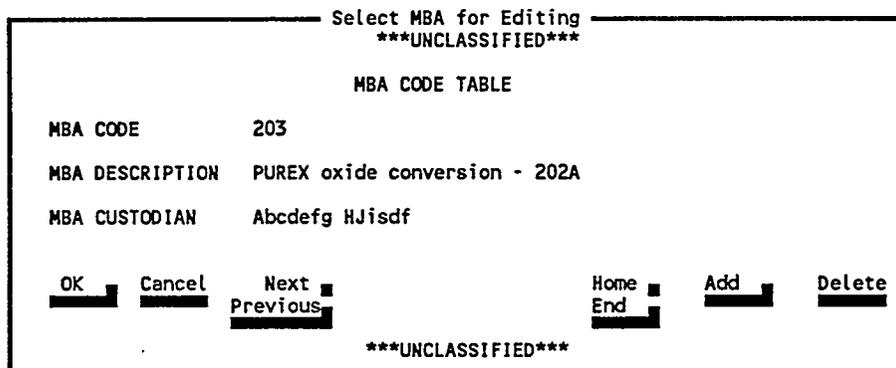
In this section, the System Administrator can setup the system. Nothing has been prepared for the prototype for handling the users. The administrator can however Edit or print the reference tables.

When the "Edit Ref Tables" selection is made from the Main Menu, the following screen will appear.



The box that appears below the main menu line is a sub-menu selection area.

When the "MBA's" selection the following screen appears:



When the "COEI's" selection the following screen appears:

```
COEI Edit Screen
***UNCLASSIFIED***

CATEGORY CODE TABLE

COEI CODE          771
COEI CODE DESCRIPTION Samples and Standards

COEI CODE - MASTER TYPE CODE ACCEPTABILITY
10 20 40 44 45 46 47 48 50 60 70 81 82 83 87 88
 1  1  1  0  1  1  1  1  1  1  1  0  1  1  1  0

OK  Cancel  Next  Home  Add  Delete
      Previous
```

When the "Locations" selection the following screen appears:

```
Physical Location Edit Form
***UNCLASSIFIED***

LOCATION CODE TABLE

LOCATION CODE          10
LOCATION DESCRIPTION   234-5 Building, room 308
MBA CODE             211
BUILDING NUMBER      234-52

OK  Cancel  Next  Home  Add  Delete
      Previous
```

When the "Material Type" selection the following screen appears:

```
----- Edit Material Type Form -----  
***UNCLASSIFIED***  
  
MATERIAL TYPE CODE TABLE  
  
UNIQUE MATERIAL TYPE CODE      11  
GENERAL MATERIAL TYPE CODE      10  
LOW RANGE VALUE                 0  
HIGH RANGE VALUE                .21  
MATERIAL DESCRIPTION            Depleted Uranium  
WEIGHT UNIT                     g(PRE)/kg(NMI)  
  
OK      Cancel      Next      Home      Add      Delete  
      Previous      End  
  
***UNCLASSIFIED***
```

When the "Category Codes" selection the following screen appears:

```
----- Category Code Edit Form -----  
***UNCLASSIFIED***  
  
CATEGORY CODE TABLE  
  
CATEGORY CODE      10  
CATEGORY DESCRIPTION Anode Heels  
SCRAP CODE        1  
  
OK      Cancel      Next      Home      Add      Delete  
      Previous      End  
  
***UNCLASSIFIED***
```

When the "MBA Tank" selection the following screen appears:

```
History Tank-MBAS Record Input
***UNCLASSIFIED***

TANK - MBA RELATIONS

TANK NUMBER      1234
MBA CODE         211
TANK DESCRIPTION This is another Tank

OK  Cancel  Next  Home  Add  Delete
      Previous  End

***UNCLASSIFIED***
```

When the "Projects" selection the following screen appears:

```
Project Code Edit Form
***UNCLASSIFIED***

PROJECT CODE TABLE

PROJECT CODE      58
PROJECT NUMBER    H40100106F
PREVIOUS PROJECT  0000000000
APF FLAG          5
PROJECT DESCRIPTION
NRC Fuel Studies

OK  Cancel  Next  Home  Add  Delete
      Previous  End

***UNCLASSIFIED***
```

When the "Print Ref Tables" selection is made from the Main Menu, the following screen will appear.

```

Inventory Records  Reports  Administratave  Exit
-----
User
Edit Ref Tables  >
Print Ref Tables >
Project
MBA's
Scrap
COEI
Location
Category Code
-----
Produce MBA's Table Report
Produce Scrap Table Report
Produce COEI Report
Produce Location Description Report
Produce Category Code Report
  
```

If the "Project" report is selected, a report similar to the following will be generated.

9/16/94 ***** T E R C E S ***** Page 1
PRJCDT TABLE Listing

Project Code	Project Number	Previous Project Number	APF Flag	Description
58	H40100106F	0000000000	5	NRC Fuel Studies
59	HGE02310SS	0000000000	5	Special isotope separation studies

***** T E R C E S *****

If the "MBA's" report is selected, a report similar to the following will be generated.

9/16/94 ***** T E R C E S ***** Page 1
MBACTD Table Listing

MBA Code	MBA Description	MBA Custodian
203	PUREX oxide conversion - 202A	Abcdefg HJisdf
211	Facility Services - Z Plant	xxxxxx

***** T E R C E S *****

If the "Scrap" report is selected, a report similar to the following will be generated.

***** T E R C E S *****
SCRPTC Table Listing

9/16/94 Page 1

Scrap Code	Scrap ID	Scrap Group Description		
1	1 A	metals and alloys	(Other than PuBe)	
2	1 B	metals and alloys	(Other than PuBe)	With uranium
3	1 C	metals and alloys	(Other than PuBe)	With thorium
4	1 D	metals and alloys	(Other than PuBe)	With zirconium
5	2	PuBe Sources		
6	3 A	miscellaneous scrap	Powder	
7	3 B	miscellaneous scrap	Powder with uranium	
8	3 C	miscellaneous scrap	Powder with thorium	
9	3 D	miscellaneous scrap	Powder with zirconium	
10	4	polystyrene scrap		
11	5	scrap solutions		
12	6	waste drums		
13	7	incinerator ash		
14	8	slag and crucible		
15	9	other miscellaneous	Scrap	
16	10	product		
17	17	unknown-not totaled		
18	18	miscellaneous samples		
19	19	Pu reclamation WG		

***** T E R C E S *****

If the "COEI" report is selected, a report similar to the following will be generated.

***** T E R C E S *****
CICIDT Table Listing

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COEI Code	COEI Description	COEI CODE - MATERIAL TYPE CODE ACCEPTABILITY															
		10	20	40	44	45	46	47	48	50	60	70	81	82	83	87	88
771	Samples and Standards	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	0
777	Another COEI Example	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0

***** T E R C E S *****

If the "Location" report is selected, a report similar to the following will be generated.

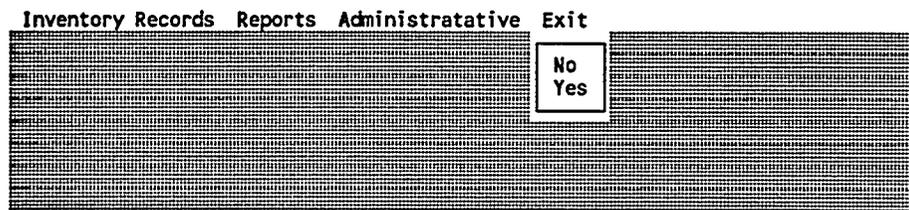
***** T E R C E S *****
Location Descriptions

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Location Code	Location Description	MBA Code	Building Name
10	234-5 Building, room 308	211	234-5Z
1A	PUREX oxide conversion	203	202A
28	Behind 234-5 Building	211	234-5Z
30	Z-9 crib mining	211	Z-9
61	Facilities Services	211	234-5Z
9	234-5 Building, room 263	211	234-5Z

***** T E R C E S *****

When the "Exit" selection is made from the Main Menu, the following screen will appear.



Answer "Yes" to exit the prototype.

ATTACHMENT G .. REVIEW COMMENTS

Attachment F shows all the changes to the document as compared with the final review copy submitted for comments on September 28, 1994. The following people reviewed this document and provided comments:

D.W. Engel, M.N. Serier, L.P. McRae, F.G. Fetteroff, D.E. Six from Safeguards and F.K. Mangan, K.C. McBride, and V.K. Russell from BCSR.

The changes are shown in the redline/strikeout format. Only the appropriate paragraph within the section where the changes occurred is included within this attachment. Editorial changes have not been included.

There was one global comment, whose changes were not included in this section: Change lowercase "nm", which stands for Nuclear Materials to uppercase "NM"

In addition, attachment F has been replaced with the final prototype information.

The comments will now follow starting on the next page.

1.2 Scope

This document:

- provides an overview of the NMSS replacement need and strategy
- cites sources that substantiate the replacement need and urgency
- includes a recommended course of action
- describes a prototype system that is one of the alternatives considered
- proposes the consideration of a contingency system for emergency backup of the NMSS

This document does not:

- specify a replacement strategy for systems other than the NMSS
- use or refer to vendor firm bid quotes other than those already available on site
- identify any funding monies or agencies that have committed to the replacement recommendation
- guarantee the availability of programmer resources to support the NMSS replacement solution
- provide detailed schedules for alternative implementation

2.0 CONCEPT DEFINITION

2.1 Statement of Need to Define the Current Environment

The following is a list of organizational goal:

- significantly reduce the risk of using old unsupported hardware
- a new system that is supportable and that meets current system requirements
- a replacement system with more efficient operational screens and reports similar to the existing system
- a replacement system that is capable of storing, retrieving, and backing up data at least equal to the existing system
- a replacement system that has access control processes functionally equivalent to the existing system, ~~if actually required~~
- a replacement system that can be programmed to provide audit trail tracking capability
- readily available and maintainable hardware (e.g. PC Workstations)
- implementation software having a broad base of locally available software programmers
- software having a proven user friendly interface and environment
- hardware and software that is relatively low cost
- hardware that can operate in a normal office environment thus reducing the continuing costs for operating, heating, and cooling
- a replacement system that will be created with supporting documentation according to WHC-CM-3-10
- supports International Atomic Energy Agency (IAEA) requirements at NMSS or locally ~~at the NMSS~~
- complies with ~~generally accepted~~ general accounting principles
- TID database for data cross-checks
- ~~• supports International Atomic Energy Agency (IAEA) requirements for the NMSS~~

2.2 Scope of Need

The NMSS is a dual database system that maintains the official inventory and transaction records of all WHC managed Nuclear Materials (NM). This system provides data to the Oak Ridge, Tennessee, database and various reports to RL and WHC.

NMSS or a replacement system ~~may be~~ is required to support the following interfaces:

- VSIS for backup
- NMSS, Oak Ridge, TN, by tape and SACNET (essentially magnetic tape reports)
- CAS via a MUX Loop for alarm signals
- Operations Alarm Panel for alarms

2.4 Solution Objectives

As already described, the NMSS needs to be replaced so that the current high risk is reduced to an acceptable level. Any replacement system needs to:

- (1) provide essentially the same functionality with the same distinctive features as the current NMSS
- (2) operate with a resultant performance that will be adequate (as good or better than the existing system)
- ~~(3) offer essentially the same distinctive features as the current system~~

3.0 EXECUTIVE SUMMARY

3.1 Schedules

~~Detailed implementation schedules are not provided in this document because detailed implementation requirements have not yet been identified and documented and a project plan developed. General implementation time ranges are provided in Attachment A. Major benefits anticipated from following the recommendations are found in Sections 5.0 and 6.0 of this document.~~

4.1.2 User Identification

WHC Safeguards and Security staff and NM custodians are direct users of the NMSS. Other organizations receiving reports and data from the NMSS are:

- NMSS at Oak Ridge Tennessee (data is exported using floppy diskettes ~~magnetic tape~~ and the SAC-NET classified data link)
- DOE-RL Safeguards and Security (accesses routine reports and issues ~~ad hoc queries; special requests~~ for data)
- WHC Material Management (MM) (data is usually prepared in a PARADOX format to be exported to WHC MM via floppy diskette)
- WHC NM custodians

Information produced by this system is classified as "Confidential". Even if the NM data in the NMSS is de-classified, it is unlikely that this information will ever be released to the public.

4.2 Constraints

Two constraints that would significantly impact the resolution of the replacement of the NMSS are:

- the current DOE directive precluding the acquisition of computer hardware and software for all but critical systems
- the ~~availability of low probability~~ that funding will be identified to support problem resolution recommendations in the Safeguards area

4.2.2 Interfacing Functions

Interfaces that NMSS makes with other systems are:

- Vault Safety and Inventory System: NMSS and VSIS computers are PRIME units. They communicate with each other via a PRIME proprietary Ethernet network. Files are routinely downloaded from the NMSS to the VSIS. In case of a NMSS computer failure, the VSIS can access the NMSS disk drives and run NMSS functions as a backup. VSIS files are also copied to the NMSS, but the NMSS cannot backup VSIS real-time functions. There is also the NMSS Inventory Records file that the VSIS uses to prepare some routine reports. The expectation is that a NMSS replacement system would be implemented to satisfy these requirements. However, ~~because a new US/IAEA agreement may develop in the future requiring that the link between the NMSS and the VSIS be discontinued because of new IAEA requirements, the link between the NMSS and the VSIS may have to be discontinued.~~

4.2.4 Development, Operations, and Maintenance

Some of the requirements needed for a problem resolution are:

- Development Phase

In development, the current NMSS must continue to be operated. This is true up until the new process has satisfied all testing and has been accepted for routine use. Depending on the funding available, if network cabling can be

installed so that the two systems can operate concurrently for an extended time ~~(up to six months)~~ ~~(at least 6 months)~~, this is the preferred approach. Even after the existing system has been replaced, it is expected that for a few months the old NMSS hardware and software will be maintained in a standby mode.

- Operations

Data integrity and accuracy are essential in the replacement solution.

~~The replacement system must be capable of continuous operation; The replacement system must operate continuously;~~ however, day shift will be the predominant usage time. Required information (e.g. NMSS data bases such as PRE and NMI) must be available and must be backed up routinely. No real time needs (i.e., ~~data acquisition;~~ data entry, data validation) have been identified.

4.2.5 Acceptance Criteria

Acceptance Criteria for a NMSS replacement approach are:

- Demonstrated Performance: ~~Up to six months~~ ~~A 6-month~~ successful parallel operation with required accuracy and performance of the existing NMSS.
- Functional Requirements: A replacement system that successfully performs ~~current existing~~ required data base, data storage, data backup, screen display and reports performed by the existing NMSS (unused or ~~unnecessary~~ functions may be phased out).

5.0 FEASIBILITY ANALYSIS

5.1 Description of Alternatives

Alternative descriptions are as follows:

- **IMPLEMENT AND USE A MANUAL PROCESS**

- This alternative assumes that the NMSS automated system will be taken out of service after it is demonstrated that the manual process is functioning successfully for ~~up to six months~~ 6 months in parallel operation.

- **MODIFY DOE LANMAS FOR USE**

At present, DOE is sponsoring the development of a generic NM accountability system that may be used DOE site-wide. Using this approach, hardware and software would be acquired compatible with the DOE site-wide LANMAS. A copy of the LANMAS software will then be transferred to WHC and installed on a PC workstation based limited access network. Software changes will be made to customize the LANMAS software so that it will meet DOE-RL and WHC requirements (e.g. support NMSS functionality). The new system will be tested in parallel for ~~up to six months~~ at least 6 months to assure proper functionality. The existing NMSS will then be taken out of operation. Users will need to be trained on the use of the new system.

- **ACQUIRE PC NETWORK AND RUN ON PARADOX PLATFORM**

Additional PC workstation and file server hardware will be acquired as needed. NMSS functionality will be implemented on a PARADOX platform and will be serviced by a limited access (HLAN access will not be supported because of the classification of data) file server. The new system will be tested in parallel for ~~up to six months~~ at least 6 months to assure NMSS functionality is retained. The existing NMSS will then be taken out of operation. Users will need to be trained on the use of the new system.

- **ACQUIRE SUN NETWORK AND RUN ORACLE (SYBASE, ETC.)**

This alternative relies on the acquisition of six SUN workstations and one file server. Database software such as ORACLE will also be required as will utility software to support the network based system. This system will be tested in parallel for ~~up to six months~~ at least 6 months with the current NMSS in full operation to assure proper functionality. The existing NMSS will then be taken out of operation. Users will need to be trained on the use of the new system.

5.2.1 Comparison by Costs

Alternatives are compared by looking at cost estimates. In summary, there are five alternatives that costs were estimated for and comparisons made. In order to gain a better perspective of implementation scenarios, cost estimates over a five year time span were made (FY95 through FY99). The following table provides a five year summary of the costs and shows the resulting ranking.

COST ANALYSIS RESULTS

<u>ALTERNATIVE</u>	<u>Five Year Total Estimate</u>	<u>RANK</u>
DO NOTHING	\$960,000 \$850,000	3
MANUAL PROCESS	\$952,500 \$885,000	2
DOE LANMAS	\$1,227,500 \$1,200,000	4
PC NETWORK / PARADOX	\$885,500 \$875,000	1
SUN NETWORK / ORACLE	\$1,440,000 \$1,412,500	5

Details for each of the cost estimates per alternative are included in Attachment A.

Assumptions and clarifying statements to support the estimates are as follows:

DO NOTHING

- a high probability exists that the programmer analyst supporting NMSS will retire requiring up to a six month 6-month training period for the replacement programmer at an estimated cost of \$55,000

PARADOX

- one to two years will be required to develop the system and run in parallel with NMSS for up to six months at least 6 months
- PARADOX will support up to six concurrent users with a reasonable response time

SUN

- a three year period will be required to obtain funding and to acquire and install hardware and develop software and run in parallel with NMSS for up to six months

ALL ALTERNATIVES

- all cost estimates are based on current dollars and have not been corrected for inflation influences
- the assumption is made that the PFP facility will continue to store and control NM for at least the next five years
- no funding will be available until at least March 1995
- program development costs assume two analysts performing development activities in addition to the analyst maintaining the current NMSS
- two computer networks (e.g., PRIMENET and PC network/SUN network, etc.) will be concurrently maintained during system development and parallel testing

5.2.2 Comparison by Intangibles

For intangible analysis, points are assigned and tallied for overall comparison as follows:

- | | |
|----------------------------------------------------------|----------|
| • alternative meets requirements | 2 points |
| • alternative exceeds requirements | +1 " |
| • alternative greatly exceeds requirements | 0 " |
| • alternative doesn't or won't meet minimum requirements | -1 " |
| • alternative is expected to be seriously deficient | -2 " |

Each of the alternatives is scored according to the following criteria:

- suitable support staff availability
- efficient use of staff
- continuing hardware maintenance
- continuing software maintenance
- security concerns
- data accuracy
- procedural impact
- probability of meeting DOE requirements
- training requirements

Note that more points (+2) are assigned for meeting requirements than for exceeding them. It is viewed as costly to exceed requirements and therefore wise use of funding is to satisfy what is needed not to exceed requirements. Comparison details to support results of intangible comparisons are show in Attachment B and show that staff concurrence favors ranking as shown. The following table contains a summary of the intangible analysis results.

INTANGIBLE ANALYSIS RESULTS

ALTERNATIVE	POINT SCORE	RANK
DO NOTHING	+0	4
IMPLEMENT USING A MANUAL PROCESS	-4	5
MODIFY DOE LANMAS	+11	2
ACQUIRE PC NETWORK AND RUN USING PARADOX	+17	1
ACQUIRE SUN NETWORK AND RUN USING ORACLE	+9	3

5.2.3 Comparison by Advantages and Disadvantages

This is another way of looking at intangible comparisons using a pre-selected set of advantages (+s) and disadvantages (-s'). Each alternative is looked at to see which of the +'s and -'s apply and then a tally is made. The alternatives are then ranked in order of the sum of the +'s and -'s. The accepted set of advantages and disadvantages are as follows:

Disadvantages:

- alternative does not readily support ~~ad-hoc queries~~ special requests for information such as (e.g. an emergency inventory at WHC's ~~our~~ or RL request)

The following table lists each alternative and the number of advantages and disadvantages associated with it. A detailed listing for the alternatives and their advantages and disadvantages are found in Attachment C.

ADVANTAGES and DISADVANTAGES RESULTS

<u>ALTERNATIVE</u>	<u>NUMBER OF +'s</u>	<u>NUMBER OF -'s</u>	<u>SUM</u>	<u>RANKING</u>
DO NOTHING	3	4	-1	4
IMPLEMENT USING A MANUAL PROCESS	2	5	-3	5
MODIFY DOE LANMAS	5	+1	3+4	23
ACQUIRE PC NETWORK AND RUN USING PARADOX	+6	+1	+5	+1
ACQUIRE SUN NETWORK AND RUN USING ORACLE	6	2	3+5	21

5.2.4 Comparison by Risk

Risk analysis is summarized in Figure 3.

~~Note that two of the alternatives, the replacement of NMSS by manual methods and the "DO NOTHING" approaches are not considered. "DO NOTHING" is not considered because it scored 17 points (above acceptable risk level) and is considered extremely high risk for a continued mode of operation. The manual process is not included in the comparisons since it will not meet all DOE order requirements and because it will not fare well from an "image" or political standpoint (see Section 5.2.5).~~

5.2.6 Ranking Summary

The following table shows all the alternatives, all the comparison criteria, and all of the rankings to summarize the analysis in one figure.

ALTERNATIVE RANKING SUMMARY TABLE

<u>ALTERNATIVES</u>	<u>COST</u>	<u>INTANGIBLES</u>	<u>+ 's / - 's</u>	<u>RISK</u>	<u>POLITICAL</u>
DO NOTHING	3	4	4	High	4
MANUAL PROCESS	2	5	5	N/A*	5
DOE LANMAS	5	2	3	3	3
PC NETWORK / PARADOX	1	1	1	1	2
SUN NETWORK / ORACLE	4	3	1	2	1

* note: the manual alternative is viewed as not meeting all DOE requirements and therefore not considered

6.0 Recommendation

The SUN Network / ORACLE system and the PARADOX PC Network systems are the recommended problem solution paths. If funding cannot be obtained so that work may start on one of these options by early FY95, a contingency an emergency backup scaled down system is proposed. This backup system is described in the next section of this document.

7.0 Contingency Solution

A Paradox prototype has been developed as a response to the high level of risk to immediate or eventual system failure and the possibility of retraining new maintenance analysts. A NMSS PARADOX prototype contingency demonstration was developed following the NMSS user manual. This prototype shows that such a system can be developed in a relatively short time frame and placed in reserve in case of NMSS failure. There would be an initial cost of about \$60,000 to develop this contingent system, although it may not be compliant with all company requirements. It is assumed that exceptions would be required to operate the contingency emergency backup system until a suitable replacement system can be developed and placed in operation.

7.2 Requirements

Current high level requirements for the contingency solution is as follows:

- ~~(3) Database structure must meet DOE requirements~~
- ~~(3) Database structure must be functionally equivalent to NMSS (MBA's, etc.)~~

7.4 Advantages of a Contingency Product

- + software procedures and modules developed for the contingency emergency backup system can be used for the PC NETWORK / PARADOX full featured system at a later date if documented adequately or using reverse engineering tools

Cost Estimates for the Contingency System -- Remove Charts

Cost estimate details are provided here for each of the study alternatives, cost estimate based on equipment needs and labor required to implement the solution. A five year implementation cost schedule has been developed for each of the alternatives. Note that the cost of continuing to run, maintain, and support the current NMSS is shown for each alternative because for each alternative a new process and system has to be developed, established and tested prior to the phaseout and shutdown on the current NMSS. Costs have not been adjusted for inflation and are all shown in today's dollars.

Alternative Original Cost Estimates

1995	Do Nothing	Manual	LANMAS	PARADOX	SUN Workstation
Training	55000 0	125000 70000	95000 0	95000 0	55000 0
Total Estimate	225000 170000	295000 240000	225000 170000	375000 320000	440000 385000

1996	Do Nothing	Manual	LANMAS	PARADOX	SUN Workstation
Programmer Support	110000	27500 55000	110000	82500 410000	110000
Training	0	10000 0	0	20000	0
Total Estimate	170000	207500 225000	415000	315000 342500	420000

1997	Do Nothing	Manual	LANMAS	PARADOX	SUN Workstation
Programmer Support	110000	0	82500 410000	55000	82500 410000
Training	55000 0	10000 0	30000	0	50000
Total Estimate	225000 170000	150000 140000	347500 375000	65000	370000 379500

1998	Do Nothing	Manual	LANMAS	PARADOX	SUN Workstation
Training	0	10000 0	0	0	0
Total Estimate	170000	150000 140000	120000	65000	105000

1999	Do Nothing	Manual	LANMAS	PARADOX	SUN Workstation
Training	0	10000 0	0	0	0
Total Estimate	170000	150000 140000	120000	65000	105000

Year	Do Nothing	Manual	LANMAS	PARADOX	SUN Workstation
1995	225000 170000	295000 240000	225000 170000	375000 320000	440000 385000
1996	170000	207500 225000	415000	345000 322500	420000
1997	225000 170000	350000 140000	347500 375000	65000	370000 397500
1998	170000	350000 140000	120000	65000	105000
1999	170000	350000 140000	120000	65000	105000
Total Cost over Five Years	960000 850000	952500 885000	322750 120000	885000 857500	1440000 1412500
Average Annual Cost	192000 170000	190500 177000	245500 240000	177000 171500	288000 282500

Detailed analysis results based on advantages and disadvantages are as follows:

System Codes:

DN -- DO NOTHING
MP -- MANUAL PROCESS
LM -- DOE LANMAS
PD -- PC NETWORK / PARADOX
OR -- SUN NETWORK / ORACLE

Advantages	Assigned Points				
	DN	MP	LM	PD	OR
Meet NMSS functionality	#1	#0	#1	#1	#1
Meet DOE reporting requirements	#1	#0	#1	#1	#1
Improve operational performance	#0	#0	#1	#1	#1
Expected to be easy to learn	#1	#0	#0	#1	#0
Expected to be maintainable (hardware and software)	#0	#1	#0	#1	#1
Easy to obtain support staff	#0	#1	#1	#1	#0
Meet performance testing requirements	#0	#0	#0	#0	#1
Disadvantages					
Poses significant risk to performing accountability functions	#1	#1	#0	#0	#0
Offers increasing difficulty in obtaining support staff	#1	#0	#1	#0	#1
Does not readily support routine requests for information such as the NMSS and WHC Material Management needs	#0	#1	#0	#0	#0
Does not readily support ad-hoc queries for information such as (e.g. an emergency inventory at WHC's or RL request)	#1	#1	#0	#1	#1
Not expected to meet requirements if number of transactions increases significantly	#1	#1	#0	#0	#0
Does not provide adequate interfacing as required (see Section 2.2)	#0	#1	#0	#0	#0
Total Sum	#1	#3	#3	#5	#3

~~DO NOTHING~~

~~Total Point Score = (3 's and 4 's) = 1~~

~~Advantages:~~

- ~~—| alternative expected to meet NMSS functionality~~
- ~~—| alternative expected to meet DOE reporting requirements~~
- ~~—| alternative expected to be easy to learn~~

~~Disadvantages:~~

- ~~—— alternative poses significant risk to performing accountability functions~~
- ~~—— alternative offers increasing difficulty in obtaining support staff~~
- ~~—— alternative does not readily support special requests for information such as Material Management needs and special inventory inquiries i.e. an emergency inventory at our or RL request~~
- ~~—— alternative is not expected to meet requirements if the number of transactions increases significantly~~

~~MANUAL PROCESS~~

~~Total Point Score = (2 's and 5 's) = 3~~

~~Advantages:~~

- ~~—| alternative expected to be maintainable (hardware and software)~~
- ~~—| alternative expected to easy to obtain support staff~~

~~Disadvantages:~~

- ~~—— alternative poses significant risk to performing accountability functions~~
- ~~—— alternative does not readily support routine requests for information such as the NMMSS and WHC Material Management needs~~
- ~~—— alternative does not readily support special requests for information such as Material Management needs and special inventory inquiries i.e. an emergency inventory at our or RL request~~
- ~~—— alternative is not expected to meet requirements if the number of transactions increases significantly~~
- ~~—— alternative does not provide adequate interfacing as required (see Section 2.2 of this document)~~

~~DOE LANMAS~~

~~Total Point Score = (5 '+'s and 1 '-'s) = 4~~

~~Advantages:~~

- ~~+ alternative expected to meet NMSS functionality~~
- ~~+ alternative expected to meet DOE reporting requirements~~
- ~~+ alternative expected to improve operational performance~~

- ~~+ alternative expected to be maintainable (hardware and software)~~
- ~~+ alternative expected to be easy to obtain support staff~~

~~Disadvantages:~~

- ~~— alternative does readily support special requests for information such as Material Management needs and special inventory inquiries i.e. an emergency inventory at ou or RL request (Is this an advantage or disadvantage??)~~

~~PC NETWORK / PARADOX~~

~~Total Point Score = (6 '+'s and 1 '-'s) = 5~~

~~Advantages:~~

- ~~+ alternative expected to meet NMSS functionality~~
- ~~+ alternative expected to meet DOE reporting requirements~~
- ~~+ alternative expected to improve operational performance~~
- ~~+ alternative expected to be easy to learn~~
- ~~+ alternative expected to be maintainable (hardware and software)~~
- ~~+ alternative expected to be easy to obtain support staff~~

~~Disadvantages:~~

- ~~— alternative is not expected to meet requirements if the number of transactions increases significantly~~

~~SUN NETWORK / ORACLE~~

~~Total Point Score (6 + 's and 1) = 5~~

~~Advantages:~~

- ~~—|— alternative expected to meet NMSS functionality~~
- ~~—|— alternative expected to meet DOE reporting requirements~~
- ~~—|— alternative expected to improve operational performance~~
- ~~—|— alternative expected to be easy to learn~~
- ~~—|— alternative expected to be maintainable (hardware and software)~~
- ~~—|— alternative expected to easy to obtain support staff~~

~~Disadvantages:~~

- ~~—|— alternative does not readily support special requests for information such as Material Management needs and special inventory inquiries i.e. an emergency inventory at our or RL request~~