[redacted]

Office of Civilian Radioactive Waste Management

Office of Resource Management

Licensing Support System Preliminary Needs Analysis

February 1988

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

Preface

This is the first in a series of four reports on the Licensing Support System (LSS) prepared by the DOE Office of Civilian Radioactive Waste Management (OCRWM) for the Office of Management and Budget (OMB). The LSS is an information management system intended to support the needs of all the parties involved in repository licensing, including the Department of Energy (DOE) and the Nuclear Regulatory Commission (NRC). The reports in this series are:

Preliminary Needs Analysis

Preliminary Data Scope Analysis

Conceptual Design Analysis

Benefit-Cost Analysis

The Preliminary Needs Analysis, presented in this report, and the Preliminary Data Scope constitute the system requirements basis for developing a conceptual LSS design, which will be presented in the third report. The Benefit-Cost Analysis evaluates alternatives within this conceptual design. These four reports, and subsequent refinements, are intended to provide the basis for determining the LSS design specifications.

1.0 INTRODUCTION

1.1 Purpose and Scope

The LSS computer system design being developed by OCRWM to support the requirements of all parties in the repository licensing process (including NRC and DOE) will be based on a detailed set of system specifications. These specifications will be derived from statutory, programmatic and user requirements. This Preliminary Needs Analysis, together with the Preliminary Data Scope Analysis (next in this series of reports), is a first effort under the LSS Design and Implementation Contract toward developing a sound requirements foundation for subsequent design work. These reports are preliminary. Further refinements must be made before requirements can be specified in sufficient detail to provide a basis for suitably specific system specifications.

This preliminary analysis of the LSS requirements has been divided into a "needs" and a "data scope" portion only for project management and scheduling reasons. The Preliminary Data Scope Analysis will address all issues concerning the content and size of the LSS data base; providing the requirements basis for data acquisition, cataloging and storage sizing specifications. This report addresses all other requirements for the LSS.

According to the definition in the LSS System Development RFP (DOE, 1987), the LSS consists of both computer subsystems and non-computer archives. This study addresses only the computer subsystems, focusing on the Access Subsystems.

After providing background on previous LSS-related work, this report summarizes the findings from previous examinations of needs and describes a number of other requirements that have an impact on the LSS. The results of interviews conducted for this report are then described and analyzed. The final section of the report brings all of the key findings together and describes how these needs analyses will continue to be refined and utilized in on-going design activities.

1.2 Background

The Nuclear Waste Policy Act (NWPA) of 1982 authorizes the siting and construction of the nation's first permanent repository for spent fuel rods and high-level nuclear waste. Under the law, the US Department of Energy (DOE) is responsible for siting and construction, the Nuclear Regulatory Commission (NRC) for licensing, and the nuclear utilities for providing the funding. The NRC is allowed three years in which to consider the application for a license to authorize repository construction.

Shortly after the passage of the NWPA, the NRC became convinced that it would be impossible, under existing procedures for the conduct of high-level nuclear waste repository licensing proceedings, to complete the proceedings within the three years allowed by the Act. The principal

reason for this conclusion lay in two aspects of document discovery, the process by which parties and intervenors identify and exchange documents relevant to the issues pertaining to repository licensing. The first aspect was document volume: a typical large case before an Atomic Safety and Licensing Board (ASLB) of the NRC generates a record of 10,000 documents. The number of documents generated in connection with the repository design was expected to be 300 to 1000 times greater, depending upon whether discovery was directed to three sites or one. The second aspect was delay inherent in the discovery process itself. (Jordan, 1986) Under existing discovery rules, a document production request in a large case can require 12 to 18 months of manual effort. Large file rooms have to be established by each party and time has to be provided to manually sort and select records at the site of production. With multiple well-funded parties this means extensive travel, scheduling, review, and motion practice. (Olmstead, 1986) To meet a three-year licensing timeframe, this time-consuming activity must be substantially reduced.

Based on the above concerns, in 1984 the NRC's Division of Waste Management initiated efforts to further scope the problem. The regulatory staff met with DOE (including the three field offices) and the affected States and Indian Tribes. It was found that there was general agreement on the need for a common computerized system to handle the massive volume of documents and accommodate a three-year licensing review. The staff also visited agencies that currently use state-of-the-art computerized storage and retrieval systems, such as the Library of Congress and the Patent Office. However, it was found that none of the existing state-of-the-art systems would fully meet NRC's needs.

By 1985, the NRC became persuaded of a two-part solution to this apparent impasse:

- A computerized information storage and retrieval (IS&R) system that would serve as the sole basis of discovery, processing and making available all relevant documents in advance of the licensing hearings

- A rule, adopted by all parties, that would with a few exceptions limit discovery to what was contained in this IS&R system

In addition, removing as much document discovery as possible from the proceedings, through modifications to the NRC Rules of Practice was proposed (10 CFR 2).

This last proposal reflected concern about the second aspect of document discovery mentioned above: it did little good to create a means for rapid retrieval of information and documents in discovery if the means consumed a great deal of time during the license review period. Of the sources of delay, perhaps the most detrimental to the three-year licensing time frame is the motions practice, the filing of and response to legal motions. NRC estimated that 40 percent of a typical hearing before an ASLB was consumed in motions practice. The NRC therefore proposed that motions and responses should be filed to an ASLB computer by phone lines; in other words, by electronic mail.

With the electronic mail concept, the NRC made two additional proposals. First, it would save a great deal of time if all parties would agree to supply their documents electronically; more specifically, in a format that could be used by the IS&R system software. Documents created before a certain date could be processed into an interim IS&R data base by traditional means (i.e., by manual cataloging and abstracting) and after that date the documents could be provided in electronic format or be made machine-readable by rekeying. Under this proposal, reading the full text of documents into the data base by optical character recognition (OCR) methods could ultimately eliminate the time-consuming traditional process of document acquisition, backlogging, coding, and keying.

The second additional proposal was to store electronic images of the documents on an optical disk storage (ODS) system. When a user of the full-text IS&R system located documents germane to a query, he could transmit the documents from optical disk over telecommunications lines to his remote location. This would minimize the time spent in locating, copying and mailing the physical documents.

These additional proposals were adopted within NRC (Browning, 1985) and became the basis of two extremely relevant documents. The first of these was an agreement between NRC and DOE that the IS&R system, called the Licensing Support System (LSS), would be designed around full-text and image storage. (NRC/DOE, 1986). The second proposal appeared as notices in the Federal Register (Federal Register, 1986, 1987). These stated NRC's intent to convene a panel of interested parties to negotiate a rule on discovery for the repository licensing proceeding. In addition, these proposals became the basis of an internal NRC pilot project to test the feasibility of such concepts.

Even before the NWPA was passed, the Project Management Division of Battelle Memorial Institutes had begun generating a data base from documents created at the OCRWM Salt Repository Program Office. This data base, called the Automated Records System (ARS), was designed to meet the bibliographic retrieval needs of OCRWM scientists and engineers. It took the form of traditional surrogate records created through cataloging and abstracting. Similar data bases were later established by the Basalt Waste Investigation Program and OCRWM Headquarters and were standardized to the same software and the same data base structure.

Pursuant to the Federal Register notice mentioned above, the first meeting of the Negotiated Rulemaking Advisory Committee (NRAC), which mainly comprises attorneys representing the licensing parties and intervenors, was held in September 1987. The meeting was convened by NRC under the facilitation of the Conservation Foundation. To date, the substantive agenda for the Committee has been 20 articles in a Position Paper which has been adopted by all interested elements of NRC. While many of the articles relate to legal questions of discovery, several have served as the basis for Committee consensus on design of the LSS.

The NRAC has not yet addressed several questions on its agenda that are of vital importance to use of the LSS for discovery.

1) Should discovery, and hence the LSS, embrace documents from

sources other than the parties (i.e., other than DOE and NRC)?

2) How will it be possible to ensure that all parties' relevant documents are submitted to the LSS?

3) What are the standards of performance with which the LSS must comply?

When it issued a Request For Proposal (RFP) for the LSS in March 1987 (DOE, 1987), OCRWM was unable to specify in detail the characteristics of the system that would be required for discovery. The Committee had not yet been convened. However, it became clear that the repository licensing proceedings will be in the nature of litigation (Jordan, 1986); therefore, the LSS must possess certain characteristics not ordinarily required of an IS&R system. Administrative staff indicate that they are more interested in tracking compliance with regulations than in retrieving individual documents on specific topics.

From all this it is clear that the LSS must:

1) Serve as the sole basis for expedited document discovery,

2) Provide access to licensing information so that all parties' legal counsel and their experts can address the grounds for repository licensing decisions and determine the soundness of technical work,

3) Provide an automated library of reports and other bibliographic materials of use to OCRWM and NRC technical staff in conducting their work on licensing document development and review,

4) Serve as a mechanism for tracking OCRWM compliance with repository licensing regulations.

2.0 SOURCES OF INFORMATION ON LSS NEEDS

The needs analysis presented in this report has considered four principal sources of information:

- The results of early needs assessments for the LSS and for similar systems
- The current status of the negotiated rulemaking process
- The requirements applicable to LSS that result from other than user needs (such as institutional or legal requirements)
- The results of a survey of potential LSS users

This section presents the requirements on LSS identified in each of these four sources.

2.1 Previous Examinations of Needs

2.1.1 Requirements Definition for ARS

The Records and Information System (RIS) is a forerunner of the Automated Records System (ARS) at the OCRWM Salt Repository Project. The requirements definition for RIS began in 1979. At that time, three steps were taken to determine the needs the system was to serve:

1) Survey of Project staff
2) Survey of nuclear utilities, to profit from their lessons learned in similar projects
3) Interview visit to NRC to learn about their system's strengths and weaknesses

Survey of Project Staff

A survey of the staff of the OCRWM Salt Repository Project was conducted to determine what they thought they needed from a records management system. In summary, they asked for the following capabilities:

- A way to account for the documents, so that none were lost. This was the first requirement for a future system to support licensing.
- A way to locate documents and retrieve them quickly.
- A system to replace paper files (e.g., by microfilm).

- A system that would permit rapid retrieval by subject, originator, recipient, date created and other related parameters.

- A method to track commitments to DOE.

Survey of Nuclear Utilities

In 1979, visits were made to ten nuclear utilities to learn about their records management needs and about their existing systems. The specific questions asked were:

- Was a manual or a computerized record management system in use?

- If computerized, what hardware and software were in use?

- What problems were encountered and how did they solve them?

- What did they like and not like about their systems?

- Where was records management responsibility originally located in the organization and how was the records management function organized?

- Who were the users of their system?

The utility systems were designed as inventories of the records (i.e., they assigned a number to each document and then listed them in chronological order). Only one of the ten sites used a manual system. It was extremely labor intensive and had a large backlog of documents to process.

There were many variations in the hardware and software. In general, the records management function used the equipment available in the company, which was also used by other groups. One of the major complaints across the survey was the lack of a dedicated computer, which resulted in long delays.

Most utilities reported that records management was not a high priority with their companies. There were instances in which lack of attention resulted in costly retrofits or reprocessing of records. The lack of subject search capability was also a frequent complaint.

Records management was usually located in the administrative function of the organization and was sometimes linked with the library. The mail room and control of incoming and outgoing correspondence was almost always part of records management. Rarely did the records manager report to a vice-president or higher official. Drawing control was usually a function of records management and was very active for those plants with ongoing construction projects. Users were most often the records management staff searching for known items.

The most frequently offered advice to the survey team was to get a dedicated computer and to build subject retrieval capability into the system.

Visit to NRC

The NRC correspondence and document processing functions operational in 1979 were microfiche-based and did not have subject search capability. The microfiche was retrieved by a cumbersome mechanical process. The contractor who operated the system recommended that Battelle develop a BASIS application for the operation, so that they could add a structured index retrieval capability.

Requirements for RIS

Based on information collected in the two surveys, it was decided that the RIS would be the basic records management system for the Salt Repository Project, but would also include technical literature on high-level nuclear waste disposal. It would be designed to permit searching capability of both project records and this technical literature.

The Battelle Computer Center designed the software application and CDC computers were used. The system design team worked with the records management staff so that the requirements would be understood and supported in the design. The manager of the design team is still responsible for system upgrades and modifications today. This continuity has been a valuable resource, and a critical one facilitating the ability to migrate the system from BASIS to DM. This system maintains a continuing focus on the future because of the very long-term nature of the nuclear waste program and the rapid advances in computer technology. It was understood from the beginning that a system could not be designed for a one-time use and then discarded when the software became obsolete or was superseded.

In 1986 it was determined that an integrated relational data base environment would better accommodate the needs of the RIS users. The data bases were moved from the BASIS applications to DM, which provided the relational capability. Following this transformation, the system was renamed the Automated Records System (ARS).

The documents in the RIS/ARS are cataloged for and are retrievable via structured indices by:

Date of creation	Title
Accession number	Abstract
Microfilm number	Descriptors (Keywords)
Originator/Author	Attachments
Receiver	Project ID

2.1.2 LIS Requirements Study

The Licensing Information System (LIS) was an early name for the

concept that is essentially the same as the LSS. In 1985 Roy F. Weston Inc. performed a study for OCRWM (Weston, 1985) of the LIS requirements. This report provides a rich source of information on expectations for the LSS as it is being defined in 1988.

LIS Objectives

The objectives of the LIS were that a) it must serve OCRWM's current needs, b) be configured for growth and flexibility, and c) use existing information management systems in place at OCRWM Headquarters and the Project offices to the greatest extent practical.

Requirements Survey

Weston interviewed various program participants and information system specialists including OCRWM Headquarters staff, particularly those within the Office of Geologic Repositories (OGR). Licensing engineers at OCRWM and Weston were interviewed, and briefings and workshops were held with the Project offices. Meetings also were held with two nuclear facilities.

Several commercial data systems were examined in addition to the existing systems at the Project offices, including:

- Corps of Engineers Environmental Legislative Data System
- LEXIS
- JURIS.

Requirements for LIS

The requirements of the repository licensing process on the LIS include:

- The system must be interactive and comprehensive with regard to licensing information (i.e., it must be a useful tool for all participants in the licensing process).

- The system must provide rapid access to the information regardless of the user's geographic location and the geographic location of the computer system containing the information.

- The LIS record must be durable and extend for 60 to 90 years, until repository closure.

The Weston report identified nine specific requirements LIS should support:

1) Provide a comprehensive reference source of all regulations and other regulatory guidance documents applicable to the repository licensing process.

2) Establish and maintain a living licensing schedule network.

3) Identify and track all issues related to regulatory compliance, the work plans and actions directed at their resolution, and their outcome.

4) Record and track all commitments and resulting actions.

5) Document the preparation and modification of key documents needed for regulatory compliance.

6) Provide a comprehensive reference source (archive) of all information produced or captured by OCRWM which may have a bearing on regulatory compliance.

7) Maintain the confidentiality of any information which must have such protection.

8) Provide long-term storage and access to all program information which may have a bearing on regulatory compliance.

9) Provide rapid search and (if possible and practicable) full-text storage, searching and retrieval for regulatory compliance information.

System Scope

The conceptualization of this first large-scale, program-wide information system involved both a strategy toward meeting the extraordinary information needs and records management requirements of the program and a tool to be used by OCRWM during the licensing process.

As a strategy, the LIS requirements represent acknowledgment of the need for:

- A comprehensive structure to licensing data capture and management,
- An aggressive effort to identify, document and integrate the activities of OCRWM regulatory, siting, and design programs,
- An integration of the repository program's information policy.

During the interviews, no clear definition of licensing data versus program data emerged. DOE Headquarters Office of Geologic Repositories staff interviewed often suggested that any program information could be called into question under certain scenarios of the licensing process. DOE Headquarters Office of General Council staff held the view that to ignore a given segment of information as non-licensing would be counterproductive and that all information on the program will be subject to discovery during the ASLB hearings during licensing.

Full-Text Storage and Searching

The Weston report addressed full-text capture, storage and searching requirements for the LIS and cautioned that, although the technology is available, it is new and expensive. They state that "extreme care and thought needs to be exercised in deciding which regulatory compliance information should be maintained on-line in full text and in loading these documents into the system." (Weston, 1985)

Constraints

In this study the following constraints were determined to apply to the LIS:

- Existing systems and equipment should be built upon and utilized to the extent practicable;
- Users and project personnel are geographically scattered, making telecommunications networking difficult;
- The system must serve the program needs for 60 to 90 years;
- A lack of common hardware and software exists across the Project offices and DOE Headquarters; and
- There is no definition of licensing information to be included in the system (i.e., is all program information subject to discovery?).

2.1.3 Discovery Requirements Study

In 1986, John S. Jordan & Associates addressed the problem of a three year license application in a report (Jordan, 1986) to the NRC. Specifically, the report considered whether a licensing information management system might be a means of expediting discovery and providing full access to the documentation well in advance of the licensing proceeding. An examination of the legal requirements, and the problems posed by the requirements, was provided along with proposed solutions. The report described the components, characteristics, and configurations of an IS&R system that will satisfy the requirements of and implement the solutions to the legal problems.

The report primarily addresses issues related to the material to be included in an IS&R system for repository licensing support, which will be extensively discussed in the forthcoming Preliminary Data Scope Analysis report. However it also addresses five requirements issues within the scope of the present needs analysis.

1) Security. If documents that are proprietary, classified, subject to attorney-client privilege, or otherwise exempt from discovery are entered into the IS&R system, the system must have the ability to assure restricted access to specifically identified information.

2) Retrievability of information in the system must be extremely high, at or near the state of the art, for it to be acceptable for legal discovery.

3) Recall is the proportion of documents found in a search, relative to the total number of documents in the data base which meet a search criterion. This is a measure of the amount of relevant material missed in a search. The recall of the system must be as high as possible and the cost of maintaining a high degree of recall must be independent of data base size for the system to practically meet the needs of discovery.

4) Precision is the proportion of truly relevant documents found in a search, relative to the total number of documents found. This is a measure of the amount of inappropriate material returned during a search. To be useful for discovery, the precision of the system must be extremely high.

5) Speed. The size of the data base dictates that for the system to be of practical use during discovery, the system must make use of state-of-the-art technology to maximize access and minimize delay time in identifying material sought.

2.1.4 NNWSI Bridge Program

The OCRWM Nevada Nuclear Waste Storage Investigation (NNWSI) Project has developed an information management system (IMS) to support the project in areas of project management, licensing, long-term record storage, and dissemination of public information. It is envisioned that the IMS will either supply information to the LSS or more directly be the repository of project-specific information for the LSS. The general functional requirements of the IMS were stated in the Systems Concepts Evaluation Report (SAIC, 1986) and are summarized as follows:

1) Assist DOE in management of the project by providing a uniform set of project information; establishing correlation among issues, comments, regulations, work activities, commitments, documents and other key parameters; alerting DOE to unresolved compliance issues; allowing expeditious response to requests; and providing a mechanism to identify potentially contentious issues.

2) Help expedite NRC review of licensing submittals by reducing reliance on discovery through early public access to documentation; limiting the issues in contention by tracking and documenting issues; providing complete defensible submittals; and supporting timely preparation of hearing material.

3) Provide secure storage of records for extended periods and ability to retrieve documents by organizing and maintaining for retrieval all data for license amendments; providing method for controlling, storing, and retrieving records in accordance with 10 CFR 60 and 10 CFR 50 Appendix B.

4) Meet NWPA requirements for information, consultation, and cooperation by establishing a means of disseminating and sharing information; and recording and tracking objections and their resolutions.

The resulting general requirements for both a tracking function and a document storage and retrieval function are parallel to those of LSS. Some additional, more specific requirements were derived during the IMS conceptual design. The system should:

1) Be designed for the needs of the non-technical user,
2) Provide access to 40 simultaneous users of the tracking or structured index and 60 simultaneous users of the document collection,
3) Maximize compatibility with other related systems,
4) Be flexible in accommodating future enhancements,
5) Maintain the monitoring and tracking information consistent with the official project status and current within 30 days,
6) Provide various indexing and retrieval options including bibliographic, keyword, abstract, and full-text search of the document text,
7) Enter documents into the system within 30 days of receipt,
8) Provide a demonstrated potential for high percentage of recall (80%) and precision with recall efficiency taking precedence,
9) Provide, if possible, for ranking of documents in response to a query according to the importance to the query.

In 1987, SAIC initiated the Information Management System Bridge Program (IMSBP). The purpose of the IMSBP was to test and evaluate the technical feasibility of implementing a records management system based on full-text storage, searching and retrieval technologies (SAIC, 1988).

The Bridge Program involved time measurements for data capture, accuracy of optical character recognition processes, storage requirements for electronic images, and retrieval tests on indexed data, document text, and document images. The resulting information will prove to be valuable in the LSS conceptual design and will be referenced in later reports in this series.

2.1.5 NRC Pilot Project

In 1985 the Aerospace Corporation, under contract to the NRC Division of Waste Management, conducted a requirements analysis for a Licensing Information Management System (LIMS) which could facilitate daily operations and address the 3 year high-level waste license review process. The program led to a demonstration Pilot Project which was designed to test and evaluate the application of computer technology. The requirements analysis (Aerospace, 1986) was based upon interviews conducted with personnel in the Office of Nuclear Materials Safety and Safeguards, as well as other organizations in NRC, a review of the NRC Document Control System, and a review of the provisions in the rules for licensing proceedings (10

CFR 2). The resultant requirements were general in nature, concentrating on system functionality:

1) Comprehensive Content: Store in retrievable manner the full text of any record likely to be requested that pertains to high-level waste in compliance with 10 CFR 2. Provide capability to capture, store, and retrieve records relevant to licensing of nuclear waste during transport and for all proposed sites including permanent and monitored retrievable storage.

2) Multi-Media Accommodation: Store, index, and provide access to records on hard copy, microfiche, charts, magnetic tape, disk, and other accessible media.

3) Broad Indexing Capability: Be able to search and select by keywords, or descriptor phrases, that define the subject, author, and title and by significant words in context in abstracts and text. Be able also to search on date, issuing agency, identifying number, and other necessary identifiers. To ensure information recall and precision, the search routine must operate on both standard abstract terms (e.g., title, author, keywords) and the full text.

4) Prompt Response: Verify the existence of a record, determine the location of a record, and display, on line, the full text of records resident in the data base in real time at authorized user terminals. Produce hard copy of any record by use of high-speed laser printing. Distribute quality copies of records to users in accordance with the requirements 10 CFR 2 and 9.

5) Operational Availability: Make the LIMS available as soon as possible for the prelicensing phase and have it remain operational during licensing and after licensing.

6) Security: Protect against the loss and destruction of records and protect privileged material by controlled access.

7) Related Systems Disclosure: Disseminate general descriptions of information management systems maintained within the DOE community related to high-level waste. Provide instructions for user access to systems and provide a thesaurus of keywords and descriptors to facilitate user queries.

8) Simplicity of Use: Provide access (read and print only) for non-technical users with no prior on-line data base interaction experience.

9) Long-Term Viability: Incorporate capability to improve service throughout the licensing period.

10) Accessibility: Provide remote terminals so data bases are accessible to personnel of the States, Indian tribal organizations, and the general public.

11) Compatibility: Provide network interfacing compatibility to access other information management systems and data bases. A menu-driven interactive LIMS is required to lead the user to the on-line data bases and provide a common and unified access to the full information system.

12) Reliability: Maintain system with minimum downtime. Protect data files during system crashes and provide recovery in less than 24 hours.

13) Affordability: Provide an information management system and networking system that are cost effective.

14) Standardization: Use data transmission, library, and information science standards for data storage and records transfer for data bases as set by the American National Standards Institute.

15) Completeness: All participating parties involved with the LIMS must acknowledge (certify) that they have adopted and followed procedures ensuring that all relevant records are submitted to the LIMS.

The Pilot Project (officially termed the Transitional Licensing Support System) was implemented by NRC to begin the capture of HLW licensing-related documents and to test the feasibility of various technical concepts for information storage, primarily image capture, optical disk storage, and full text search and retrieval.

2.1.6 LSS Functional Requirements Study

Arthur Young International completed a study and issued a report on the functional requirements and design concepts for the LSS (Young, 1987) for the OCRWM Office of Geologic Repositories. The requirements identified, which are in the scope of this preliminary needs analysis (i.e., which relate to requirements other than those concerning data scope), are summarized below.

Information Access Features

1) Structured index searching. The LSS should support queries for specific types of information about documents which have been compiled through cataloging. Searches for the following types of information should be supported:

Author/originator	Originating organization
Title	Recipient
Date created	Receiving organization
Accession number	QA level
WBS number	Access restriction
Abstract	Keywords and phrases
Site applicability	Report number
Type of document	Revision number

2) Full-text searching. The LSS should support full-text searching of LSS records. Full-text searching involves finding the location of words and phrases (and their logical combination) within records.

System Performance Features

1) Search and Retrieval Features
   - The system should provide menu-driven user access.
   - The search criteria during a query should be able to be retained.
   - User help should be available on-line.
   - Bit-mapped images of documents should be available as well as ASCII text.
   - Summary descriptions of retrieval information and counts of retrieved items should be available.
2) Document Control Features
   - The system procedures should verify the integrity of information at the time it is captured into the system.
   - The system procedures should verify that information has been authorized for entry at the time of capture.
   - The system should avoid duplicate records.
   - The information in the system should be verified for conformity with the original source document.
   - The association between extracted cataloging information (appearing in a header, for example) and the associated document text in the system should be verified.
3) Access Control Features
   - Access to the system should be controlled and restricted to authorized users, including members of the public.
   - Accidental or malicious destruction and alteration of information in the system should be prevented.
   - The system should be able to detect and prevent "unreasonable" queries which would overburden the system.
4) Acceptable Input Media
   - The system should be able to capture information from computers and word processors in the electronic form of disks and magnetic tape.
   - The system should also be able to capture hard copy text and figures.
5) Output Features
   - The system should support screen output in ASCII as well as bit-map form, and should be able to highlight search information and other items of special interest.
   - The system should be able to display both cataloged and full-text information.
   - The system should be able to support the transmission of ASCII data for downloading.
6) Miscellaneous Capabilities
   - The system should be able to support multi-user access from around the country.
   - The system should provide suitable backup and recovery capabilities.
   - The system should be operational by 1991.

2.1.7 Conclusions From Previous Examinations

An assessment of the general need for an LSS combined with the specific needs of potential users outlined in the foregoing reports leads to a number of general characteristics of a system which should be considered in the design. These characteristics include:

- A method for capturing, validating, and managing all documents pertinent to the licensing process,
- A method of ensuring the security of the system as a whole, as well as any confidential or proprietary documents, against unauthorized access and alteration,
- A retrieval mechanism that is quick, has multiple access points, and provides good recall and precision,
- A method for ensuring that all documents or document surrogates are fully searchable,
- A storage system that can provide paper, microform, or electronic media copies of any document in the system,
- A method for rapid access to the information stored, support of simultaneous usage, and ease of use for both the novice and experienced user,
- A provision for the conversion to future technologies, while maintaining compatibility with systems currently in use.

These characteristics support the needs expressed by NRC for meeting the three-year licensing timetable. It is evident that while these conclusions provide a firm conceptual basis, they do not present any quantifiable detail on which to base system design specifications. Further, these examinations were undertaken before the NRAC began its proceedings and, therefore, could not consider the imminent Rule. Neither have other non-end user requirements on the LSS been considered in great depth to date. The following two sections address these requirements.

2.2 Negotiated Rulemaking Advisory Committee Requirements

The Federal Register notices (Federal Register 1986, 1987) establishing the intent to form a HLW Licensing Support System Advisory Committee (generally referred to as the Negotiated Rulemaking Advisory Committee or NRAC) for negotiated rulemaking contained some information pertaining to the requirements for an LSS which form a basis for their discussions. These requirements as envisioned by the NRC can be summarized as follows:

- Capture in electronic form all of the data that would normally be generated to support the licensing decision.

- Contain a "no-access" file for privileged data with appropriate safeguards.

- Provide open access to all parties, with the exception of data in the privileged file, available at minimal cost to the user.

- Facilitate review of the information through the provision, to the extent practicable, of full text search capability.

- Provide for electronic transmission for submission of motions and other documents associated with the licensing proceeding.

As noted in the Introduction, representatives of all parties began meeting in September, 1987 to negotiate a rule that would determine the requirements of the LSS and thereby expedite the necessary revisions to 10 CFR 2 relating to Rules of Practice for Adjudicatory Proceedings.

The NRAC met monthly through December, 1987, when Congress passed the Nuclear Waste Policy Amendments Act and substantially altered the scope of the nuclear waste management program. As a result, the membership of the Committee decreased substantially and the January and February, 1988 meetings were canceled, pending a reorganization of the Committee's agenda.

The Committee currently consists of representatives from the following organizations:

- State of Nevada
- Department of Energy
- Nuclear Regulatory Commission
- Edison Electric Institute and Utility Nuclear Waste Management Group
- Coalition of non-profit environmental groups (Sierra Club, Environmental Defense Fund, Friends of the Earth)
- Local governments from the vicinity of the Yucca Mountain site.

Other organizations may petition for membership at any time. The meetings are open to the public and public comment is invited.

2.2.1 Negotiated Rulemaking Process

The process which has been used by the Committee is based on achieving a consensus, which NRC is then bound to use in development of the final rule. The steps in the development of consensus include:

1) Establishment of the procedures for the process

2) Education of the members in the licensing process and information management

3) Identification of the issues

4) Negotiation of the issues

5) Draft of the rule

6) Consensus on the rule.

The September meeting was primarily procedural (Step 1), and the October meeting focused on Steps 2) and 3). The meetings in November and December consisted of negotiation of some issues with the appearance of tentative consensus being reached. NRC has elected to expedite the negotiation process by submitting their position on several issues to the Committee, which has become the reference point for discussion. The issues which have emerged can be summarized as follows:

1) What documents must be in the LSS? (i.e. discoverable)

2) What subset of these documents must be in full-text and when must this be completed?

3) How will privileged material be handled?

4) How will drafts, handwritten material, and marginalia be handled?

5) What are the mechanics and responsibilities for record entry?

6) What are the procedures governing access to LSS - who, how, and at what cost?

7) What procedures are required for dispute resolution prior to the license application submission?

8) Who will have administration and oversight over LSS?

To date, Items 1, 2, and 3 have been discussed in detail with a tentative consensus emerging on these issues. The remaining items have been addressed only briefly by the group as a whole.

The remaining schedule for the process is as follows:

March - negotiation and "tentative" consensus of all issues

April - draft language of the rule

May - agreement on language of rule

June - final consensus on rule

2.2.2 Identification of Needs

Based on OCRWM's and contractors' observation of the negotiated rulemaking process and the discussions to date, it is our opinion that certain requirements and needs are emerging from this process. As noted in the schedule above, the March meeting will provide significant further insight into the consensus position. While the final position of the

Committee could be different than the current status would indicate (which is the reason for the term "tentative" consensus on the issues), we believe the following needs can be identified pending final consensus:

- Different records within the LSS may require different treatment in cataloging and indexing. The LSS should include the capability for headers including subject terms or keywords and abstracts, and full-text search although not all records will use all of these indexing methods.

- Probably most, but not all documents will have the text entered into LSS and indexed for search.

- The filing of motions and other documents associated with the hearing will be facilitated by an electronic mail capability.

2.3 Other Non-User Requirements

2.3.1 Standards and Quality Assurance

Generally speaking, all records that are part of LSS must be legible, identifiable, and retrievable. They must be stored in a manner providing protection against damage, deterioration, or loss, and requirements must be set for access, retention, maintenance, and disposition. Certain of these requirements have been mandated by OCRWM, National Archives Records Administration (NARA), General Services Administration (GSA), National Fire Protection Association (NFPA), and the American National Standards Institute (ANSI) in conjunction with the American Society of Mechanical Engineers (ASME). They appear in such documents as the Code of Federal Regulations, NARA and GSA Bulletins, OCRWM documents, and NFPA and ANSI/ASME Standards, some of which are summarized below. These requirements place additional non-user requirements on the LSS.

Since the LSS is to be the repository for OCRWM records, it must be operated in accordance with the quality assurance (QA) plans that would normally be followed by that Office. Therefore, any activity affecting the quality of the records and their computer surrogates must be controlled through the use of written procedures (Quality Assurance Plan). In addition, records must be kept to provide evidence of these quality-related activities. Quality assurance procedures, responsibilities, and criteria are detailed in OGR's Quality Assurance Plan for High-Level Radioactive Waste Repositories; ANSI/ASME NQA-1 (1983), Quality Assurance Program Requirements for Nuclear Facilities; and 10 CFR 50, Appendix B, Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants. Some responsibilities include performing periodic QA audits; controlling the removal of records from the system; controlling access to the records; protecting records against damage, deterioration, or loss; and developing indexing for prompt retrieval of documents. Procedures to be developed include those for record validation, record storage access and protection, filing and indexing of records, and removal of documents from storage. Minimum criteria for these procedures and responsibilities are specified in these documents. (DOE, 1986)

A Records Management Plan must also be prepared which will identify the types of records to be entered into the system, methods which will control in-process records, and methods and schedule for purging non-permanent records. All QA records to be entered into LSS must be identified by a unique number or other similar designation. In addition, QA final reports are to contain a listing, by unique record number, of all documents used to compile or evaluate the report. This listing is to include all referenced documents, as well as review documents, computer codes, data sheets, etc. All of these referenced documents shall be retrievable from the system, with the exception of readily available publications such as encyclopedias, dictionaries, handbooks, etc. (DOE, 1986)

Records for storage in the system may be provided by any system user. However, only designated agents are authorized to enter data directly into the system. In addition, measures are to be established to assure that only these authorized personnel have access to the computer and archives. The system must include features to prevent unauthorized access and willful or accidental damage to the data base contents or archival materials. (DOE, 1986)

A determination must be made at the time a document is received as to which form of the document (paper, microform, or electronic) will be the "record" of that document. All records, whether paper, microform, or electronic, can be destroyed only according to an approved retention schedule (NARA, 1987). Since most of the records in this system are post-closure (retention of 300 to 1000 years) or lifetime records (retention for the operating life of the repository), it is necessary to determine which form of the document is to be the "record" to ensure against inadvertent loss (DOE, 1986). All records are to be controlled from the time they are received until they are stored in a permanent storage facility or, in the case of non-permanent records, disposed of in the designated manner.

All record storage media, whether electronic, microform, or magnetic, must be properly labeled. The minimum amount of information on each label for electronic and magnetic media includes title, dates, software and file code, and identification of the equipment on which the records were created (36 CFR 1234). Microform is to be labeled in a similar manner (36 CFR 1230). All records are to be indexed to assist in locating the records; indexes should be determined by those characteristics which would assist in distinguishing one record from another. Records should be easily retrieved by authorized personnel throughout the retention period.

Records that are documentation of experiments or research shall be contained in bound logbooks or other suitable means. Entries in these documents shall consist of those items described in Supplement No. 5 to the OCRWM Quality Assurance Plan for High-Level Waste Requirements, items such as description of the experiment's objective, qualifications of the participating individuals, identification of equipment and materials used.

Both NARA and GSA have set guidelines and requirements for the storage and handling of magnetic media; these are detailed in 36 CFR 1234. In

general, magnetic media are to be tested before use and annually sampled for loss of data. Error rates are not to exceed ten before the data is transferred to a new tape and data restored if possible. Specific documentation is to be supplied with each diskpack or reel of tape. Records on disks or diskettes are to be transferred to magnetic tape for permanent storage. Duplicate copies of media are to be stored off-site. Data are to be stored on National Bureau of Standards (NBS) mandated media.

Similar standards for microform records have been detailed in 36 CFR 1230. Before replacing original records by microform, steps must be taken to ensure that the microform is an adequate substitute for the original. The microform must be of archival quality. Inspection of microforms are to be scheduled every two years using a randomly-selected sample. Microform that is found to be deteriorating shall be replaced. Specific instructions for disposing of microform are given in 36 CFR 1230.26.

Standards for physical storage facilities for either temporary or permanent storage of archival materials are included in 36 CFR 1228 Subpart J. These requirements are set to guard against fire, theft, and deterioration. Since these requirements do not directly affect the records themselves, they will not be discussed in this report.

2.3.2 Schedule

Two driving forces determine the time frame in which the LSS should be operational. The first is the contractual requirement between DOE and development contractor (SAIC) to provide for a system operational by August of 1990. (The schedule has been modified from the original RFP (DOE, 1987) to accommodate the current requirements analysis). The definition of operation consistent with the August 1990 date is to demonstrate "successful loading and system operation of up to 4,000,000 pages of real data." The date upon which the LSS will be fully operational (i.e. contain all backlog data and maintain loading of current data) will be a function of the backlog volume and the rate at which it can be absorbed.

The second driving force is the programmatic requirements to use the LSS prior to the license application submittal to NRC. The primary users of the LSS at this stage would be DOE personnel preparing the licensing documents and potential parties to the hearing who would participate in the discovery process. Given that the contractual data of August 1990 is over 4 years prior to the anticipated application submittal (see Section 4.2.2), it would appear that these dates are consistent and the LSS development schedule is in accordance with program requirements.

2.4 Direct Needs Evaluation from Potential Users

Several of the studies summarized in Section 2.1 relied on interviews to collect data on LSS requirements. These interviews, however, were generally intended to compile licensing process and program understanding, and not to determine the individual needs of representative potential LSS users. The studies could not therefore address user needs in sufficient detail to provide the basis for LSS system specifications. The analysis

presented here has attempted to refine that understanding of needs by direct contact with potential users, a process which has also been enhanced over previous attempts by the fact that potential users have become more educated in the facets of on-line retrieval systems. The following two sections of this report discuss the results of these interviews (Section 3) and estimate their impact on geographic and temporal demand on LSS (Section 4).

3.0 SURVEY OF POTENTIAL USER NEEDS

3.1 Identification of Usage Groups

In order to make valid assumptions about the use of LSS, the users were divided into categories: engineers, lawyers, managers, intervenors, etc. Recognizing that a single user may use the LSS in more than one way (i.e., a lawyer might be seeking technical as well as legal material), the users were grouped into four usage pattern categories, reflecting similar traits:

- Technical and Engineering Usage
- Regulatory and Licensing Usage
- Management and Administrative Usage
- Public Information and General Public Usage

It also became apparent that, in addition to these end-users of LSS, there were two other usage groups:

- Intermediary Usage
- Data Base Management and Quality Assurance Usage

Although the intermediaries would be searching for the same information as the end-users, the way they used the system to search and retrieve the information and the amount of time spent on the system for each search is expected to be very different. Similarly, the way in which the Data Base Management Group uses the system would be different from all the other groups. A description of the usage category, examples of who would fall into the category, the type of information sought, the subsystems of interest (secondary interests are in parenthesis), and the query approach of these users was developed for each usage pattern. A questionnaire that could be used for all groups (except the Data Base Management Group) was then developed. Since the demands on the system of this latter group would be radically different from the other five, a different questionnaire was used. The description of each of the usage categories follows.

Name of Usage Category: TECHNICAL AND ENGINEERING USAGE

Generic Description: Usage in this category is expected to be primarily by scientists and engineers requiring information during the preparation or review of technical reports used in support of the licensing process. This group will be mainly the technical staff of federal agencies, national laboratories, state and local agencies and environmental and public interest groups. Their questions will deal mostly with primary data, published analyses of technical issues, computer program documentation, QA procedures and testing procedures.

Query Approach: The thinking of this group is analytical, experimental, and scientific. They are generally concerned about everything written on a specific narrow topic or are looking for a specific piece of data to support a hypothesis, experiment, or test. Their interest is also on who authored the information or on what other information was published by the same author.

Examples: Members of NRC's Federally Funded Research and Development Center (FFRDC) technical staff developing independent verification of site performance claims appearing in the repository construction authorization request.

DOE national laboratory technical staff under contract to develop site characterization information needed to show compliance of the site with 10 CFR 60.

Technical and scientific consultants hired by public interest organizations to independently verify DOE site and repository performance claims.

Information Sought: Some of the documents sought in this usage category are DOE, NRC and national laboratory technical reports, articles in scientific and engineering journals, progress and summary reports of contract for government agencies.

LSS Subsystems: Records Access Subsystem, (Regulations Access Subsystem, Issues and Commitments Tracking Subsystem).

Name of Usage Category: REGULATORY AND LICENSING SUPPORT

Generic Description: Usage in this category is expected to be primarily by regulatory and licensing specialists (including legal staff) requiring access to both technical and regulatory information. Before submittal of the license application, this group will perform three major regulatory functions. First, regulatory support staff will perform an ongoing oversight role to ensure that technical work will result in a complete and defensible license application. Second, the regulatory support staff will direct and participate in topical report development, seeking early resolution of issues. Third, programmatic decisions must be reviewed by legislative/policy analysts to determine if actions contemplated are within the letter and intent of federal, state, and local laws and regulations.

After submittal of the license application, the licensing support staff will be responsible for developing positions on licensing issues, identifying witnesses, preparing testimony, responding to motions, etc. One important aspect of the hearing is the conduct of discovery, a process which allows all parties equal access to relevant information.

Query Approach: These users are procedure- and strategy-oriented, with a broad qualitative bent. Their concerns are with defensability of positions, completeness of documentation, and direction of overall policies and strategies.

Examples: Members of the DOE regulatory staff developing topical reports on regulated technical issues such as those presented in 10 CFR 60.

Intervenors requesting all information regarding the basis for design decisions.

NRC licensing staff assessing the completeness of license application documents.

Information Sought: Some of the documents sought in this usage category are technical reports, correspondence containing review comments, technical meeting minutes, regulations, regulatory guidance, planning documents, and commitments.

LSS Subsystems: Regulations Access Subsystem, Records Access Subsystem (Issues and Commitment Tracking Subsystems).

Name of Category: MANAGEMENT AND ADMINISTRATIVE USAGE GROUP

Generic Description: Usage in this category is expected to be primarily by managers and administrators who are concerned with projects and contracts they are conducting or monitoring. This group will be mainly task, project and program managers and administrators as well as line managers, at government agencies, national laboratories and private contractors. Their questions will deal mostly with project information such as commitments, obligations, deliverables, schedules and progress reports. (Note that no financial information is to be stored in the LSS.)

Query Approach: This group is concerned with meeting schedules and commitments, managing projects and meeting deadlines for milestones, and monitoring contracts. They will generally be looking for specific information and specific documents.

Examples: NRC contract administrator responsible for administration of technical contract with private sector firm for supporting independent development of performance assessment capabilities at NRC.

Administrative assistant to OCRWM branch chief responsible for developing a portion of repository construction authorization request to NRC.

Staff member of private contracting firm (working for NRC or DOE) responding to request for information from firm's management, concerning contract milestone schedules.

Information Sought: Some of the documents sought in this usage category are planning documents, cost and schedule performance charts, statements of work (SOWs), QA audit reports, correspondence, action and commitment tracking documents, and memoranda of understanding.

LSS Subsystems: Issues and Commitments Tracking Subsystem, Records Access Subsystem, (Regulations Access Subsystem)

Name of Usage Category: PUBLIC INFORMATION AND GENERAL PUBLIC USAGE

Generic Description: Usage in this category is expected to be primarily in support of information needs of the general public, either in response to direct inquiry or through dissemination by public information specialists. This group will be mainly public information officers, public document room staff, members of educational and other public institutions, reporters, community members, civic activists and members of concerned citizens groups. Their questions will deal mostly with general and descriptive information about nuclear waste management and OCRWM activities, and summary information on technical and environmental issues.

Query Approach: These users are thinking in broad, general terms, their information requirements usually focused on descriptive and issue-related material for personal or local applications or to disseminate to a wide range of constituents.

Examples: OCRWM Public Information Staff, responsible for the preparation of information brochures, briefings, etc.

Public information and (non-technical) research staff of the Sierra Club, researching background of points developed in the repository construction permit request.

Members of affected communities and Indian tribes, researching questions of specific local or general background interest.

Information Sought: Some of the documents sought in this usage category are records of public hearings, issue papers, fact sheets, documents open for public comment, and press releases.

LSS Subsystems: Records Access Subsystem, (Regulations Access Subsystem)

Name of Usage Category: INTERMEDIARY USAGE

Generic Description: Usage in this category is expected to be primarily in support of information needs of all usage categories, generally in response to inquiries by those who do not have direct access to LSS or those who do not want to access the system themselves. This group will be mainly librarians and information specialists and may also include administrative assistants, researchers and paralegals who have a working knowledge of information retrieval or have become thoroughly experienced in searching the LSS.

Query Approach: These are service-oriented people who are patient, persistent, and curious enough to try many methods of obtaining information for others. They generally have a broad understanding of the organization of information to assist them in their task. Their concerns are more with the methods of extracting information from the system than with the content.

Examples: Information specialist in OCRWM Public Information Office

Reference librarians at DOE libraries in Germantown, Oak Ridge, Washington, D.C. and at DOE national laboratories.

Paralegal staff at an intervenor law firm.

Information Sought: The documents sought in this usage category will be all of the documents in the system needed by each of the four end-usage categories.

LSS Subsystems: Records Access Subsystem, Regulations Access Subsystem, Issues and Commitments Tracking Subsystem

Name of Usage Category: DATA BASE MANAGEMENT AND QUALITY ASSURANCE USAGE

Generic Description: Usage in this category is expected to be primarily one of controlling and facilitating the flow and quality of data and documents into and out of the LSS. This group will be mainly QA/QC staff, data base maintenance staff and data base-use trainers. Their questions will deal with support activities such as quality control audits, error corrections, data base maintenance and maintaining an up-to-date thesaurus.

Query Approach: This groups is concerned with the operation of the system--how to get information in and out, what checks and balances to perform, etc. They are generally systematic, detail-oriented, and persistent in tracking errors and problems.

Examples: A data base administrative staff member verifying that the system contains all of the referenced attachments to a correspondence previously entered in the system.

A data base administrative staff member verifying that a document meets all system acceptance criteria (e.g., legibility and completeness) before being entered into the LSS.

A data base administrator performing internal consistency and QA checks on the content of document header information for data base maintenance.

Information Sought: The documents sought in this usage category will be all of the documents in the system needed by each of the four end-usage categories.

LSS Subsystems: Records Access Subsystem, Regulations Access Subsystem, Issues and Commitments Tracking Subsystem.

3.2 LSS Needs Evaluated

As indicated in Section 1.1, the scope of this analysis is limited to requirements not related to the amount or type of information stored in the LSS. These requirements can be classified as pertaining 1) to system capabilities and performance requirements or 2) to information access features of the system. The following subsections list the specific topics within these two categories for which data were collected during the interviews. Questions were not asked directly on most of these topics, so the respondent would not be prompted to "need" whatever was possible. Rather, the questions were directed toward the requirements of the job performed by the respondent.

3.2.1 System Performance Requirements

Information was sought on the system performance topics listed below. The data on these system performance requirements are needed for communications and computing capacity sizing, communications topology, terminal distribution, output capacity and distribution, security design, QA procedures development, and selection of operational features.

I) User session characteristics
- 1) Average session characteristics
  - a) session length
  - b) sessions per day (or per week)
    - per user
    - per installation (site)
- 2) Peak session characteristics
  - a) session length
  - b) sessions per day
    - per user
    - per installation (site)
  - c) when is peak expected?
    - time of day
    - during licensing processes

II) User geographic distribution
- 1) Number of users
  - a) total number of users at site
    - initially
    - peak
  - b) number of simultaneous users
    - initially
    - peak
  - c) what organization does this represent
- 2) User location
  - a) city
  - b) site / building
  - c) are limited capabilities acceptable at remote locations?
  - d) maximum acceptable waiting time to wait to get on a terminal
    - routinely
    - priority / urgent

III) Response time characteristics
  1) Interactive session (maximum and routine acceptable delay until system begins to respond)
    a) during large indexed search
    b) during large full-text search
    c) while paging a document
    d) in a Tracking Subsystem
  2) Hardcopy (maximum and routine acceptable time to receive, for print jobs >100 pages and <100 pages)
    a) copies of documents (or parts of documents)
      - time to receive <= 100 pages
      - time to receive > 100 pages
    b) material other than documents (header data, etc.)
      - time to receive <= 100 pages
      - time to receive > 100 pages

IV) Output capability needs
  1) To terminal
    a) amount of document text per screen
    b) document images needed?
  2) Hardcopy
    a) need for print capability at terminal (or is site enough)
    b) quality needed (dot matrix or laser)
  3) Downloading
    a) peak file size
    b) average file size
    c) interactive or batch (overnight)
  4) Other forms of output
    a) diskettes
    b) magnetic tape
    c) microform
    d) other forms

V) Other features
  1) Need for electronic mail on system
  2) Need to be able to annotate text on system

3.2.2 Information Access Features

Information was sought on the information access topics listed below. The data on these system performance requirements is needed for the selection of retrieval software features, data base architecture, header and cataloging procedure design, and training planning.

I) Which access technique would user need most?
  1) Full-text search
  2) Structured index searching
  3) Combination
    a) both always available, or
    b) availability limited by size of search
      - tradeoff point (size or number of "hits")
      - speed limitations, if any

II) Full-text searching features
  1) Need to full-text search
    a) maximum amount of text at one time
    b) nature of information to be searched
      - document text only
      - document text and all header information
      - document text and abstract only
  2) Full-text features needed
    a) Boolean logic
    b) proximity relations
    c) misspelling tolerance

III) Structured index searching features
  1) Data base entry points (header fields needed)
  2) Which need controlled vocabularies

IV) System/end-user interface
  1) Direct access
    a) simple prompted
    b) prompted and command language
    c) expert system assisted
  2) Access via trained operator

3.3 Description of the Interview Sessions

During the period from 25 January to 2 February 1988, SAIC staff conducted 44 interviews with potential LSS users and with people having significant insight into the behavior of future users. Most of the people interviewed are affiliated with the NRC, DOE, and NRAC; some surrogate users were also included. A complete list of these people and their affiliations is included in Appendix A.

The majority of interviews were conducted face-to-face; the others were conducted by telephone. The sessions averaged over an hour each. Interviewers used a sequenced check list of topics and questions but were given considerable discretion in allowing the people interviewed to have their full say and to change topics at will. The purpose of this interview style was to put respondents at ease and encourage them to be frank.

A variety of both facts and opinions were collected during the interviews and will provide a continuing source of assistance in planning for the LSS. The immediate concern is with the rich statement of needs acquired by the interview process. Some of the information is quantitative and lends itself to concise presentation. Other information is less easy to quantify. The latter information is presented here only when it reflects a position taken by several respondents and represents a trend of opinion expressing a specific need. Many respondents asked to be involved in other LSS data collection and planning activities. Contact with these people will be maintained and they will be involved to the greatest degree possible.

3.4 Results of Interviews

The interviews usually covered five main topics:

- Expected LSS User Session Characteristics: the average and peak number of sessions per day, typical session lengths, and the anticipated peak both in terms of time of day and events in the licensing process.

- Distribution of Users: the total number of users at a site and the number of simultaneous users at a particular site, both during initial use of the system and at peak times.

- Response Time Requirements: the time it would take the system to respond while conducting a search, as well as the time it would take to receive hardcopy of a desired document, either whole or in part.

- System Output Requirements: output to terminal screen, to printer, or to download to other systems; other forms of output including diskette, magnetic tape, microform, electronic mail, or other user-defined output.

- LSS Information Access Needs: available access (full-text, structured index, or both), searchable information (document text, abstract, headers), search mechanisms (Boolean logic, proximity relationships, misspelling tolerances), and data base entry points (author, document type, technical discipline); system/end-user interfaces (menus, expert system assists, intermediaries) were also included.

Table 1 shows some of the interview findings that can be conveniently quantified. This table combines and summarizes the detailed results obtained for the six usage groups used in sequencing the topics described in the following paragraphs. The detailed results and further refinements obtained from prototype tests and other sources (see Section 5.0), will constitute the requirements basis for the LSS system specifications.

TABLE 1: Summary of Some Quantitative LSS Performance Requirements as Seen by Potential Users

System Characteristics	Minimum Value	Maximum Value	Central Tendency of Response
User Session Characteristics			
Average Session Length	5 mins.	All Day	65 mins.
Peak Session Length	5 mins.	All Day	90 mins.
Avg. No. of Sessions	None	Continuous	1/day
Peak No. of Sessions	4/year	20/day	3/day
Peak Time of Day	Early AM	Late PM	Mid-Late AM
When Peak Occurs	--	--	Major Licensing Events
Max. Acceptable Wait			
to log-on - Routinely	2 secs.	2 days	2 hrs.
to log-on - Priority	2 secs.	2 hrs.	1/2 hr.
Acceptable Interactive Response Times			
Large Indexed Search			
Max. Delay at Peak Demand	1 sec.	30 mins.	12 mins.
Acceptable Routine Delay	1 sec.	24 hrs.	1/2 hr.
Large Full-Text Search			
Max Delay at Peak Demand	15 secs.	30 mins.	15 mins.
Acceptable Routine Delay	2 mins.	1 day	1/2 hr.
While Paging a Document			
Max Delay at Peak Demand	1 sec.	1 min.	10 secs.
Acceptable Routine Delay	1 sec.	1 hr.	15 mins.
Hardcopy Receipt Times			
Documents			
100 pages or less	5 mins.	2 days	1/2 day
More than 100 pages	4 hrs.	3 days	1 day
Header and Other Data			
100 pages or less	5 mins.	2 days	6 hrs.
More than 100 pages	5 mins.	2 days	1 day

3.4.1 User Session Characteristics

The average potential user anticipates using the LSS computer systems about once each day for an average session length of about an hour. The variation among potential users is great, ranging from 5 minute sessions to those who expect to be on the system the entire day. The Technical and Engineering and the Regulatory and Licensing Support Usage Groups represent most of the potential users. While average total use would be similar between these groups, interview data shows that the Regulatory and Licensing Support Group would have session needs of substantially longer duration than the Technical and Engineering Group, but would need only about half the number of sessions as their technical counterparts. Usage by all groups shows that there would be a marked increase at peak times during the licensing process, with a likelihood of the number of sessions tripling and session length increasing to about an hour and a half. These peaks would occur daily from mid- to late-morning and from mid- to late-afternoon and are expected to be intense when the preparation, issuing, and review of key licensing documents are being conducted. (See Section 4.2 for a more detailed discussion of these results.) Under routine circumstances, potential users would be willing to wait almost two hours to have a terminal available, but under priority conditions, they would want access in about 25 minutes.

3.4.2 Acceptable Interactive Response Times

The tolerance for delays in system response reflect the kinds of searches being conducted by users. Simple prompts or requests (such as paging through a document or searching a tracking system) would be expected to be processed quickly (an average of 20 seconds and 15 minutes, respectively) while longer searches using a large index or full-text would be expected to require more time (about a half hour each). Longer delays under peak demand appear tolerable to potential users. On the average, they would be willing to wait about twice as long under these conditions. Representatives of the Management/Administrative usage group are much less patient than those of the other groups. They also insist, as do many of the other users, that the system provide some feedback quickly and allow the user to go on to other work while the search is being conducted. A desire was frequently expressed for some means of feedback as to the expected delay associated with a given request.

3.4.3 Hardcopy Output

The requirements for receipt of hardcopy as an output of LSS varies very widely. Managers would be willing to wait 3 hours on the average for documents of 100 pages or less. Technical users would wait 7 hours and regulatory staff over 22 hours for the same materials. For hardcopy more than 100 pages most users would wait overnight but regulatory staff would be content with about a two-day delay. The tolerable waiting time for hardcopy of header and tracking information is, across all groups, about half the time of the wait for small documents.

3.4.4 Print Requirements

With very few exceptions, potential users would require a print capability. The typical need is for a dot matrix printer at or near the terminal. Laser printers would generally be required on the same floor or in the same building. Several technical users stressed the importance of laser printers to produce required diagrams and maps.

3.4.5 Downloading

About half of all respondents stated requirements for downloading LSS information to other systems. Average and peak downloads generally ranged from 2-3 pages to 20-30 pages. However, some regulatory staff indicated peak load requirements in excess of 1,000 pages.

3.4.6 Other Forms of Outputs

Only a few of the respondents specified other than hardcopy output. Diskettes were the most frequently mentioned but fewer than 25% of respondents so indicated.

3.4.7 Other System Features

More than 90 percent of potential users said that they would consider electronic mail to be a useful LSS service. The ability to annotate text on the system was favorably evaluated by about half of the respondents. However, many, both pro and con, were very concerned that, if implemented, such a capability would be able to assure privacy and security. The tone and frequency of this concern was much noted by interviewers.

3.4.8 Information Access Feature

Potential users were asked about their full-text searching and structured-index searching needs. More than 90 percent of the respondents indicated a preference for having a combination of both available. Of this large majority, about half felt that the combination search capability should always be available while the other half believed that the availability of full text searching could be limited by size of search. Boolean constraint and proximity-type features were consistently supported. Misspelling tolerance features were heavily favored, but most of these respondents insisted that an on-off switch for this feature be provided.

3.4.9 Data Base Entry Points

A long array of header fields were provided to respondents who were asked to indicate which fields they thought were important to their expected uses. A header is defined as cataloging information appended to the beginning (or "head") of a document and can consist of such fields as author, corporate affiliation, journal name, number of pages, etc. The

following field descriptions were found desirable by a wide majority:

- o Technical Discipline and Subdiscipline
- o Originating and Recipient Organization
- o Dates the Document Was Created
- o Author
- o Issue (from Hierarchy)
- o Document Type
- o Baseline Data Flag
- o Cross-references for NRC and DOE Document Numbers.

Mixed support was provided for:

- o Geographic Reference
- o Technical Level
- o Commitment Status
- o WBS Number.

Several respondents indicated the usefulness of the NRC Division of Waste Management Technical File Plan Index. Others made reference to adding an indication of the level of quality assurance.

Respondents were also asked to indicate which fields should be subjected to controlled vocabularies. Those fields judged to be most valuable as entry points were indicated as requiring controlled vocabularies. In addition, many respondents emphasized that controlled vocabularies can be very helpful.

3.4.10 System/End-User Interface

Most respondents favored accessing the system through a prompted and command line user interface, over a simple-prompt capability. Almost all respondents suggested there would be need for some kind of expert-assisted interface, but most rejected the idea of having access restricted to only trained operators.

3.4.11 Intermediary, Public Information and Data Base Maintenance Usage Groups

Our sample of Intermediaries were mostly librarians. All Intermediaries were very familiar with searching computerized data bases, including full-text, bibliographic citations, and citation/abstract combinations. All of these potential users stressed the need for user-friendly interfaces, provided a great deal of helpful details on pit-falls in searching, and consistently emphasized the need for controlled vocabulary and the on-going training of users. Intermediaries would prefer a system where menus or expert-assisted features could be bypassed by experienced users.

The Public Information Support group emphasized the importance of tracking issues and the need of prompt entry of documents into the data base. While abstracts were not much supported by other users, this group

and the Intermediary group stressed their usefulness, especially in narrowing searches down to a manageable number of hits before looking at full-text.

Data base maintenance users were concerned with procedures for loading the data base, changing and adding fields, controlling access to validated users, and providing QA activities to ensure the integrity of the data base and computer system. Much of their commentary focused on the good and bad features of their own systems. This experience will be useful in later LSS design activities.

3.4.12 Number of Users

At the present time, several years before peak activity in the repository licensing process, estimates of the number of LSS users must have appreciable uncertainty. The relative proportion of usage in the categories identified above is somewhat more certain. The following estimate of this distribution is based on discussions with key respondents during the interviews:

Technical and Engineering Usage	45%
Regulatory and Licensing Usage	25%
Management and Administrative Usage	5%
Public Information and General Public Usage	5%
Intermediary Usage	18%
Data Base Management and Quality Assurance Usage	2%

Although extremely uncertain, the magnitude of the number of LSS users must be estimated so that preliminary system sizing estimates can be made. These estimates are similarly based on interview discussions, but also consider DOE and NRC staffing plans and budget projections for organizations involved in licensing. The following estimates have been made for the number of users in two categories at peak loading during the licensing processes:

DOE HQ and Project Staff and DOE Contractor Staff	200 ± 75 users
NRC HQ, NRC Field and FFRDC Staff and State, Indian Tribe and Intervenor Usage	150 ± 50 users

Some of this uncertainty results from the ambiguous definition of "user". If occasional users are considered (i.e., everyone who would be issued a user name and account number), the number of users is probably near the top of this range. If only moderately heavy users are considered, the value would be closer to the estimate. It is important to continually resolve this value (and its geographic distribution). Note that, although the recent functional requirements report (Young, 1987) did not directly estimate the number of LSS users, the estimate of 188 terminals needed to support Washington, D.C. and the Nevada site only is consistent with the estimate above if a user to terminal ratio of about 2:1 is used.

4.0 DISTRIBUTION OF NEEDS

As pointed out by several of the studies summarized in Section 2, both the broad geographic distribution of users and the long time period the system must function are significant challenges in the design and implementation of the LSS. This section presents estimates of the geographic and temporal distribution of the need to access LSS.

4.1 Geographic Distribution

Information on the geographic distribution of usage demand is necessary for determining the distribution of LSS terminals and the design of the supporting communications network topology.

The DOE, the NRC and their contractors are expected to comprise the vast majority of LSS users. The main concentrations of these users are expected to be in:

	DOE	NRC
Washington, DC Area	Headquarters M&O Contractor HQ Technical Services Contractor Other contractors	Headquarters FFRDC Contractors Misc. contractors
Las Vegas, NV	NNWSI Management Support Contractor NTS contractor Other contractors	---
San Antonio, TX	---	FFRDC contractor

Figure 1 shows these three locations, as well as ten other locations across the country which were identified during the interviews (discussed in the previous section), as potential locations for LSS users. These interviews suggest that in the 1990 - 1992 time frame, the distribution of usage among these locations is approximately:

Washington, DC Area	50%
Las Vegas, NV	30%
San Antonio, TX	10%
Other Locations	10%

These values should be considered only estimates, since several assumptions on program and contractor stability have been made. One such assumption is

Figure 1. Geographic distribution of anticipated LSS usage. Principal usage is expected to be centered in the Washington, D.C. area (50%), Las Vegas, NV (30%), and San Antonio, TX (10%).

that the LSS usage by NRC FFRDC staff would be evenly divided between San Antonio and the Washington, D.C. area.

4.2 Needs as a Function of Time

The information on the temporal distribution of usage demand, coupled with information on the number of users (per usage location), is needed in sizing system computing capacity, sizing the width of links in the system communication network, and determining the number of terminals needed per location. Because of the extremely long period during which the LSS must function, estimates of long term demand variations is also important in designing the system. This section presents estimates of the average daily demand on the system and of the variations on this demand as the repository licensing progresses.

4.2.1 Access Needs as a Function of Time of Day

The information collected in the interviews discussed in Section 3 was used to estimate the distribution of usage demand during an average day in the 1990 - 1992 time frame. This distribution, presented in Figure 2, is based on responses to the following:

- Average session length
- Average number of sessions per day
- Preferred time of day for working on the system.

This information on daily demand was combined with the estimated geographic distribution of usage given in Section 4.1 (to adjust demand to a single time zone). Each person interviewed was assigned to represent one or more usage group/location combination in the following correlation matrix. This matrix associates the geographic distribution estimates from Section 4.1 with the usage group distribution estimates from Section 3.4.12. Note that no weight was assigned to Data Base Management Usage Group users (shown in parentheses in the table) in San Antonio and at Other Locations, since no LSS computer center is anticipated at these locations. Data Base Management users were assumed to be distributed between Washington, D.C. and Las Vegas in a 3:1 ratio. The results in Figure 2 are not sensitive to these assumptions.

		End Usage Groups			Support Usage Groups		
	All Groups	Tech. 45.0%	Reg. 25.0%	Manag. 5.0%	Pub. 5.0%	Inter. 18.0%	D.B. 2.0%
Location:							
Washington, DC	50.0%	22.5%	12.5%	2.5%	2.5%	9.0%	(1.5%)
Las Vegas	30.0%	13.5%	7.5%	1.5%	1.5%	5.4%	(0.5%)
San Antonio	10.0%	4.5%	2.5%	0.5%	0.5%	1.8%	(0.0%)
Other Locations	10.0%	4.5%	2.5%	0.5%	0.5%	1.8%	(0.0%)

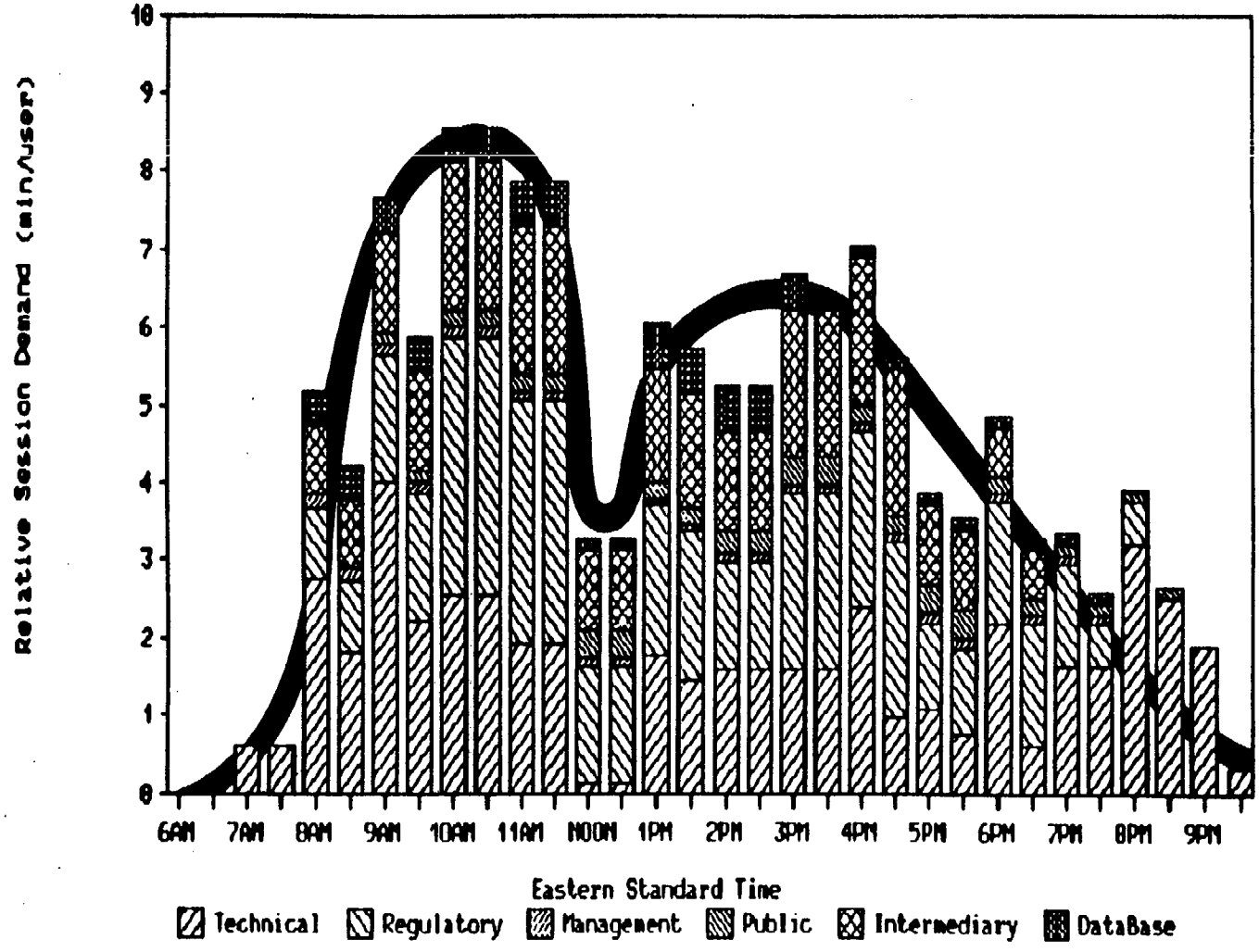


Figure 2. Routine daily usage demand histogram (in minutes per user) adjusted to Eastern Standard time.

The average daily demand profile of each usage group/location combination was determined by averaging the profiles of the representatives sampled (so that sample size does not influence results). This was then weighted by the factors in the matrix above and summed for each usage group. The cumulative histogram of these results is given in Figure 2. The y-axis in the histogram is in minutes of demand per user for each half-hour interval. These results, multiplied by the total number of LSS users (at a given time, estimated in Section 4.2.2) gives an estimate of total demand for the system, in minutes per half-hour during the day.

It must be emphasized that these results are only estimates. Numerous assumptions were made which cannot be verified at this time. Only the general shape and relative proportions, as illustrated by the smoothed curve in the figure, should be considered. Although data were collected to produce a similar histogram for peak (as opposed to average) demand, the figure was not included here because the uncertainties in the peak analysis would be even greater and the results potentially misleading.

4.2.2 Access Needs as a Function of Program Schedule

The level of usage demand on LSS is expected to vary as a function of the licensing process schedule. Demand will be driven primarily by the preparation (i.e., before submittal) and review (i.e., after submittal) of key milestones on that schedule. Estimates of demand variation over time have been made by analyzing this schedule (and correlating staffing level estimates when available). Figure 3 shows the current licensing schedule, reflecting the recent changes resulting from the Nuclear Waste Policy Amendments Act. Note that because of recent changes in the OCRWM program, some of the elements in the figure are in flux, and estimates needed to be used.

Major milestones (general major document submittals) expected to have significant impact on LSS demand have been folded down from these schedules to the time-lines in the middle of Figure 3c. Below these time-lines, a double histogram is presented. Bars above the line represent estimates of the number of users affiliated with NRC, all NRC contractors, States and Indian Tribes and their contractors, intervenors, and legislators. The bars below the line represent estimates of the numbers of users affiliated with DOE and DOE contractors.

No scale has been provided, to avoid over interpretation of the numerical significance of the graph and to uncouple the results presented from the uncertainties associated with estimating the total number of potential users. The graph is intended to portray relative demand over time. The user demand estimates in Section 3.4.12 could be used to scale this graph by taking the combined peak usage estimates to represent the total magnitude between the DOE peak in 1994 (during the preparation of the repository and MRS license applications) and the NRC peak in 1995 (during the review of their review).

Note that LSS usage demand has not been simply correlated to the milestone dates, but accounts for phaseout of detailed technical work in the 3 to 6 months before the delivery date and accounts for initial reading and phase-up during the 3 to 6 months after.

TIME-LINE FOR KEY OCRWM ACTIVITIES

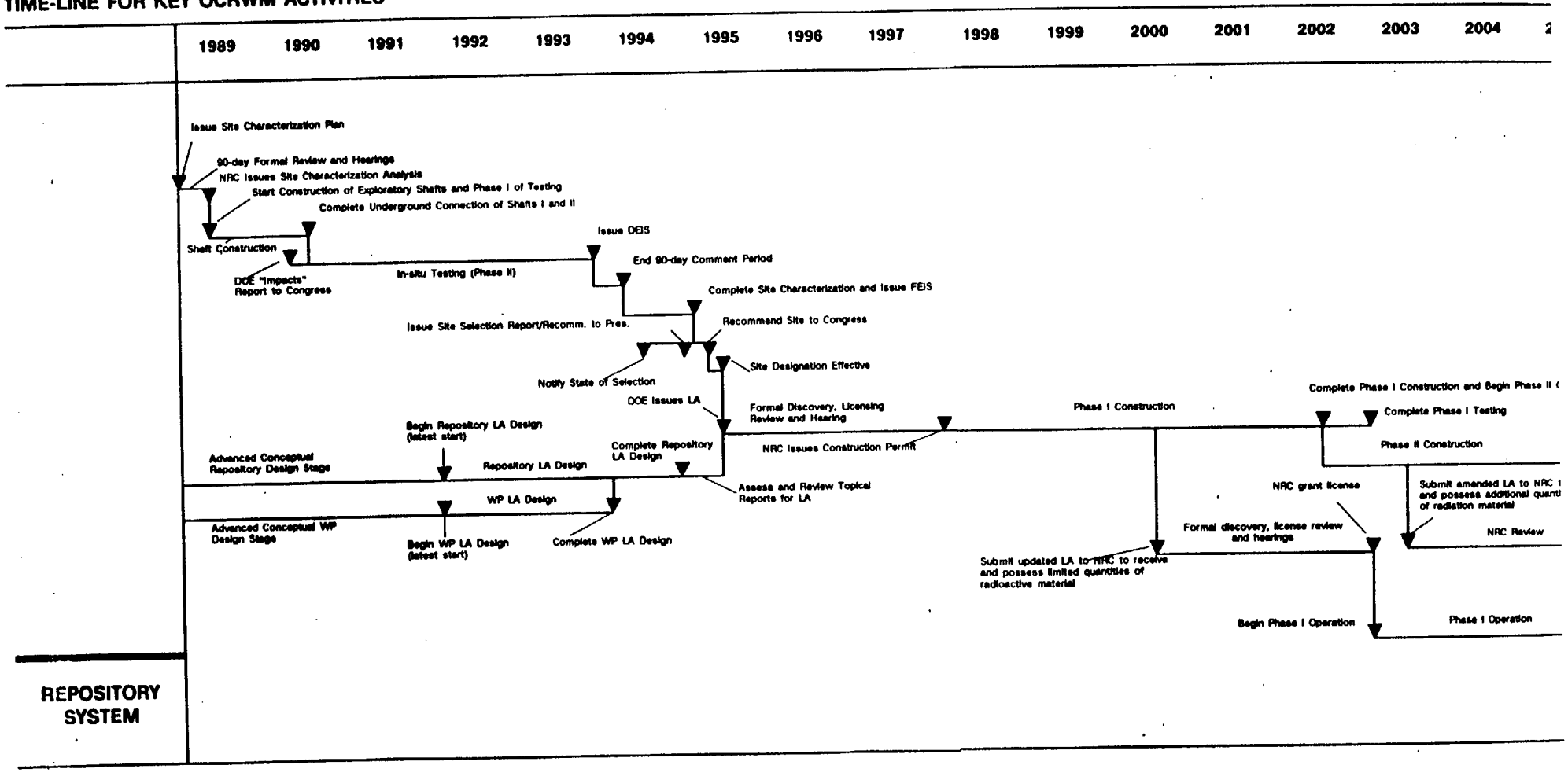
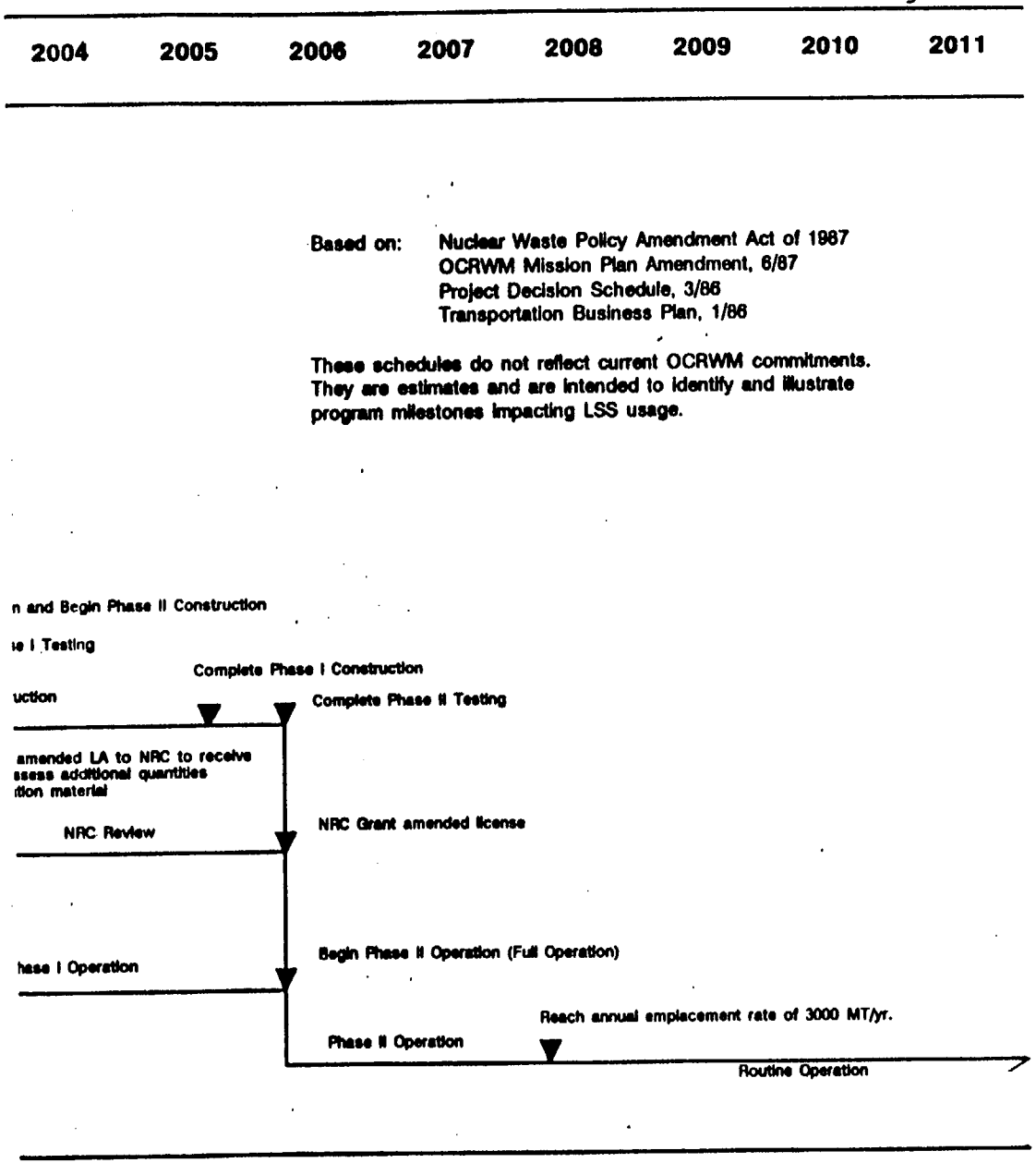


Figure 3a


2004
2005
2006
2007
2008
2009
2010
2011
Based on: Nuclear Waste Policy Amendment Act of 1987
OCRWM Mission Plan Amendment, 6/87
Project Decision Schedule, 3/86
Transportation Business Plan, 1/86
These schedules do not reflect current OCRWM commitments. They are estimates and are intended to identify and illustrate program milestones impacting LSS usage.
n and Begin Phase II Construction
se I Testing
Complete Phase I Construction
uction
Complete Phase II Testing
amended LA to NRC to receive
ssess additional quantities
ition material
NRC Review
NRC Grant amended license
hase I Operation
Begin Phase II Operation (Full Operation)
Reach annual emplacement rate of 3000 MT/yr.
Phase II Operation
Routine Operation

TIME-LINE FOR KEY OCRWM ACTIVITIES

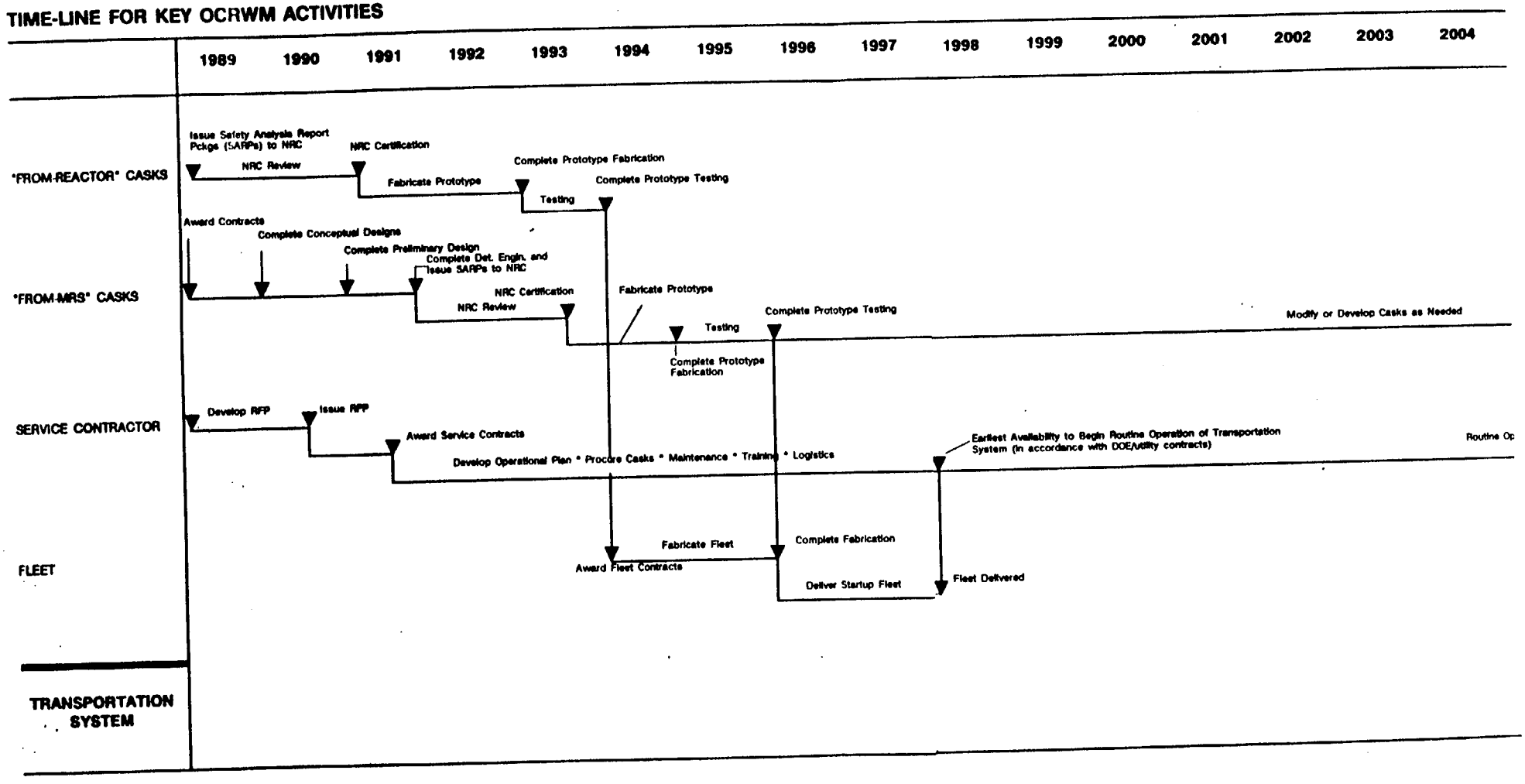
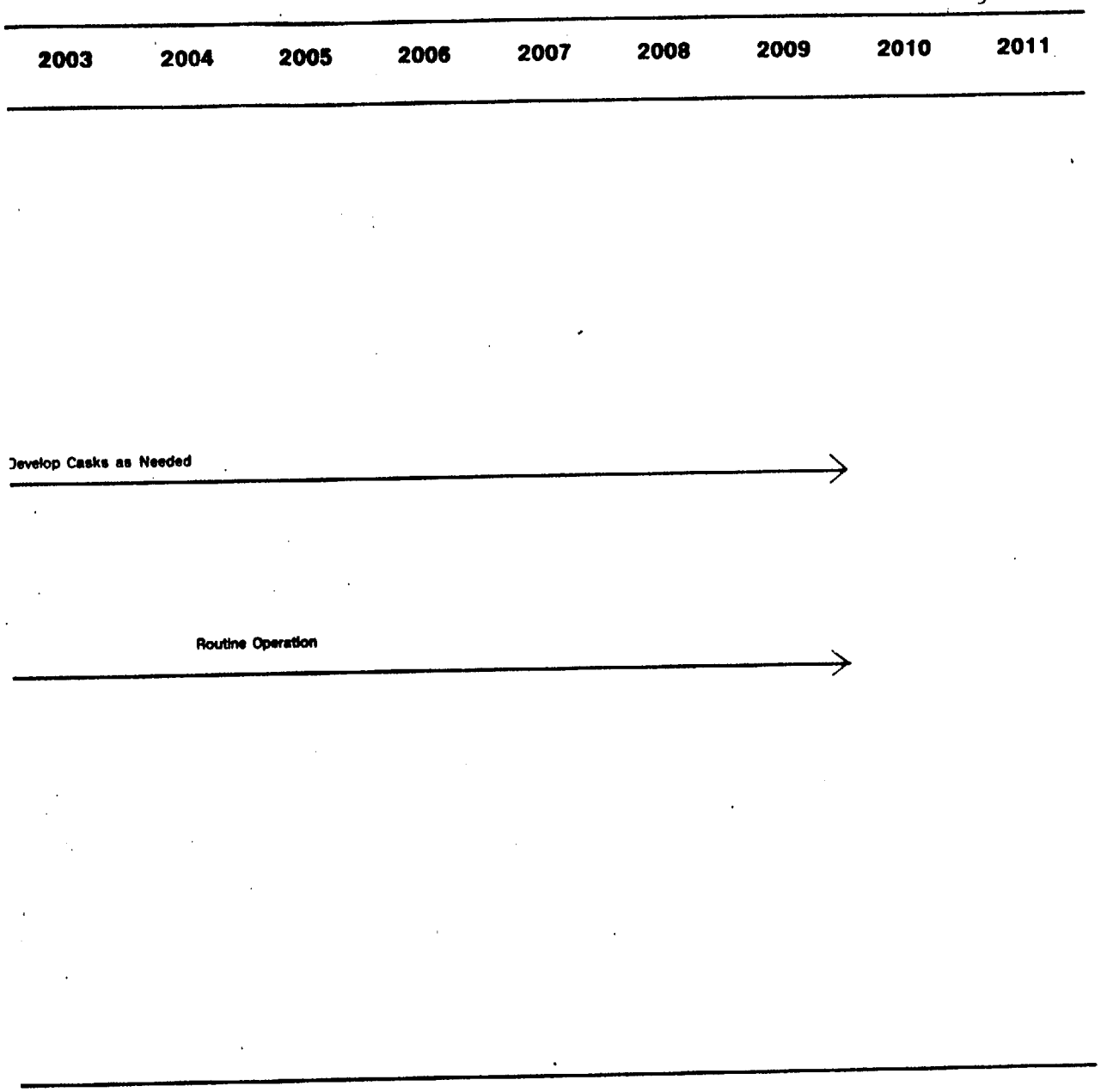


Figure 3b


2003
2004
2005
2006
2007
2008
2009
2010
2011
Develop Casks as Needed
Routine Operation

TIME-LINE FOR KEY OCRWM ACTIVITIES

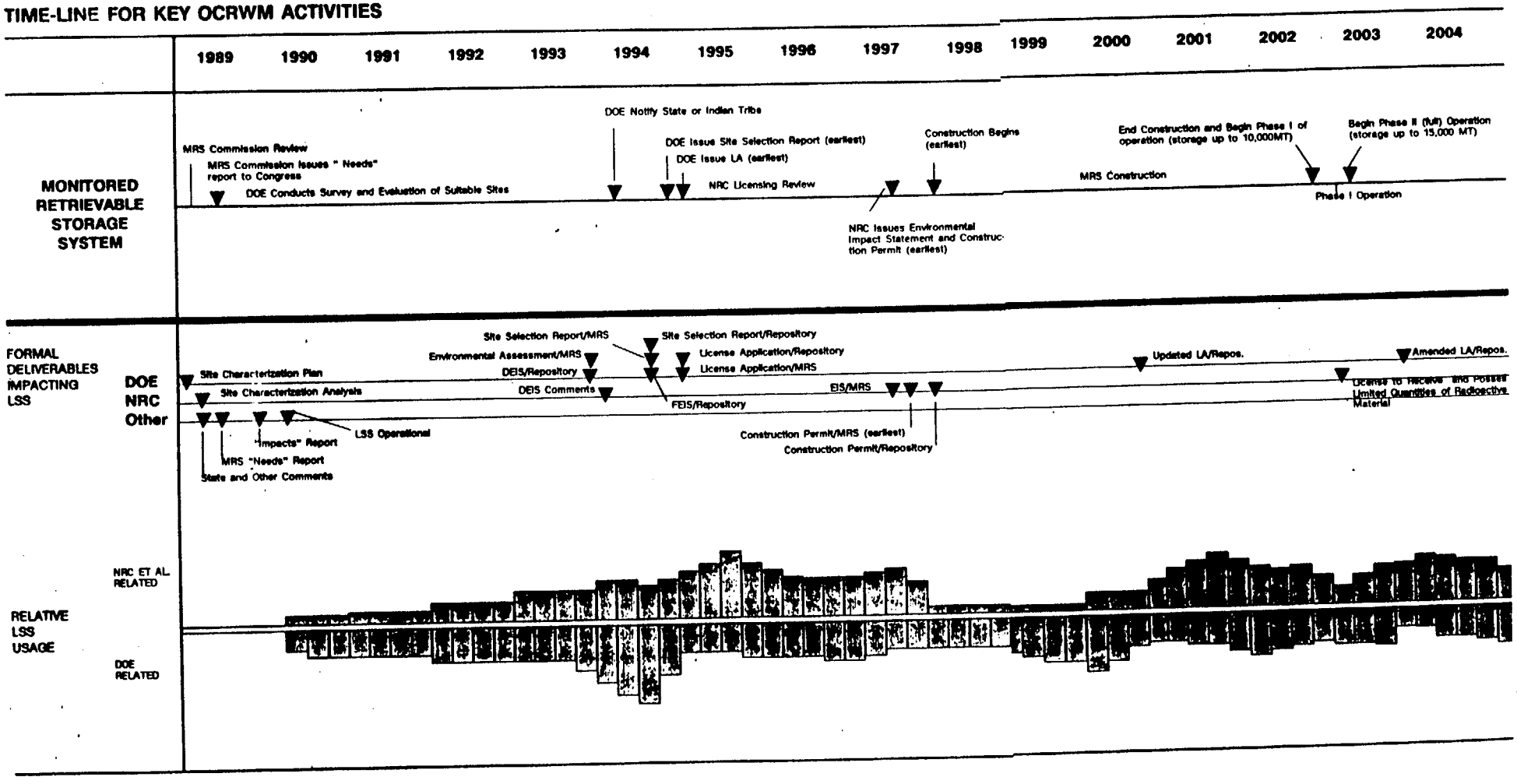
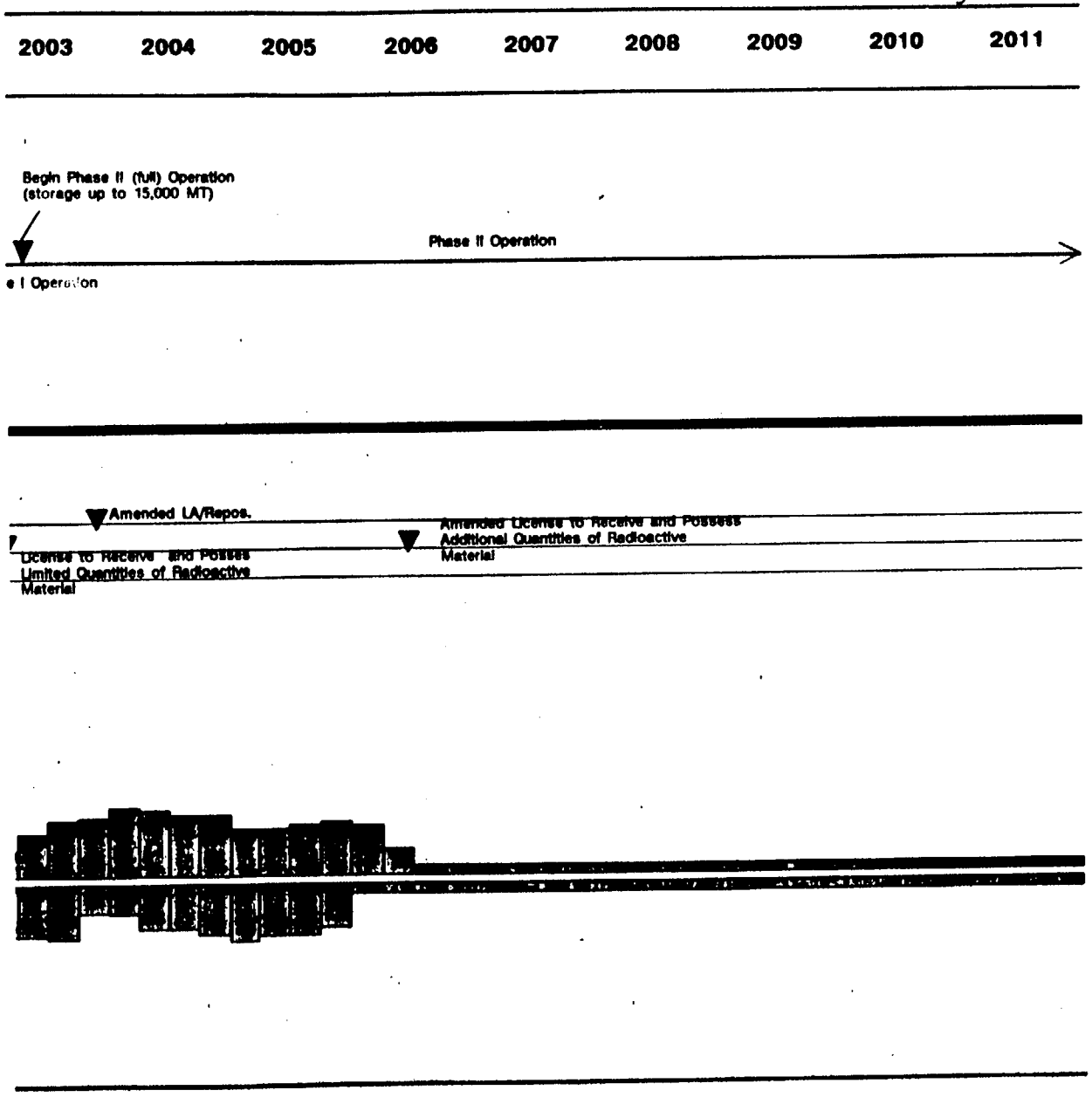


Figure 3c


2003
2004
2005
2006
2007
2008
2009
2010
2011
Begin Phase II (full) Operation
(storage up to 15,000 MT)
Phase II Operation
Amended LA/Repos.
Amended License to Receive and Possess
Additional Quantities of Radioactive
Material
License to Receive and Possess
Limited Quantities of Radioactive
Material

5.0 CONCLUSIONS

The background studies described in Section 2 clearly indicate the need for a sophisticated LSS computer system. The size of the system, the variety of the documents that must be included in the data base, requirements for terminals at geographically distributed sites, and simultaneous use of the system, all suggest an advanced computer system that will make use of state-of-the-art technology. The specific and varied demands of users revealed in the interviews reported in Section 3 further indicate the need for a "user-friendly", flexible system that can satisfy the needs of many users with dissimilar needs.

The need for carefully controlled vocabularies for multiple bibliographic and subject data base entry points for structured index searching is a particularly significant finding of the interviews. Many large data bases that have relied on only full-text or full-text in combination with simple headers have proven to produce low recall and precision. The experience of the potential users interviewed for this report underscore the findings of the literature. Their experience and needs (the best proxy available for LSS usage prediction) indicates the necessity for comprehensive, in-depth cataloging of LSS documents.

This needs analysis has resulted in the identification of numerous requirements which must be met by the LSS, including those currently identified by NRC as needed to meet the 3-year repository licensing processes. In some cases the evidence is firm. In other cases, the evidence is preliminary and indicates that further analysis and cost/benefit studies must be conducted to determine if the apparent need is sufficient to support a clear system requirements. Those requirements which clearly fall into the firm category are:

General Functions

- The LSS should include capabilities for managing various types of data bases (document, tracking data, etc).
- Information should be stored in the form of headers for all records and in full-text for many, if not all documents.
- The system should include the capability for efficient and accurate data retrieval using a variety of methods.
- Data should be capable of being distributed in hardcopy form.
- The system should be capable of generating various types of reports.
- The system should be easy to use with minimum training necessary, containing built-in help functions, and providing assistance when needed, either through an expert system or on-call assistance.
- There should be a procedure to identify and minimize or avoid duplicate records.
- The records should be maintained in a secure environment.
- Electronic mail capability should be provided.

- The data should be entered and maintained under an independently verified quality assurance program.

Data Retrieval Methods

- Structured index searching via detailed and extensive headers should be available, involving subject terms and keywords assigned with the aid of a controlled vocabulary.
- Full-text search capability on both document text and headers should be available.
- Search aids including thesaurus, boolean logic, and proximity searches should be available to meet the performance requirements identified.

Data Bases

- The system should include data bases for documents, regulations, tracking of issues and commitments, and indexes for non-documents such as physical sample inventories.

User Community

- The number of users needing the system will probably exceed 350 at peak demand.
- Major geographic centers of users will be Washington D.C., Las Vegas, Nevada and San Antonio, Texas. Other locations, comprising about 10% of the users, are expected.
- Discernible usage patterns will exist in terms of user characteristics, time-of-day use, and use in relation to the program schedule.

Performance

- The system should be designed to maximize recall and precision with minimum performance targets on the order of 80 percent.
- Response to large queries should be available in approximately 15 to 30 minutes.
- Documents should be available for viewing on a screen in less than 30 seconds after they are identified.
- Routinely, hardcopy of documents should be available overnight.

Schedule

- The system should be available for use by August of 1990, which would provide over 4 years of use prior to license submittal.

Certain additional needs were identified in the course of this study, however additional study will be required to determine if they will become firm requirements. These include:

General Functions

- Electronic (bit-map) images may be required for some records,

particularly graphs, diagrams and maps.

- The capability for downloading data may be desirable.
- Some files (such as privileged information or annotated records) may require limited access or privacy.

Data Retrieval Methods

- The utility of abstracts, particularly if they must be created for LSS cataloging, is not clear, especially for documents which can be searched in full text.
- The utility of misspelling tolerance is also unclear, but should be selectable if included.

User Community

- Some users have expressed interest in a priority access system.

The conclusions and requirements derived from this report represent a set of findings to be revised as the requirements definition progresses. These refinements are not expected to significantly alter the conclusions, but rather to allow them to reflect in detail any statutory changes and to refine the basis for quantitative system specifications. The activities which are expected to contribute to this process over the next 6 months include:

- The Preliminary Data Scope Analysis (the second report of this series) will be based in part on interviews to be conducted with subject experts to help define the information to be included in the LSS data base. Interviews of this nature will not be limited to data scope but must overlap into data retrieval and functional definition of the LSS. For example, the potential requirement for electronic storage and retrieval of graphic information, diagrams, and maps will be better defined when the quantity, characteristics, and use of such information is identified in the data scope analysis.

- The Negotiated Rulemaking Advisory Committee will continue deliberations on the rulemaking process which will identify, among other things, their judgment on the information to be included within LSS, the types of information to be in full-text, the need for privacy of files, input to the data entry process, and requirements for access to LSS. As the conclusions of this committee become firm, they will be incorporated into the refinements of these requirements.

- The resultant Conceptual Design Analysis (the third report in this section) will be a specific concept which can be used as a reference for detailed review. Some of the questions used in the interviews thus far have, of necessity, been general and without benefit of such a frame of reference. The conceptual design analysis will support a detailed scrutiny of requirements, rather than continuing to investigate general concepts.

- An important aspect of the system definition and design is the development of an LSS prototype which will provide the technical data required to refine and complete system specifications. The prototype will provide significant insight into data entry and retrieval techniques. The use of a prototype system, with a representative data base and truly prototypical software, will be tested by potential users. These tests will provide firm technical information to support refinements in retrieval methods and header fields.

As shown by the series of documents which have preceded this report, LSS requirements have been extensively reviewed, considered and discussed over a period of years. Through the process outlined in this report, the subject is now receiving the concentrated study and analysis necessary to create specifications from which a system can be designed. This could not have been achieved without the assistance of all involved parties and we look forward to continued cooperation.

REFERENCES

Aerospace, 1986; Requirements Definition for Licensing Information Management System for Nuclear Waste, Draft Revision 2, the Aerospace Corporation, prepared for NRC, March 1986.

ANSI/ASME NQA-1, 1983; Quality Assurance Program Requirements for Nuclear Facilities, American National Standards Institute and American Society of Mechanical Engineers, 1 July 1983.

Browning, R.E., 1985; Shortening NRC Review Time for the Repository Authorization Application, Nuclear Regulatory Commission, 9 May 1985.

DOE, 1986; Quality Assurance Plan for High-Level Radioactive Waste Repositories, DOE OCRWM Office of Geologic Repositories, August 1986.

DOE, 1987; Request for Proposal: Design and Implementation of a Licensing Support System, DOE Office of Civilian Radioactive Waste Management, 11 February 1987.

Federal Register, 1986, 1987; 18 December 1986 (51 FR 45338) and 5 August 1987 (52 FR 29024).

Jordan, 1986; Discovery and rulemaking perspectives on the use of an information storage and retrieval system in the licensing proceedings for the high-level waste repository, John S. Jordan & Associates, prepared for NRC, 14 February 1986.

NARA, 1987; Electronic Recordkeeping, National Archives and Records Administration Bulletin 87-5, 11 February 1987.

NRC/DOE, 1986; Agreement in Principle, Davis/Rusche, February 1986.

Olmstead, W.J., 1986; Regulatory Issues Associated with Licensing A High-Level Waste Repository, proceedings of the Symposium on Waste Management, March 1986.

SAIC, 1986; NNWSI Project Information Management System Concepts Evaluation Report, Science Application International Corp., prepared for OCRWM NNWSI, August 1986.

SAIC, 1988; Information Management System Bridge Program Preliminary Test Results, Science Applications International Corp., prepared for OCRWM NNWSI, January 1988.

Weston, 1985; Licensing Information System Requirements Study: Draft Report of Findings, Roy F. Weston Inc., prepared for OCRWM Office of Geologic Repositories, 2 October 1985.

Young, 1987; LSS Functional Requirements and Design Concept Report, Arthur Young International, prepared for OCRWM, 31 March 1987.

APPENDIX A
List of People Interviewed

Charlotte Abrams
Division of High Level Waste Management
U.S. Nuclear Regulatory Commission

Avi Bender
Administration and Resources Management Office
U.S. Nuclear Regulatory Commission

Felton Bingham
Environmental Assessment Division
Sandia National Laboratories

Charles (Ched) Bradley
Office of NEPA Project Assistance
U.S. Department of Energy

Francis (Chip) Cameron
Office of the General Counsel
U.S. Nuclear Regulatory Commission

Richard Codell
Division of High-Level Waste Management
U.S. Nuclear Regulatory Commission

Robert Cranwell
Manager, Waste Management Systems Division
Sandia National Laboratories

Helen Cummings
Energy Library (Germantown)
U.S. Department of Energy

Mark Delligatti
Division of High-Level Waste Management
U.S. Nuclear Regulatory Commission

Norm Eisenberg
OCRWM Office of Geologic Repositories
U.S. Department of Energy

Stan Echols
Office of the General Counsel
U.S. Department of Energy

Dan Fehringer
Division of High-Level Waste Management
U.S. Nuclear Regulatory Commission

APPENDIX A
List of People Interviewed
(Continued)

Steve Frank
Office of NEPA Project Assistance
U.S. Department of Energy

Mark Frei
OCRWM Office of Geologic Repositories
U.S. Department of Energy

Mike Glora
Project Regulatory Compliance Department
Science Applications International Corporation

Donna Hickling
Manager, Marketing Resource Center
Booz, Allen & Hamilton

Ginger King
OCRWM Office of Policy and Outreach
U.S. Department of Energy

Hannah King
Energy Library (Germantown)
U.S. Department of Energy

Melinda Kassen
Attorney
Environmental Defense Fund

John Linehan
Division of High-Level Waste Management
U.S. Nuclear Regulatory Commission

Mike Martin
OCRWM Records Management Facility
KOH, Inc.

Peter McGrath
Group Manager, Energy Systems Group
Science Applications International Corporation

Abigail Muller
Central Research Library
Oak Ridge National Laboratories

Mal Murphy
Special Deputy Attorney General
State of Nevada

APPENDIX A
List of People Interviewed
(Continued)

Gerald Parker
OCRWM Office of Geologic Repositories
U.S. Department of Energy

Carol Peabody
OCRWM Office of Geologic Repositories
U.S. Department of Energy

Jerome Pearring
Division of High-Level Waste Repositories
U.S. Nuclear Regulatory Commission

Jeanne Perrone
Energy Library (Germantown)
U.S. Department of Energy

John Randall
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission

Ed Regnier
OCRWM Office of Geologic Repositories
U.S. Department of Energy

Kathleen Ruhlman
Public Document Room
U.S. Nuclear Regulatory Commission

Len Scoplar
Manager of Regulatory, Safety & QA Department
Roy F. Weston, Inc.

Trudy Scott
Energy Library (Washington, D.C.)
U.S. Department of Energy

Jaynie Shaheen
OCRWM Office of Policy and Outreach
U.S. Department of Energy

Betsy Shelburne
Public Document Room
U.S. Nuclear Regulatory Commission

Barry Smith
Attorney
Tourtellotte, Ross and Gray

APPENDIX A
List of People Interviewed
(Continued)

Jan Statler
Manager, OCRWM Records Management Facility
KOH, Inc.

Ralph Stein
Director, OCRWM Office of Engineering & Geotechnology
U.S. Department of Energy

Eileen Tana
Division of High-Level Waste Management
U.S. Nuclear Regulatory Commission

Michael Teubner
Lockheed Engineering and Management Service Company

Dean Tousley
Attorney
Harmon and Weiss

John Trapp
Division of High-Level Waste Management
U.S. Nuclear Regulatory Commission

Mary Louise Wagner
Staff, Energy and Natural Resources Committee
U.S. Senate

Jeff Williams
Office of NEPA Project Assistance
U.S. Department of Energy

APPENDIX B
Abbreviations Used

ANSI	American National Standards Institute
ARS	Automated Records System
ASCII	American Standard Code for Information Interchange
ASLB	NRC Atomic Safety and Licensing Board
ASME	American Society of Mechanical Engineers
BASIS	A text-oriented data management system developed by Battelle
CDC	Control Data Corporation
CFR	Code of Federal Regulations
DEIS	Draft Environmental Impact Statement
DM	A relational data base system developed by Battelle
DOE	Department of Energy
EIS	Environmental Impact Statement
FEIS	Final Environmental Impact Statement
FFRDC	Federally Funded Research and Development Center
FR	Federal Register
GSA	General Services Administration
IMS	Information Management System
IMSBP	Information Management System Bridge Program
IS&R	Information Storage and Retrieval
JURIS	US Department of Justice Legal Information Retrieval System
LA	License Application
LEXIS	Mead Data Central Legal Data Base
LIMS	Licensing Information Management System
LIS	Licensing Information System

APPENDIX B
Abbreviations Used
(Continued)

LSS	Licensing Support System
M&O	Management and Operations contractor
MRS	Monitored Retrievable Storage
MT	Metric Tons
NARA	National Archives Records Administration
NBS	National Bureau of Standards
NFPA	National Fire Protection Association
NNWSI	Nevada Nuclear Waste Storage Investigations
NRAC	Negotiated Rulemaking Advisory Committee, officially known as the HLW Licensing Support System Advisory Committee
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
NWPA	Nuclear Waste Policy Act of 1982
OCR	Optical Character Recognition
OCRWM	DOE Office of Civilian Radioactive Waste Management
ODS	Optical Disk Storage
OGR	OCRWM Office of Geologic Repositories
OMB	Office of Management and Budget
QA	Quality Assurance
RFP	Request For Proposal
RIS	OCRWM Salt Repository Project Records Information System
SAIC	Science Applications International Corporation
SARP	Safety Analysis Report Package
TFS	Technical Field Services
WBS	Work Breakdown Structure
WP	Waste Package