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**Civilian Radioactive Waste Management System
Management & Operating Contractor**

Evaluation of Licensing Support System Options

Revision 0

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EXECUTIVE SUMMARY

Under the Nuclear Waste Policy Act, as amended (NWPA), the Nuclear Regulatory Commission (NRC) is required to issue a final decision approving or disapproving the Department of Energy's (DOE) application for a license to construct a high-level nuclear waste repository. This decision is to be made no later than three years after the date of submittal of a license application, with a possible one-year extension for good cause. Because the license applications for other NRC regulated facilities historically have taken much longer than three years to review, NRC recognized a need to streamline the review process in order to meet the statutory review period. NRC noted that a significant portion of the license review period is associated with sending, receiving, and handling information and data. Based upon this observation, NRC asserted that an electronic information management system that provides parties to the licensing proceedings with ready access to all relevant licensing documents could substantially reduce the license application review period. In 1987, NRC initiated a negotiated rulemaking process to modify the rules of practice for domestic licensing proceedings (10 CFR Part 2) to impose special provisions intended to expedite the licensing process for geologic repositories. The negotiated rulemaking resulted in NRC's 1989 promulgation of a revised 10 CFR Part 2, including a new Subpart J, that required the DOE to design and develop an electronic information management and distribution system to support the licensing process. The NRC designated this system as the Licensing Support System (LSS) and required that the LSS be available and certified by NRC at least six months prior to submission of a license application for a high-level waste repository.

The DOE Office of Civilian Radioactive Waste Management (OCRWM) began to design and develop the LSS in 1988. A number of LSS analysis and design documents were prepared for OCRWM between 1988 and 1989, and a prototype system was completed and tested in 1990. However, a major reassessment of the OCRWM Program made in 1989 (DOE, 1989b) indicated that the target date for submittal of a repository license application was to be delayed from 1995 until 2001. In 1991, DOE postponed further work on the LSS in order to concentrate program resources and efforts on site characterization activities and early resolution of licensing technical issues with the NRC.

As a direct outcome of the strategic planning efforts within the DOE and, specifically, within the OCRWM over the past year, a revised Program approach has been implemented to ensure incremental progress in the site suitability determination, and environmental impact analysis and licensing activities for the potential high-level waste repository at Yucca Mountain, Nevada. One element of the revised approach was a reorganization of OCRWM for more efficient operation, and the transfer of funding and implementation responsibilities to appropriate project field levels. Subsequently, responsibility for the design and development of the LSS to meet the requirements of 10 CFR Part 2, Subpart J, transferred from OCRWM Headquarters to the Yucca Mountain Site Characterization Office (YMSCO).

YMSCO management identified the need for an evaluation of the LSS design and implementation requirements because it was recognized that the LSS could represent a critical path constraint to the submission of a repository license application in 2001. In addition, management believed that a review of the LSS was appropriate to ensure that the existing LSS operational concept was

sound, and to identify strategies for incorporating advances in computing technology to optimize system performance and lower overall cost. YMSCO management directed the Management and Operating (M&O) Contractor to establish a working group to undertake this evaluation. In response to the LSS Working Group's charter, the group proceeded to:

- Review the LSS developmental history
- Identify the regulatory and derived LSS requirements
- Identify and evaluate viable LSS operational concept options
- Estimate page volumes likely to be stored in the LSS
- Identify cost drivers
- Estimate projected life-cycle costs of LSS-related activities
- Complete a comparative evaluation and selection of a preferred LSS option for consideration by YMSCO management
- Provide findings and recommendations for LSS development and related activities

The Working Group assembled and reviewed the full set of meeting summaries and/or transcripts from NRC's negotiated rulemaking process and LSS Advisory Review Panel deliberations. In addition, the Group studied the major LSS feasibility, data needs, and design concept documents produced for DOE over the past six years. Short descriptions of the principal historical documents are contained in this report.

The Working Group differentiated between functions of the OCRWM Records Management System and those functions attributable to the LSS. The Group initially identified and evaluated six options, representing a wide range of LSS operational concepts, that satisfy the requirements of Subpart J. In response to comments from an informal review of the Working Group's draft report, a seventh option was identified, costed, and included in the evaluation presented in this report. Each of the seven options incorporates the following features: use of digital images for records storage and as the basis for production of on-line searchable full text to support retrieval of documents, on-line searchable headers and full text files to support retrieval of documents, and transmittal of hard copy image by mail or facsimile when requested by the user. The options differ in the extent of human-correction of text files, and the means of transferring a document image (either hard copy or electronic) from the LSS retrieval center to the user workstation.

Evaluation of the LSS options was predicated upon developing a number of selection criteria each of which is capable of differentiating among the options considered. The seven LSS options were evaluated based upon seven selection criteria that were representative of LSS performance and capable of quantitatively discriminating among the options, plus an eighth criterion that reflected relative cost. The results of the evaluation process identified in quantitative terms, the relative attractiveness of each of the options. Cost was not a dominant factor fixing the relative attractiveness. Three or perhaps four of the options were evaluated as being approximately

equivalent. However, all seven of the options meet the regulatory requirements of an LSS and not one of them has a cost that varies more than \$5M above or below the \$62M average cost of the options. The Working Group focused on three options (Options 5, 6 and 8 - see Section 6.2) as being the most attractive options. Of these three options, the Working Group identified Option 6 as the preferred option for consideration by YMSCO management.

In addition to identifying a preferred option, the Working Group made a number of findings and recommendations for future actions in this report. The most significant of these are:

- An operational LSS is critical for timely license application submission and supports DOE's overall licensing strategy.
- The NRC and the LSS Advisory Review Panel expect that DOE will provide an operational LSS much earlier than six months prior to license application.
- Because the OCRWM Records Management System will provide the majority of data for the LSS, increased compatibility between the Records Management System and the LSS will reduce cost and schedule risk.
- Significant cost reductions for LSS life-cycle costs can be anticipated over previous estimates due to identification of selected costs to records management functions, improvements in technology, and reduction in labor costs. The expected ten-year cost is less than \$70 million.
- Preliminary schedules for both a "build" and "buy" implementation approach have been developed and indicate that either approach is viable. A make/buy analysis is a critical path element for both approaches.
- Care must be exercised in using historical LSS analyses and design documents as a basis for decisions because documentation is somewhat incomplete, and some documents contain LSS design requirements that go beyond those mandated by regulation.
- LSS-related technical issues need to be monitored over the life of the system so that improvements and enhancements can be selectively integrated into the LSS to enhance usability and minimize cost.

Finally, the Working Group was able to incorporate a number of secondary findings into the text of this report. These findings include:

- There is a need to revise the LSS System-Level Requirements Document to more clearly articulate the actual LSS requirements necessary for system design and acceptance testing.
- Cost factors were identified that could further reduce the cost of the LSS (including a reduction in the amount of information that comprises the document header).

- Near-term issues that must be resolved in cooperation with the LSS Advisory Review Panel were articulated.
- Using updated cost profiles, the principal milestones and schedule for implementing an LSS were established.
- The activities and costs attributable to the OCRWM Records Management System were differentiated from those of the LSS.
- The Working Group developed a proposal for specifying the scope of documentary material that should be submitted by DOE to the LSS.

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1. INTRODUCTION

1.1 OBJECTIVES OF THE LICENSING SUPPORT SYSTEM REVIEW

Responsibility for the Licensing Support System (LSS) within the Department of Energy (DOE) was transferred to the Yucca Mountain Site Characterization Office (YMSCO) during fiscal year 1994. This new responsibility prompted YMSCO management to direct the Management and Operating Contractor (M&O) to establish a working group, under the auspices of the YMSCO Assistant Manager of Suitability and Licensing, to evaluate the LSS concept and the history of LSS development plans and accomplishments. The Working Group was to conduct this review in order to meet the objective of developing and proposing to DOE a strategy for implementing the LSS that is consistent with the current Program approach. Specifically, YMSCO management directed the Working Group to focus their effort on identifying means of: 1) lowering the projected cost of the system, 2) incorporating appropriate advances in technology that could minimize cost and enhance performance, 3) accommodating any constraints emerging from the current Program approach that could impact implementation of the LSS, and 4) ensuring the capabilities to support the evolving needs of the Office of Civilian Radioactive Waste Management (OCRWM) Program.

During the evaluation, the Working Group performed the following tasks:

- Reviewed the LSS historical background
- Verified the regulatory and derived requirements that must be satisfied by the LSS
- Identified and evaluated viable LSS operational concepts
- Estimated page volumes likely to be stored in the LSS
- Identified LSS cost drivers
- Identified criteria to be used in selecting among the LSS options
- Performed analyses of projected life-cycle costs of LSS-related activities
- Completed a comparative evaluation and selected a preferred option for consideration by YMSCO management.

The remainder of this section introduces the role of the LSS during the geologic repository licensing process and discusses the interface between the LSS and the OCRWM records management system.

1.2 USE OF THE LICENSING SUPPORT SYSTEM IN NRC REPOSITORY LICENSING

The following section summarizes the licensing process for a geologic repository and identifies the intent of the LSS during the licensing process. A more detailed discussion of the repository

licensing process is contained in Appendix B. Access to the LSS facilitates document discovery in the NRC licensing process for geologic repositories.

The existing statutory and regulatory framework provides for a dual-phase Nuclear Regulatory Commission (NRC) licensing process for High-Level Waste (HLW) repository construction and operation. In the first phase, DOE will file a license application with the NRC, and must obtain a "construction authorization" from the Commission as a prerequisite to commencing construction of a geologic repository operations area. For a construction authorization to issue, the NRC must determine that the safety and environmental requirements of 10 CFR Parts 60 and 51 have been met, and that the site and repository design comply with the performance objectives and criteria in 10 CFR Part 60, Subpart E. The Nuclear Waste Policy Act of 1982, as amended (NWPA), requires the NRC to review DOE's application and issue a final decision approving or disapproving that application for construction authorization within three years after the date that it is submitted.

The second phase of the licensing process occurs after DOE has received NRC construction authorization and is nearing completion of the repository. At that time, DOE must obtain an NRC license to receive and possess source, special nuclear, or byproduct material at the geologic repository operations area. Again, for this license to issue, the NRC must find that the applicable safety and environmental requirements of 10 CFR Parts 60 and 51 have been met.

NRC regulations require that an adjudicatory or "trial-type" hearing be held concerning the issuance of a construction authorization for the repository. The NRC also may authorize a hearing on the issue of emplacement of waste at the repository. The Commission has formulated new procedures in 10 CFR Part 2, Subpart J to apply specifically to its review of DOE's repository license application. These procedures will be used during any hearings in connection with both phases of the licensing process.

The Subpart J hearing procedures are designed to enhance the Commission's ability to meet the strict time limits imposed under the NWPA for the HLW repository licensing process, while concurrently providing for a thorough technical review of the novel, complex issues that will be involved. To the extent that they do not replace pre-existing NRC "rules of general applicability" for hearings in 10 CFR Part 2, Subpart G, the Subpart J regulations are intended to mesh with the traditional NRC formal hearing procedures of Subpart G.

1.2.1 The Role of Discovery

The discovery process in NRC proceedings (which is modeled after the discovery process under the Federal Rules of Civil Procedure) is designed to enable the parties to the licensing proceeding to "discover" useful information and then winnow that information for use during the hearing. By using discovery procedures, parties can (1) narrow the issues so that during the hearing only evidence on disputed matters need be produced; (2) obtain evidence for use at trial; (3) secure information about the existence of evidence that may be used during the hearing, and ascertain how and from whom such evidence may be procured. The scope of information subject to discovery generally is very broad.

1.2.2 Types of Discovery

Parties, potential parties, and interested governmental participants in the repository licensing proceeding may obtain discovery by one or more of the following methods:

- Access to the Licensing Support System
- Entry upon land for inspection, access to raw data, or certain other purposes
- Access to copies of documentary material for which only bibliographic headers have been submitted
- Depositions upon oral examination
- Requests for admission
- Informal requests for information not available in the LSS (such as the names of witnesses and the subjects those witnesses plan to address)
- Interrogatories

1.2.3 The Role of the Licensing Support System

A unique feature of the NRC's repository licensing regime is the use of an electronic information management system known as the Licensing Support System (LSS). The LSS is designed to contain the technical information supporting the DOE application, as well as potentially relevant documents generated by the NRC, DOE, DOE contractors, interested government participants, and all other parties and potential parties to the licensing proceeding, in a standardized electronic format. All parties to the proceeding will have access to the LSS through electronic full text search capability, designed to provide the flexibility of searching any word or word combinations within a document. This system thus facilitates the rapid identification of relevant documents and issues.

To increase the effectiveness of the LSS, documents containing potentially relevant licensing material would be added electronically to the LSS, and electronic access to the LSS would be provided to parties and potential parties, as early as practicable before DOE submits its license application.

1.2.4 Ensuring Compliance with the Licensing Support System

To ensure that progress is made in designing, developing and loading the LSS, NRC regulations provide that DOE's license application cannot be docketed under Subpart J unless the LSS Administrator certifies, at least six months before the application is submitted, that DOE has complied with its obligations relating to the LSS. Although Subpart J requires the certification decision six months before submission of the DOE license application, the Commission anticipates that the LSS participants will have access to the LSS well before the license application is submitted.

In theory, the LSS should enhance the ability of parties, potential parties and interested governmental participants to identify and resolve licensing issues early and prepare more effectively for the hearing, thus facilitating the NRC's ability to complete its review of DOE's license application as quickly and efficiently as possible. The parties' access to the LSS will largely take the place of traditional document discovery during the repository licensing proceeding.

1.3 RELATIONSHIP BETWEEN THE OCRWM RECORDS MANAGEMENT SYSTEM AND THE LSS

The OCRWM Records Management System (RMS) is the source of all data submitted to the LSS by OCRWM. It is estimated that 85% of the data in the LSS will be OCRWM data. This overwhelmingly large proportion of data from the RMS will significantly affect the data capture activities of the LSS.

The overlap between the data in the OCRWM RMS and the LSS suggests that significant savings could be achieved if the capture of RMS data is accomplished using LSS required formats. If data is captured by the RMS in non-LSS formats, the data would need to be converted to required formats when submitted to the LSS. The cost of data conversion both in time and money could be very high due to the large volume of data estimated for the LSS. The conversion cost would be further escalated if a quality check of the converted data would be required.

A review was conducted of the OCRWM RMS to determine if RMS data is currently compatible with the LSS requirements or if changes are needed to prepare for future LSS input.

1.3.1 OCRWM Records Management System Description

The overall objective of the OCRWM RMS is to capture and manage those records that document the chronology of events and decisions related to the Program mission. This includes records related to the Mined Geologic Disposal System as well as the Site Characterization, Waste Acceptance, Storage, and Transportation elements of the OCRWM Program. The RMS complies with policies and procedures that define the rules for capture and management. It utilizes a VAX/Ingres based indexing and retrieval system, the Records Information System (RIS), and micrographic technology to capture and preserve images of records. Documents which are not suited for microfilming are stored in their original form.

The M&O is responsible for managing and staffing the OCRWM RMS and the Central Records Facility. The records management staff uses established criteria and procedures to exclude from the records system records which are not relevant to the OCRWM Program mission. The records screening criteria is based on guidance provided by 10 CFR Part 2, Subpart J and the OCRWM Quality Assurance Requirements Description (QARD) document. Types of records which are excluded from the OCRWM RMS include administrative, non-QA procurements, financial and other similar business related records.

1.3.2 Future OCRWM Records Management System Description

In general, technology applicable to records management is in a state of transition. The OCRWM RMS is no exception. The original computerized RMS has recently been phased out and replaced by another VAX/Ingres based indexing system called the Interim-RIS (IRIS). The objective of the IRIS is to enhance records processing functions and improve the quality and accuracy of records indexing and retrieval. Implementation of the IRIS is integral to the task of reprocessing the approximately 500,000 records currently on file in the RIS. Reprocessing entails screening, indexing, and capturing an image of records currently in the RIS to reflect current requirements.

Another change being considered is replacing the microfilm with electronic images of records and documents and integrating these images with the IRIS system. The microfilming hardware used by OCRWM is becoming outdated and nearing the end of its service life. OCRWM is in the process of evaluating contemporary electronic image technology to capture and manage record images in compliance with both regulatory and operational requirements. With electronic imaging, it becomes feasible to integrate optical character recognition (OCR) technology with the other RMS functions. The OCR function would provide searchable text files in the RMS which would greatly improve records retrieval capability. As a result of enhancing retrieval capability via searchable text files, the current indexing practices could be revised to require fewer index header fields and less indexing labor.

If the OCRWM RMS transitions to an electronic image based system and includes, as part of the RMS data, the OCR text files created from the images, then the RMS data will contain the full suite of data needed by the LSS; i.e. bibliographic header, electronic image and text. Furthermore, if these RMS data products are stored in non-proprietary formats, this would ensure an optimum data transfer environment for the LSS.

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2. BACKGROUND

This section documents efforts to understand stakeholder expectations and identify any commitments made by DOE, NRC, or any other affected party regarding the development and use of the LSS. The material is grouped according to subject and organized chronologically with each group. A chronological summary of all groups is found in Table 2-1. This same information is presented in timeline form in Figure 2-1. An analysis is presented, based upon the findings and impressions of this investigation, which examines the implications of past efforts to define the LSS on future DOE policy decisions.

2.1 LICENSING SUPPORT SYSTEM MISSION

Under Section 114(d) of the NWPA, the NRC is required to issue a final decision approving or disapproving the issuance of a construction authorization for the high-level nuclear waste repository no later than three years after the date of submittal of a license application, with a possible one-year extension for good cause. Because the license application for other NRC regulated facilities have historically taken much longer than three years to review, NRC recognized a need to streamline the review process in order to meet the statutory review period. NRC noted that a significant portion of the license review period is associated with sending, receiving, and handling information and data. Based upon this observation, NRC has asserted that an electronic information management system that provides parties to the licensing proceedings with ready access to all relevant licensing documents could substantially reduce the license application review period. In particular, NRC has taken the position that an electronic information management system, referred to as the Licensing Support System, will:

- Eliminate the most labor and time intensive aspects of document discovery - the physical reproduction, review and exchange of documents after the license application has been submitted - by providing the opportunity to identify and submit discoverable documents before the license application is submitted.
- Facilitate a comprehensive and early technical review by NRC and other party staff of millions of pages of potentially relevant licensing material with electronic full text search capability.
- Result in better-focused contentions by providing parties to the proceeding early access to relevant licensing material
- Provide for electronic communications and transmission of all filings during the hearing, thereby minimizing administrative delays
- Eliminate burdensome Freedom of Information Act requests for the same information that both DOE and the NRC would likely receive if the LSS were not available
- Eliminate or reduce requests for extensions of time because documents were not provided or because adequate search time was not available.

In theory, this system should enhance the ability of potential parties to identify and resolve licensing issues early, and prepare more effectively for the hearing, thereby facilitating NRC's ability to complete its review of DOE's license application as quickly and efficiently as possible. Furthermore, early access to potentially relevant licensing material should allow the parties to effectively begin the document discovery process prior to submittal of a license application thus minimizing document discovery time during the repository licensing proceeding. It is noted that NRC has never required a license applicant to provide an electronic information management system as part of any licensing proceeding nor do they assure that the three-year license application review period will be met if such a system is implemented. However, it has been suggested by NRC that the license review will be protracted, or worse, the license application would be rejected, if the system is not implemented.

2.2 LSS RULEMAKING

The NRC's rules of practice for domestic licensing proceedings, (10 CFR Part 2) were modified in 1989 to require an electronic information management system to support the high-level waste licensing proceedings. This section summarizes the historical documents and events associated with the LSS rulemaking process leading up to and including promulgation of the final LSS rule.

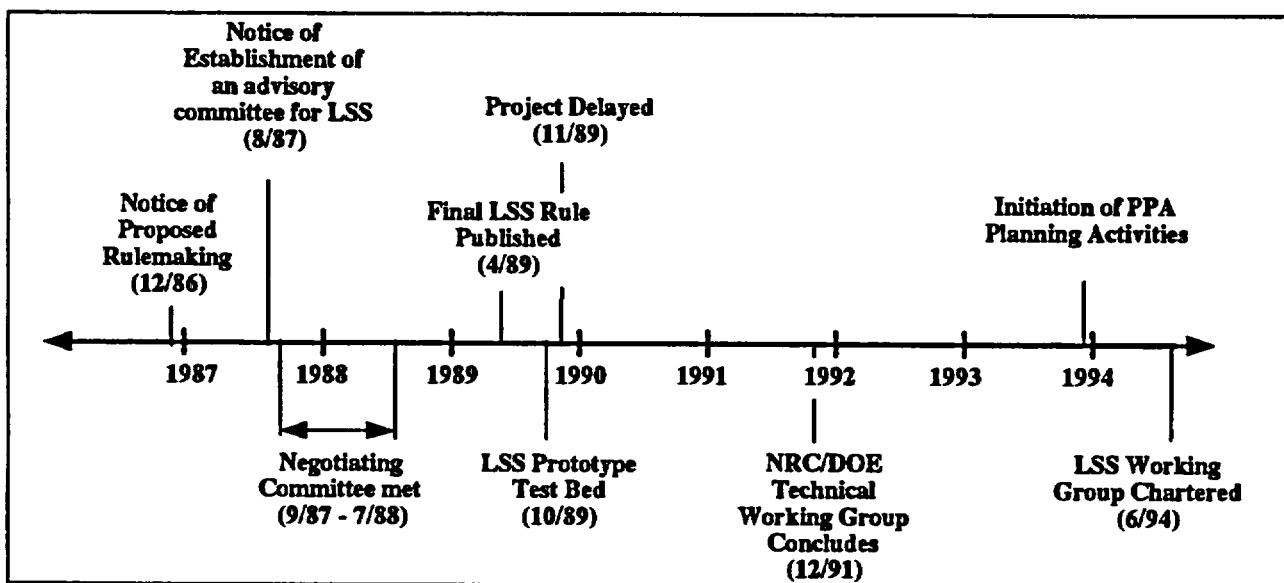


Figure 2-1. LSS Chronological Timeline

Table 2-1. LSS Rulemaking Chronology of Events

Date	Event
12/86	Federal Register notice announcing intent to form an LSS advisory committee to negotiate a the LSS rule
2/87	DOE/NRC sign an Agreement in Principle to develop the LSS (Rushe/Davis)
8/87	Federal Register notice to establish an advisory committed to negotiate the LSS rule
2/88	SAIC publishes the LSS Preliminary Needs Analysis - first in a series of four analysis documents
11/88	Proposed LSS rule published in Federal Register
1/89	SAIC publishes the LSS Benefit-Cost Analysis - last in a series of four analysis documents
4/89	Final LSS rule published in Federal Register
10/89	SAIC conducted LSS prototype tests
11/89	Secretary announced 6 year delay in submittal of license application
12/89	First meeting of the LSSARP
12/90	SAIC publishes LSS Systems-Level Requirements document
12/91	Joint NRC/DOE Technical Working Group published their report

2.2.1 "Negotiated" Rulemaking

On December 18, 1986, NRC published a notice of intent to form an advisory committee to negotiate a proposed rule on the LSS (51 FR 45338). NRC asserted that in order to meet the three year NWPA "...statutory deadline for making its decision on construction authorization, specific measures must be taken to streamline the NRC review process. One such measure is the development of an electronic information management system to provide parties to the licensing proceeding with ready access to all relevant documents." In this same notice, NRC announced that "...in an agreement with DOE, NRC will carry out a pilot project to demonstrate storage and

retrieval capabilities and to develop processes that could lead to an interim system for use within the NRC (and possibly by others) until the DOE's full information management system, formally known as the Licensing Support System (LSS) is implemented."

In February 1987, DOE and NRC signed an "Agreement in Principle" (DOE, 1987a - Rusche/Davis agreement) which committed the two agencies to prompt development of the LSS in support of the Commission's high-level waste licensing proceedings. This agreement noted that:

- There is a need to promptly develop the LSS as a major step in streamlining the licensing process
- In concert with DOE and other interested parties, a negotiated rulemaking should be initiated by NRC to describe the requirements for the system and for all parties in the licensing proceedings to fully participate in the use of the LSS in the licensing process.

A July 15, 1987 letter from DOE to NRC (DOE, 1987b) noted that all considerations of the Rushe/Davis agreement were currently being pursued. DOE intended to award a contract for LSS development in October 1987, negotiated rulemaking had been initiated, and pilot programs were ongoing at NRC and DOE to explore the use of on-line full text, image storage, and retrieval techniques. In the meantime, an Interagency Coordinating Committee (ICC) had been chartered to provide recommendations including system design, performance and operation, records management procedures, and standardized techniques for capturing documents in the electronic format. With the formation of the rulemaking committee noted below, the ICC was disbanded.

On August 5, 1987, NRC published a notice of establishment of an advisory committee to negotiate a proposed rule on LSS, and notice of first meeting (52 FR 29024). The first meeting of the negotiating committee was set for September 16-17, 1987. This notice also states that the Conservation Foundation will assist NRC in conducting the negotiation. It also references a report prepared by the Foundation (CF, 1987) which summarizes the existing framework for disclosure of documents relevant to a NRC licensing proceeding, and provides a detailed breakdown of the preliminary issues identified in the Federal Register notice. It also addresses disclosure of records and documents relevant to licensing.

The negotiating committee met nine times to craft the details of the LSS rule. The final meeting was held on July 20-21, 1988. During this meeting, the committee suggested that language be added to the rule regarding the relationship between the State of Nevada and UNLV which was named by Congress as the site where the LSS will be located. Representatives of the State declared that UNLV has an independently elected Board of Directors and, for this reason, they did not feel that it was necessary to add language to the rule clarifying there is in fact no formal relationship between UNLV and the State of Nevada for purposes of compliance with the LSS rule.

During this same meeting, the nuclear utility coalition announced their intent to withhold consensus on the negotiated LSS rule. The coalition's primary concern was the anticipated cost

of the LSS and that the LSS would not live up to its promise of meeting the three to four year licensing time frame. Because the proposed LSS was a first of a kind system, the coalition believed that problems with the system would lead to an extension in the licensing time instead of time savings. Anticipated problems included systems failures and the inability of the LSS to live up to the requirements of the rule and/or the expectations of the parties to the licensing proceedings.

Even though one of the parties to the negotiated rulemaking process withheld full support, NRC proceeded with plans to publish the new rule for public comment. As stated in the initial notice of intent to form the negotiation advisory committee, the Commission reserved the right to "...use the consensus report as a basis for a notice of proposed rulemaking..." and if consensus was not reached, "...develop the rule on its own." Thus, the LSS rulemaking process was not negotiated rulemaking in the traditional sense. The Commission clearly retained ownership of the LSS rule and does not require absolute consensus for any potential revision to the LSS rule.

2.2.2 Final Rulemaking

The NRC published the proposed LSS rule on November 3, 1988; the comment period closed on December 5, 1988. The final LSS rule was published in the Federal Register on April 14, 1989 (54 FR 14925). The supplementary information published with the final rule addresses the comments and concerns received during the comment period and provides a wealth of information for interpreting the explicit and implicit requirements for the LSS.

One item of interest published in the supplemental information is the Topical Guidelines for use in identifying LSS documentary material. These guidelines were intended to be used until NRC formally published guidelines in the form of a Regulatory Guide. The NRC acknowledges, however, that these guidelines are not "...cast in stone." The text further states that NRC is "sympathetic to the need for excluding material that is not relevant to licensing..." It is also recognized that "Cost reductions may also be realized by scaling down the universe of documents to be entered into the LSS..." These comments suggest that negotiations are still possible to define a reasonable set of documents to be entered into the LSS. Based upon the LSS Advisory Review Panel (LSSARP) charter (see Section 2.4) and the LSS rule supplementary information, it is apparent that the negotiating committee intended for the details of defining acceptable document domain boundaries be worked out by the NRC staff to the satisfaction of the LSSARP.

A point of clarification apparent from the negotiated rulemaking sessions, and the supplemental information, is that members of the negotiated rulemaking committee intended for the LSS to be an electronic document discovery system. In the supplemental information, the State of Nevada stated that "The give and take (of the negotiations) resulted in a proposed electronic discovery and motions practice system which will enhance the parties' ability to fully inform the hearing panel, and thus the Commission, on the difficult issues involved in the licensing of a repository." Furthermore, it is stated that "The LSS provides document discovery in the HLW licensing proceeding, supplemented by the derivative discovery in §2.1019. Discovery is limited to access to the documentary material in the LSS...".

Another expectation from the negotiated rulemaking committee reflected in the LSS rule is that the LSS should be available as soon as possible. As noted in the supplementary information, "...in order to accomplish the LSS objectives, DOE must have the LSS operational as far in advance of the submission of the license application as feasible," and that "DOE, with the assistance of NRC and other affected parties, must make their best efforts to see that the LSS is operational as soon as practical before the license application is submitted."

2.3 PREVIOUS EFFORTS TO DEFINE THE LSS

The Office of Management and Budget (OMB) named the LSS a Presidential Priority System in 1987 due to its size, complexity and national importance. Working with OMB, DOE developed the required design and cost benefit analyses. Reports documenting these analyses are summarized below.

2.3.1 SAIC Analysis Documents

In 1987, SAIC was contracted by DOE to formulate the requirements necessary for subsequent LSS design work as required by OMB. This work was initiated with the knowledge that the Negotiated Rulemaking Advisory Committee (NRAC) was still in the process of negotiating many LSS details including systems requirements. Nevertheless, work proceeded in an attempt to expedite LSS development. The results from the SAIC work were presented in a series of four reports:

- Preliminary Needs Analysis
- Preliminary Data Scope Analysis
- Conceptual Design Analysis
- Benefit-Cost Analysis

The needs analysis presented in the Preliminary Needs Analysis (DOE, 1988a) considered four principal sources of information; 1) the results of early needs assessments for the LSS and for similar systems, 2) the current status of the NRAC, 3) the requirements applicable to LSS that result from other than user needs (such as institutional or legal requirements), and 4) the results of a survey of potential LSS users. This document presents broad user expectations and desired system functionality which includes general research, regulatory research, document preparation, and project management functions (e.g. commitment tracking, issue resolution tracking, etc.). Although generally consistent with draft NRC guidance, this functionality is much broader than required for the document discovery system described in the LSS rule. Nevertheless, these expectations were the foundations for the subsequent LSS system design concept and became an integral part of the SAIC design.

The Preliminary Data Scope Analysis (DOE, 1988b) presents a comprehensive survey of all previous efforts to define the scope and content of the LSS. This survey includes analyses performed by NRC and DOE contractors as well as LSS inclusion/exclusion categories proposed by various stakeholders. This document estimated that the LSS will contain an upper bound of 41 million pages of information when (and if) the license application is appended to receive and possess high-level nuclear waste.

Because of the diverse objectives and needs of potential LSS users, the Preliminary Data Scope Analysis concludes that "...it is essential that LSS contain all the data needs of all anticipated users. To plan for less than this is to risk an incomplete data base and extend the licensing period beyond the target of less than three years." If one reviews the subject matter categories of documents for LSS inclusion/exclusion prepared by the State of Nevada alone (Appendix B of DOE, 1988b), it is readily apparent that a) there are no document temporal constraints, and b) the proposed content is broad and comprehensive.

The Conceptual Design Analysis (DOE, 1988c) builds upon information presented in the previous two analyses and formulates a conceptual design. The document examines several variants of this design and screens out those designs believed to have a low probability for success. As discussed previously, the functionality of these designs meet and exceed required LSS functionality because expansive user expectations have been embodied in them. The operational concepts presented in this report consider only the functionality required for the LSS to satisfy its intended mission as a document discovery system.

The final document in the SAIC suite, the Benefit-Cost Analysis (DOE, 1989a), examined the cost versus benefit for design variants presented in the Conceptual Design Analysis to identify a preferred design. This document is significant because it suggests that the total LSS cost (which included OCRWM records management cost) would be roughly equivalent to the cost of a one year delay in the repository licensing operation (\$200M in 1988 dollars). It is also stated that the predominant cost contribution to the LSS is labor, primarily for the capture process and for system operation.

Because labor costs for the capture process are directly proportional to the volume of data residing in the LSS, a natural strategy for reducing the overall LSS life-cycle costs would be to limit the volume of data entered into the LSS. However, the Benefit-Cost Analysis document suggests that "To force a cost reduction in the LSS through a reduction in ... data volume ... would risk a loss of system usefulness and user confidence, which could jeopardize the basic goal of shortening the repository licensing process."

Once these documents were reviewed by OMB, DOE was given approval to proceed with implementation of the LSS. In the same year (1988) during his farewell address on management issues, President Reagan removed the LSS from the Presidential Priority list by declaring that the system was no longer in need of OMB oversight. The four analysis documents were packaged into the Licensing Support System Concept Feasibility Analysis (SAIC, 1988b). This document summarizes the four analyses and includes the text from them as attachments.

2.3.2 LSS Prototype Testing

Because no computerized document management system for licensing support of comparable size and complexity existed, several design questions and issues arose during the conceptual design analysis that needed resolution before the system design could proceed. To address these issues, a LSS Prototype Test Bed was defined and documented in the Prototype Development Plan (SAIC, 1988a). The Prototype Test Plan (SAIC, 1988b) outlined the design issues the prototype test bed would address and described the data to be collected, procedures for the data collection

and the context in which the data would be used. The prototype test bed was intended to build an experience base for defining procedures for the capture of LSS document text, images, and catalogued header data, and provide LSS developers and users the opportunity to experiment with and to refine concepts of how people will use the LSS.

The prototype user tests were conducted from October 2, 1989 through October 13, 1989. During this two-week period, the search and retrieval strategies and behaviors of 44 users were studied using the LSS prototype test bed. The lessons learned and the analysis of the data collected during the prototype user tests are presented in the Licensing Support System Prototype Test Report (SAIC, 1990a).

System requirements for the LSS were compiled in the Licensing Support System System-Level Requirements Document (SAIC, 1990b). This document includes requirements derived from all previous efforts to define the LSS, as well as the knowledge gained during the prototype tests. This document is considered the de facto LSS functional requirements document because it captures user expectations and functionality presented in all previous SAIC design and analysis documents. A revision to this document will be necessary to reflect changes in technology, user expectations, and most importantly, fundamental changes in the LSS operational concept.

2.3.3 Program Delay

DOE was well into the procurement process for the first phase of the LSS when, in November 1989, the Secretary announced a 6 year slippage in the projected license application submittal date. With this slippage, DOE believed the LSS was no longer on the critical path for repository licensing and should be developed on a schedule consistent with the remainder of the project. Conversely, NRC strongly desired to continue development of the LSS. The two agencies reached an impasse regarding the development schedule and funding responsibilities. The issues at the time were enumerated in a memorandum from the OCRWM director to the Secretary (DOE, 1991a). This memo notes that OCRWM remains committed to timely, cost-effective implementation of the LSS.

Based upon the Program schedule slip, DOE reasoned that the design and procurement strategy that was appropriate for a 1995 license application no longer made technical or fiscal sense (DOE, 1991b). Since it was projected that DOE will provide 80-90% of the information in the LSS, the delay was recognized as an opportunity to concentrate on getting DOE information management policies and systems in order to be better prepared for information submittal to the LSS. While performing these activities, DOE realized that the most efficient way to handle LSS information is to treat it as one stream within the context of all OCRWM information.

The program launched by OCRWM to modernize their information resources across the nation was called InfoSTREAMS (an acronym for Information Storage/Retrieval/Access Management System). During a July 17, 1991 meeting of the LSSARP, DOE presented the status of OCRWM's information management environment, including InfoSTREAMS. It was noted during the presentation that many planned InfoSTREAMS features were consistent with those of the LSS (e.g. text and image capture). It was also noted that implementation of InfoSTREAMS would eliminate the need to capture documents generated by OCRWM using the LSS capture

stations proposed in the SAIC design. The planned development of InfoSTREAMS within OCRWM therefore altered the view of the LSS that had been developed and documented several years earlier by SAIC.

2.3.4 Re-evaluation of LSS Concept

NRC viewed the new InfoSTREAMS project as a way to help keep LSS development on track while minimizing cost. During a meeting between the NRC Chairman and the DOE Secretary, which included a discussion of the LSS, the two agreed that both agencies should take a "fresh, top-down look at the LSS". Following this meeting, DOE officially proposed, and NRC agreed to, a joint NRC/DOE effort to reexamine the LSS (DOE, 1991c; NRC, 1991). As a result of this agreement, the NRC/DOE Technical Working Group was formed.

The charter of the joint NRC/DOE Technical Working Group was to:

- 1) Reexamine the original SAIC-proposed LSS design to determine if it is technically sound, if it conforms to current technology, and if it is susceptible to substantial cost reduction measures
- 2) Examine the LSS Administrator-proposed cost-reduction measures to determine if they are technically acceptable and feasible
- 3) Consult NRC office representatives to determine whether their needs will be met by the LSS and, if so, whether enactment of the cost reduction measures would compromise the functionality of the LSS to the extent it would not meet their needs.
- 4) Contrast the functional requirements of the LSS with other government and industry specifications and offerings

Activities of the Technical Working Group concluded in December 1991. Findings related to the Group's charter are presented below.

Regarding items 1 and 4 of the Working Group's charter:

- "The Working Group concludes that, given the constraints of the LSS Rule, the SAIC design is a good one. The Group is confident that the system designed by SAIC can cost-effectively deliver the functionality and service expected by LSS participants and required by the LSS rule."
- "Based on the Working Group's review of the SAIC design, and the continuing effort of the DOE to stay abreast of the technology, an examination of other government and industry offering would not be warranted."

Regarding item 3 of the Technical Working Group's charter:

"All organizations consulted were unanimous in the opinion that any significant deviations from the functional requirements for the LSS would be viewed negatively by the non-federal

participants in the rulemaking process. The LSS Rule would require re-negotiation with uncertain results."

The LSSA had proposed several cost-reduction options which were to be considered by the Technical Working Group. These option included:

- Capture all DOE and NRC documents through InfoSTREAMS and LSS would re-use InfoSTREAMS capture software
- Limit LSS to QA, database maintenance, user service, capture of non-NRC/DOE material and data dissemination
- Eliminate digital image storage and retrieval
- Distribute DOE and NRC documentary material as paper copies
- Users would provide their own workstations
- Simplify LSS document capture/QA by eliminating digital imaging
- System operation would begin 15 months later than the current plan
- User training and support locations/services would be reduced
- Exclude all documents generated prior to 1982 from the LSS

After considering these cost reduction options, the Technical Working Group concluded:

- "Major cost reductions in the low-cost alternatives are, in fact, not cost reductions but cost shifts to other OCRWM or NRC organizational units outside the LSS budget"
- "The cost reduction methods presented by the LSSA are feasible; however, it is quite possible that resultant reductions in the benefits will outweigh any cost reductions"

With regard to excluding pre-1982 documents, the Technical Working Group stated that "based upon information gathered during the interview process, the group concludes that the parties to the negotiated rulemaking deliberately did not constrain the age of the documents stored in the LSS." On this same topic, the Group stated that "...while the Working Group believes that limiting the size of the database through a date boundary saves money, it also believes that this limitation would disappear in the face of later reality, with the possible result of giving up the cost savings achieved earlier to hurried and expensive solutions needed later." The scenario described considers the exclusion of pre-dated relevant documents from the LSS that would require DOE to "bulk dump" the data into the LSS at a later date at the request of an intervenor.

Finally, the Technical Working Group suggested that work on the LSS must continue expeditiously or there is great risk that the database will not be available when needed. It was estimated that it will take two to four years to load 20 million pages of document text into the LSS database in addition to the five years it will take to procure, develop, implement, and test the

system. If these estimates are indeed accurate, then it is apparent that the LSS, as currently defined, will not be ready for certification six month prior to the projected License Application submittal date of 2001.

Although the Technical Working Group presented findings for each task in its charter, the bases for these findings were not well documented thereby suggesting that its investigation was inadequate. For example, had the Group queried the existing records system, they would have discovered that there are only about 16,000 pre-1982 documents in the OCRWM records system representing only about 200,000 pages. This data volume is trivial when compared to the total projected system volume of tens of millions of pages. This observation would have led to rejection of the date boundary issue because of the insignificant nature of the cost savings. Furthermore, the Group did not conduct the task in their charter to contrast LSS functional requirements with other government and industry offerings. This task was presumably included in the charter as a metric to ensure that the LSS was being developed in the most prudent and cost effective manner. Without performing the chartered survey, the Technical Working Group could not adequately document its position that the SAIC design was the most prudent LSS solution.

2.4 LICENSING SUPPORT SYSTEM ADVISORY REVIEW PANEL

Provisions for the creation of the Licensing Support System Advisory Review Panel (LSSARP) were included in the LSS rule (§2.1011(e)(1)). The members of this panel initially included representatives from all parties who participated in the negotiated rulemaking. Current LSSARP membership includes DOE, NRC, Nye County, Inyo County, Clark County, Nuclear Energy Institute, State of Nevada, and the National Congress of American Indians. The Panel officially reports to the LSS Administrator who has the authority to appoint additional members to the Panel, as necessary. The NRC representative serves as the Chairman of the Panel. The Panel is expected to continue through the conclusion of the licensing hearing. In the context of the current Program approach, this term would be until the construction license is amended to permit DOE to receive and possess high-level waste.

The purpose of the Panel is to provide advice to DOE on the fundamental issues of design and development of the computer system necessary to implement the LSS, and the LSS Administrator on the operation and maintenance of the LSS. Specific responsibilities include providing advice on:

- Format standards for the submission of documentary material to the LSS
- The procedures and standards for the electronic transmission of filings, orders, and decisions during both the pre-licensing application phase and the license proceedings
- Access protocols for raw data, field notes, maps, etc. (otherwise referred to a graphic-oriented documentary material)
- A thesaurus and authority table
- Reasonable requirements for headers, the control of duplication, retrieval, display, image delivery, query response, and user friendly design

- Other duties as specified by the LSS Administrator
- Protocols on digitizing equipment

In addition to these duties, the LSSARP charter states that the Panel will develop recommendations on establishing priorities for the loading of documentary material into the LSS and will review and comment on proposals on whether particular categories of documentary materials should be included in the Topical Guidelines.

Both DOE and the LSS Administrator are to implement the consensus advice from the LSSARP when it is consistent with the requirements of Subpart J (§2.1011(b)(3) and §2.1011(d)(1)). Consensus advice is defined in the traditional sense - all Panel members are in agreement (NRC, 1990). In the event of dissent, the Panel will provide advice on the basis of majority view with all dissenting views attached.

2.4.1 LSSARP Accomplishments

The first LSSARP meeting was held on December 19, 1989, approximately seven months after the LSS rule was promulgated. The LSSARP initial focus was better defining the type of documents to be included in the LSS. The supplemental information published with the final rule enumerated draft topical guidelines, but it was NRC's responsibility to publish these guidelines in the form of a Regulatory Guide, and the responsibility of the LSSARP to provide advice to the Commission on the contents of the document. The LSSARP formed a task force to provide advice on the topical guideline to the Commission.

The LSSARP also formed a working group to define the types of fields required for the header of each LSS record. The final results from the LSSARP working group were presented during the April 1994 meeting. It is noted that discussions on the header specification were initiated during the first LSSARP meeting, approximately three years earlier.

The activities of the LSSARP have been generally fragmented. Although there has been much discussion on various issues, there is little to show in the form of documented progress. Consequently, if the LSSARP is to become the forum it was intended to be for resolving issues related to the LSS, the LSSARP must become more focused on the issues brought before them. DOE must assume a proactive role in bringing issues to the attention of the LSSARP and ensuring that these issues are acted upon promptly.

2.4.2 Current Issues for LSSARP Consideration

The LSSARP was created by Subpart J as an integral part of the structure supporting the development and operation of the LSS. The LSSARP is the forum in which to define and resolve issues impacting the design, fabrication, and operation of the LSS. The following list enumerates a number of issues critical to the form, structure, and future operation of the LSS, some that have already have been identified by the LSSARP, and others that should be placed before the LSSARP. No attempt has been made in the list to establish any priority among the issues. All of these issues are issues that OCRWM needs to have resolved in order effectively implement the LSS.

LSS Operation -- NRC is interested in identifying an arrangement whereby funds for LSS operation are allocated from the Nuclear Waste Fund instead of the NRC line item budget. The challenge with this issue is ensuring that NRC maintains control over LSS operations, with funding obtained from another executive branch agency.

Functional Requirements -- Although the system-level functional requirements document generated by SAIC (SAIC, 1990b) appears to reflect the most current LSS requirements, this document is in need of revision. LSSARP involvement will be necessary during the revision of the document.

Technical Working Group -- The LSSARP has identified the need for a technical working group to review the technical details of all LSS design activities. This working group would be an appropriate forum to negotiate a revision to the LSS functional requirements document.

Contents of LSS -- The problem of identifying what is to be input into the LSS continues to be unresolved, however, the Working Group has identified a strategy to deal with this issue (see Section 3.3.2).

Concept of Operation -- Certain concepts of operation and/or user expectations must be discussed with the LSSARP before detailed requirements can be generated. Such concepts include downloading text for word processing activities, timeliness for availability of images, acceptability of text that has processing errors, etc.

LSS Acceptance Criteria -- The quantitative and qualitative standards for evaluation and certification of the LSS have not been documented. Before OCRWM can work effectively toward LSS certification, the criteria NRC intends to apply to certification need to be identified.

Document Copyright -- Documents bound for the LSS may be copyrighted. The LSSARP should help to develop a procedure acceptable to all of how to deal with copyrighted material in the LSS.

Records Management System versus LSS -- There is confusion amongst the LSS community as to the respective roles of the OCRWM records management system and the LSS. This confusion has been maintained by the suggested reuse of InfoSTREAMS software. The relationship between the OCRWM records management system, InfoSTREAMS, and the LSS must be understood. It must also be reinforced that the records management system used by all parties to the licensing hearing must be independent of the LSS.

Bibliographic Headers -- The LSSARP header working group has evolved a view of the structure and magnitude of header information that it considers desirable for the LSS. This view needs to be examined within the LSSARP relative to interface issues with agency records systems, and to reevaluate whether the complicated indexing proposed is necessary given full text search capability.

LSSARP Charter -- The LSSARP should reconsider their charter to determine if it should be expanded beyond the current statement which is essentially the definition from Subpart J. The

evaluation should consider the precise role to be played by the LSSARP in the design and operation of the LSS.

2.5 OBSERVATIONS/CONCLUSIONS

Based upon the historical research summarized in the previous sections, there appears to be many commitments and expectations regarding LSS development and use. This section attempts to focus these implicit and explicit expectations and draw conclusions regarding their current implications and impact.

DOE has effectively committed to building an LSS -- DOE was a party to the negotiating rulemaking committee which drafted the language found in the final LSS rule promulgated by NRC. The bases for this rule was negotiated in good faith and represents a near consensus amongst the participating parties (except for the nuclear industry). DOE has continued to show support for LSS development in numerous correspondences and through presentations and participation in LSSARP meetings.

The LSS is intended to be used as an electronic document discovery and motions practice system -- The LSS is intended to replace the traditional method of document discovery used in past licensing hearings. NRC is convinced that electronic document search and retrieval is absolutely vital in meeting the three-year review period required by the NWPA. Because an electronic discovery system represents a convenient and effective way to expand the range of searchable documents by all parties in the licensing process, all but the nuclear industry agreed with NRC's premise.

The negotiated rulemaking committee deliberately did not constrain the scope and age of documents to be contained in the LSS -- Because the LSS represents an electronic document discovery system, and the contentions allowed during the rulemaking process will not be known until they are admitted to the hearing by the Licensing Board, the scope of documents included in the LSS must be broad to satisfy NRC discovery requirements which generally follow the Federal Rules of Civil Procedure. This suggests that the LSSARP will not easily agree to cut-off dates or any other restrictions to the range of documents included in the LSS except for non-controversial document categories.

It is unlikely that parties to the negotiated rulemaking would agree to any significant changes to the current LSS rule -- As stated previously, the LSS rule was negotiated in good faith and represents a near consensus amongst the participating parties. The state and counties have repeatedly expressed opposition to any modifications to the rule that would further compromise the agreements made in the negotiated rulemaking process. However, in the initial rulemaking, the NRC demonstrated independence from the rulemaking participants and has indicated that it is amenable to Subpart J amendments that would delete specific technical hardware/software references and requirements.

The LSS is expected to be brought on-line as soon as practical -- In order for the parties to the hearings to benefit from the LSS, it is expected that the LSS will be operational years before the license application is submitted. Realistically, time will be necessary to load the LSS, resolve

hardware and software problems, and allow users to learn how to effectively use the system. Early use of the system will provide the opportunity for users to gain confidence in the system, or conversely, point out its weaknesses while there is time to fix them.

LSS functional requirements must be developed and presented to the LSSARP for review -- The only significant attempt to define the LSS functionality was performed by SAIC in the 1988 - 1990 time frame. The SAIC LSS Systems-Level Requirements Document (SAIC, 1990b) was reviewed by the LSSARP, but never endorsed by the Panel. At the December 12-13, 1994, LSSARP meeting, the Panel stated that the SAIC document was never embraced because the requirements were viewed by many members as excessive. A new LSS functional level requirements document is therefore necessary to document the intended LSS functionality, and to communicate this functionality to the Panel members.

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3. LSS REQUIREMENTS

3.1 REGULATORY REQUIREMENTS

Functional requirements for the LSS are presented in 10 CFR Part 2, Subpart J. In addition, Subpart J identifies the LSS users, describes the responsibilities of DOE and the NRC relative to the LSS, and defines an oversight group for the LSS. These latter requirements are summarized in Appendix A of this report. Only the LSS functional requirements are summarized in this section.

The LSS functional requirements are few in number. They are specified in just four sections of Subpart J and are presented below.

10 CFR 2.1002, High-level waste Licensing Support System

- The LSS is an electronic information management system containing the documentary material of the DOE and its contractors, and the documentary material of all other parties, interested governmental participants and potential parties and their contractors.
- Access to the LSS by the parties, interested governmental participants, and potential parties provides the document discovery in the proceeding.
- The LSS provides for the electronic transmission of filings by the parties during the high-level waste proceeding, and orders and decision of the Commission and Commission adjudicatory boards related to the proceeding.

10 CFR 2.1003, Submission of material to the LSS

- Submission of material to the LSS shall be accomplished by submitting an ASCII file, an image, and a bibliographic header for all material to be included in the LSS.

10 CFR 2.1007, Access

- Access to the LSS for potential parties, interested governmental participants, and parties will be provided by full text search capability through dial-up access from remote sites, image access at remote locations, and the capability to electronically request a paper copy of a document at the time of search.
- During the pre-license application phase, terminals for access to full headers and access to images will be provided at DOE Headquarters, NRC Headquarters, and at all NRC and DOE public reading rooms in the vicinity of the candidate site for a geologic repository. Additionally, terminals will be provided at the Uranium Recovery Field Office in Denver, Colorado, and at Las Vegas, Nevada; Reno, Nevada; Carson City, Nevada; Nye County, Nevada; and Lincoln County, Nevada. After the license application is docketed, access is to include searchable full text at the identified sites.

10 CFR 2.1013, Use of LSS during the adjudicatory proceeding

- The LSS Administrator shall establish a file within the LSS to contain the official record materials of the proceeding in searchable full text, or for material that is not suitable for entry in searchable full text, by header and image, as appropriate.
- Transcripts will be entered into the LSS on a daily basis.
- All filings in the adjudicatory proceeding shall be transmitted electronically. Parties and interested governmental participants will be required to use a password for electronic transmission of documents.

The technical description of the LSS is general in nature. It is an electronic information management system whose purpose is to support document discovery. It is a system that can be used from selected remote sites, a system that will support full text searches, a system that will supply images to users as requested, and it is a system that will allow communications and electronic transfer of information. The details of how the LSS is to be designed, constructed, and operated to meet these goals are not identified as LSS requirements.

3.2 USER EXPECTATIONS

It is generally believed that the total system-level requirements for the LSS consist of regulatory requirements, derived requirements (i.e., requirements imposed by operational necessity), and user expectations. Only user expectations will be addressed in this section.

User expectations consist of those views by potential users that somehow have been endorsed by a group or organization as legitimately establishing a standard of performance, a characteristic, or a feature of the LSS. There are a number of questions that arise from this definition regarding the identity of the group or organization that can authorize views by users as valid expectations, regarding the standards that are used to validate user views, and regarding the identification of any currently accepted user expectations. The historical records have been searched, but no clear answers have emerged to these questions.

A search of the LSS historical record for user expectations leads to the LSS Preliminary Needs Analysis (DOE, 1988a). This document is based in part on results from surveying potential LSS users. However, the majority of interviews and data collected was directed not at potential LSS users, but at potential users of an OCRWM records management system (the majority was DOE personnel). While it is estimated that DOE material will comprise 85% of the LSS material, DOE will be primarily interested in discovering information in the remaining 15%. The primary users of the LSS will therefore be parties other than DOE.

Subpart J only requires that the LSS support document discovery. By contrast, the preliminary needs document identifies additional functionality to provide access to licensing information, provide an automated library of reports, and serve as a mechanism for tracking OCRWM compliance. Hence, the data developed in the LSS Preliminary Needs Analysis document are inadequate to the present needs of identifying LSS user expectations for an LSS that is a tool for document discovery only.

The system-level requirements document (SAIC, 1990b) was examined for user expectations. The contents of this document include many aspects of design and procedures that might be associated with the LSS, but no indication that any of these came from an articulation and validation of user expectations.

The conclusion reached after examining the available historical data, the final rule, and the negotiating record is that there is no well defined set of user expectations that has evolved from user views and preference; been validated as appropriate to evaluate the impact to LSS implementation; and for which the origin of the expectation has been documented. However, there is some sense of common concerns by potential users throughout the historical material. For example, there seems to be a common view that the requirements of Subpart J are appropriate to an LSS, and there seems to be a common view that the LSS should come into being at the earliest possible time.

3.3 LSS CONTENT

Past and present LSS cost projections indicate that LSS life-cycle costs are sensitive to the volume of information included in the LSS. Thus, in order to estimate total LSS cost, an estimate of the volume of information to be included in the LSS is necessary. This section describes the method used to estimate total pages and presents the results. It also discusses the issue of document relevancy (and thus information volume) and presents an approach for resolving this issue. Finally, the requirement to include non-concurred draft documents in the LSS is discussed.

3.3.1 Data Volume

The cost estimates described in Section 5.2 present LSS life-cycle costs for a total volume of pages included in the system. In order to predict absolute system costs, and provide nominal system design parameters, the projected volume must be estimated. This section briefly describes the data volume estimates performed by SAIC during the initial LSS design effort in addition to updated calculations used by the Working Group to perform cost estimates.

3.3.1.1 SAIC Volume Estimates

In their Preliminary Data Scope Analysis document (DOE, 1988b), SAIC estimated lower and upper bounds on the volume of the LSS database. This estimate examined the holdings of the various records systems at the time, and projected the holdings in each to August 1990, the time at when the LSS was to be partially loaded and available for use. The methods used to make these projections varied, but in general, were based upon historical growth rates for each system, estimates of the number of pages per document, percent of documents judged to be licensing relevant, and percentage of duplicate documents in each system. The low and high estimates were then extended through the year 2009 by assuming compounded annual growth rates of 10% and 20%, respectively, and distributing this growth in accordance with planned Program activities and milestones. The results of this estimate are shown in Figure 3-1.

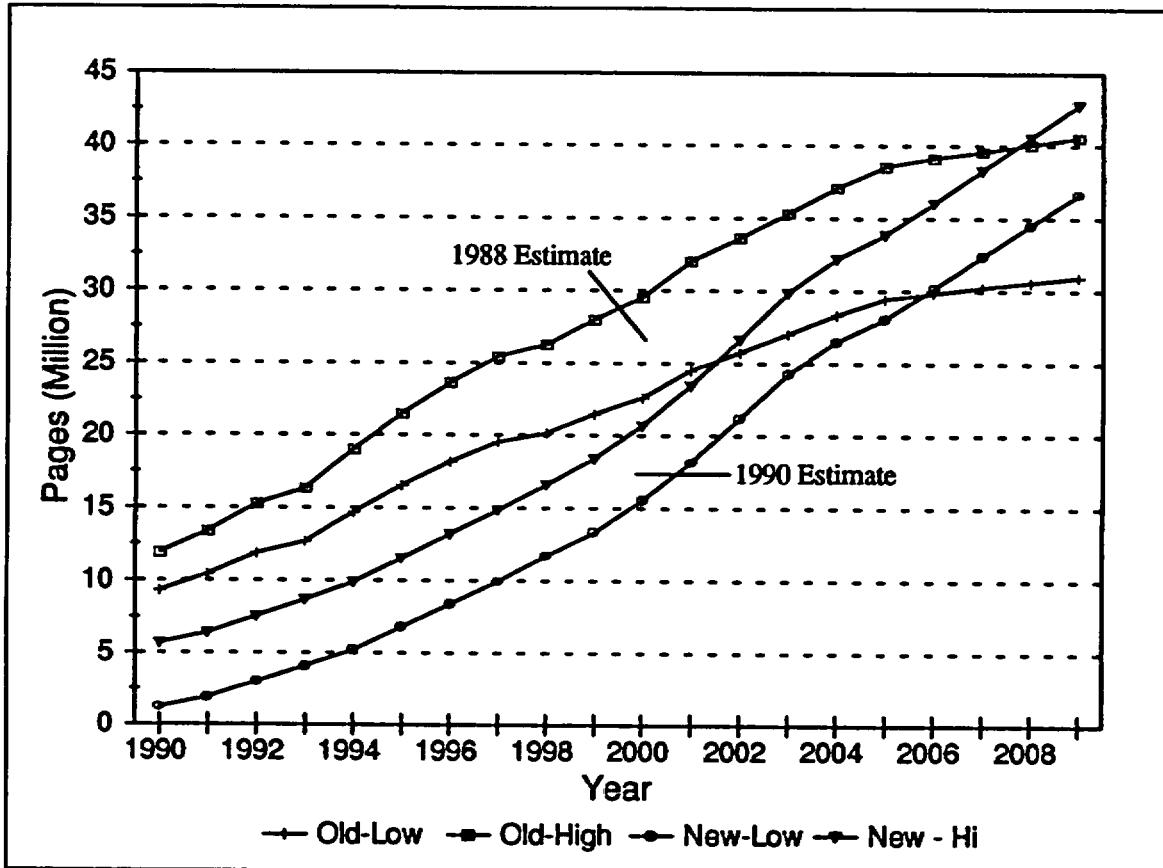


Figure 3-1. SAIC Data Scope Analysis Results

SAIC subsequently updated the initial data volume calculations to reflect changes in the repository Program, and to correct calculation errors that were discovered after the initial estimates were published. The results of this effort were published in the LSS Revised Data Scope Analysis (SAIC, 1990c) and are compared to the initial estimates in Figure 3-1. When the calculation errors were corrected, the initial data volume numbers dropped substantially. By the year 2009, the end point of the revised estimates approached the end point of the initial estimates. This result is due primarily to a increase in the percentage of documents assumed to be licensing relevant.

3.3.1.2 Working Group Volume Estimates

The LSS data volume estimates were revised by the Working Group to reflect the specific milestones and deliverables associated with the Program approach, and to reflect refinements in the records system document screening practices introduced since the SAIC estimates were performed. Like the SAIC estimates, the total volume is expressed in terms of pages, consists of contributions from DOE, NRC and other stakeholders, and is coupled with the current Program schedule. Unlike the SAIC estimates, the licensing relevancy of a document is not considered explicitly. Furthermore, the volume contributions from the NRC and stakeholders are estimated in a less rigorous manner than the DOE contribution, because DOE is expected to produce 80 - 90% of the LSS volume.

Initial Conditions

Historical records system data are used as a starting point for estimating future DOE LSS contributions. The Headquarters and Project Interim Records Information Systems (IRIS) were queried to obtain a count of the total documents entered into each system as a function of time. Table 3-1 presents the results of this query.

Table 3-1. OCRWM Records System Intake (Records/Year)

Year	HQ	YMSCO	Total	Pages
1987	104,452	33,815	138,267	1,797,000
1988	51,936	16,941	68,877	895,000
1989	29,407	52,967	82,374	1,071,000
1990	13,874	61,920	75,794	985,000
1991	14,891	29,616	44,507	579,000
1992	7,460	29,412	36,872	479,000
1993	10,011	29,835	39,846	518,000
1994	23,350	21,266	44,616	580,000

The total number of pages are estimated by multiplying the document totals by 13 pages/document, the average number of pages per document for the combined Headquarters and Project records systems.

OCRWM Volume Profile - The Delphi Method

Although the major milestones associated with the Program approach are defined, the volume of information generated to support these milestones is unknown. Instead of assuming a nominal volume growth rate, the Working Group polled a set of senior Program employees to elicit their knowledge of the Program approach and expected documentation. An informal survey was distributed to certain individuals who retain a share of the "Program memory" and who were involved with planning the Program approach. Each participant was asked to estimate the relative volume of pages that they felt would be entered into the OCRWM records system between now (1994) and the year 2010. The participants normalized their estimates relative to the year(s) that they expected the maximum records system intake to be. The results of the survey were then averaged (using the harmonic mean) to yield the relative profile shown in Figure 3-2. This profile

was converted to absolute pages based upon a multiplier obtained from the 1994 relative factor and the 1994 data volume (multiplier = 1994 volume / 1994 relative factor).

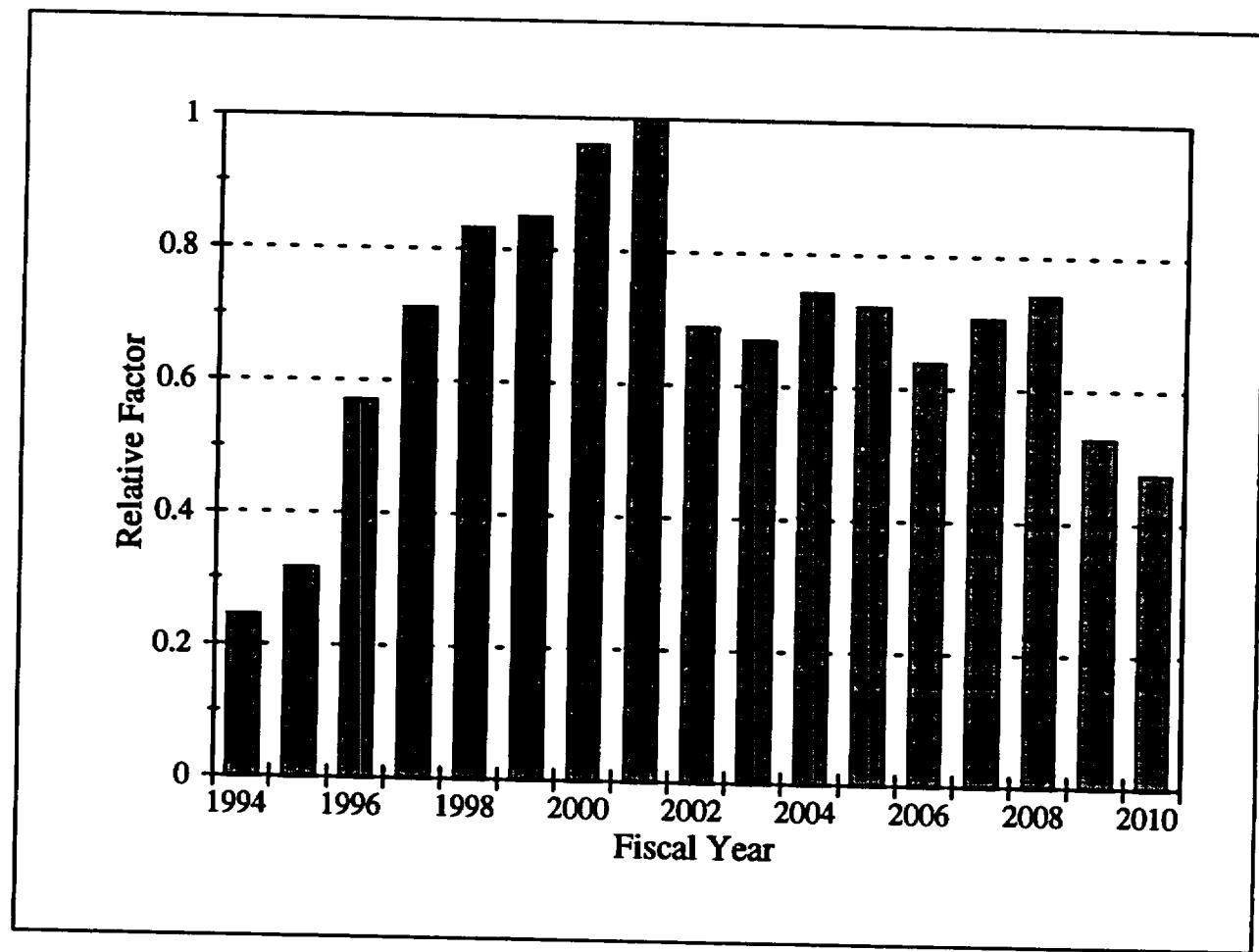


Figure 3-2. OCRWM Records System Intake - Relative Profile

NRC and Stakeholder Contributions

The NRC volume contributions were estimated based upon two data points provided by NRC. NRC provided the total number of licensing relevant pages for 1990 and for 1994. These data are summarized in Table 3-2.

Table 3-2. NRC Licensing Relevant Pages

Year	Pages
1990	315,000
1994	550,000

The slope of a line drawn between these two points is 58,750 pages/year. NRC volume contributions are projected through FY10 by assuming this slope increases at nominal compounded growth rate of 10%/year. Using this method, the cumulative NRC page count in FY10 is 2.7M pages. These pages are distributed over time using a normalized distribution function based upon the one assumed for OCRWM contributions (Figure 3-2).

The various stakeholders participating in the LSS Advisory Review Panel were asked to provide an estimate of their total expected contributions to the LSS. The sum total of their responses was 830,000 pages. This cumulative volume was distributed over time using the same method described previously for NRC contributions.

Revised Estimates

The projected cumulative records system intake through the year 2010 is tabulated in Table 3-3 and plotted in Figure 3-3. This figure includes parametric curves which are intended to illustrate the impact of document relevancy on the volume projections. The 90% relevant curve represents the LSS data volume expected if OCRWM includes all records from the RMS in the LSS except for those specifically excluded by the LSS rule. It is therefore an upper-bound. The 50% relevant curve illustrates the data volume reductions possible if more selective inclusion criteria are used to screen documents. The 50% curve is arbitrary. The actual data volume reduction would depend upon the inclusion criteria selected.

The Working Group volume projections are also compared with the 1990 SAIC volume projections in Figure 3-3. The primary difference between these two projections is the rate at which data is projected to grow after the license application is submitted. Finally, the data volume projections have been overlaid with the Program approach schedule and relative profile in Figure 3-4 for a composite view of the data volume calculations.

Table 3-3. Working Group Projection of LSS Data Volume

Year	OCRWM Pages/Year	OCRWM Cumulative	NRC Pages/Year	NRC Cumulative	Others Pages/Year	Others Cumulative	Total Pages Added Yearly	90% Relevant Cumulative	50% Relevant Cumulative
1994	580,000	6,905,000	59,000	550,000	18,000	18,000	657,000	6,782,000	4,020,000
1995	750,000	7,655,000	59,000	654,000	23,000	41,000	832,000	7,584,000	4,522,000
1996	1,351,000	9,005,000	65,000	760,000	42,000	82,000	1,457,000	8,947,000	5,345,000
1997	1,682,000	10,687,000	71,000	891,000	52,000	134,000	1,804,000	10,644,000	6,369,000
1998	1,970,000	12,657,000	78,000	1,046,000	61,000	195,000	2,109,000	12,632,000	7,569,000
1999	2,013,000	14,670,000	86,000	1,203,000	62,000	257,000	2,161,000	14,663,000	8,795,000
2000	2,276,000	16,946,000	95,000	1,381,000	70,000	327,000	2,440,000	16,959,000	10,181,000
2001	2,371,000	19,317,000	104,000	1,567,000	73,000	400,000	2,548,000	19,351,000	11,625,000
2002	1,628,000	20,945,000	114,000	1,694,000	50,000	450,000	1,793,000	20,994,000	12,616,000
2003	1,584,000	22,529,000	126,000	1,818,000	49,000	498,000	1,759,000	22,593,000	13,581,000
2004	1,756,000	24,285,000	139,000	1,956,000	54,000	552,000	1,949,000	24,365,000	14,651,000
2005	1,708,000	25,993,000	152,000	2,089,000	53,000	605,000	1,913,000	26,088,000	15,691,000
2006	1,514,000	27,506,000	168,000	2,208,000	47,000	652,000	1,728,000	27,615,000	16,613,000
2007	1,674,000	29,181,000	184,000	2,339,000	52,000	703,000	1,910,000	29,305,000	17,632,000
2008	1,756,000	30,937,000	203,000	2,476,000	54,000	757,000	2,013,000	31,077,000	18,702,000
2009	1,247,000	32,184,000	223,000	2,574,000	38,000	795,000	1,509,000	32,335,000	19,461,000
2010	1,124,000	33,308,000	245,000	2,662,000	35,000	830,000	1,404,000	33,469,000	20,146,000

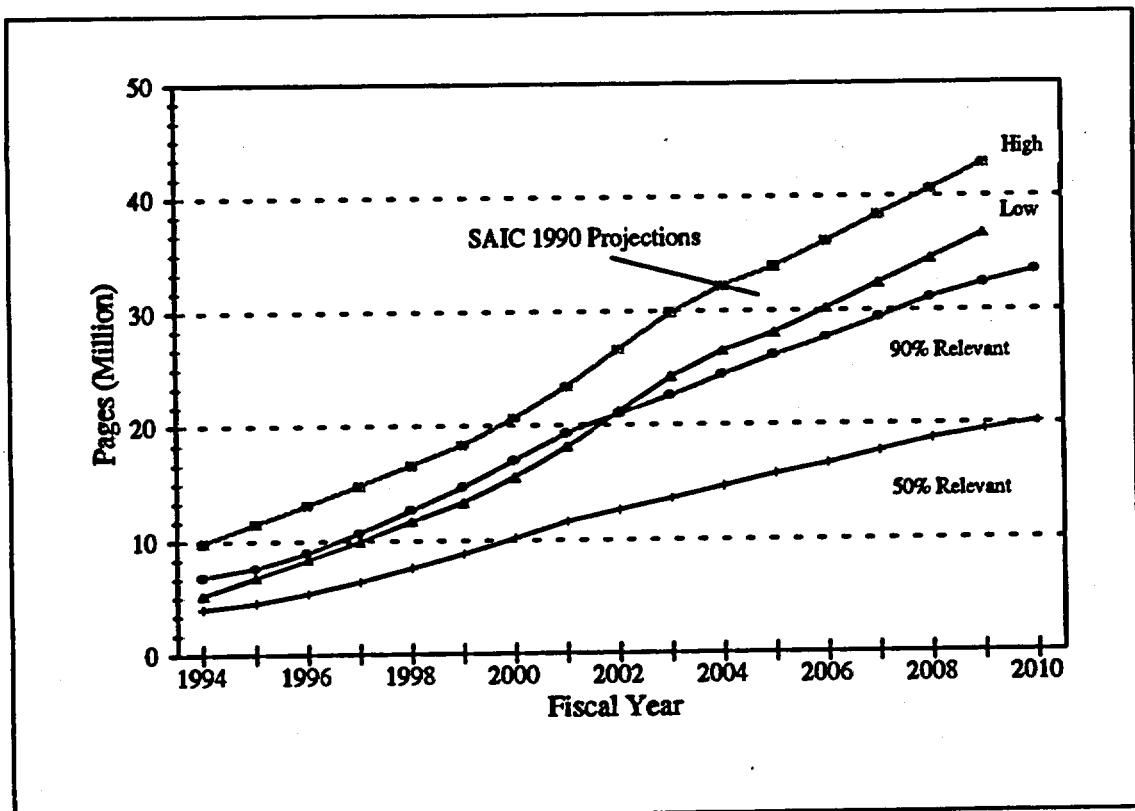


Figure 3-3. Cumulative LSS Data Volume

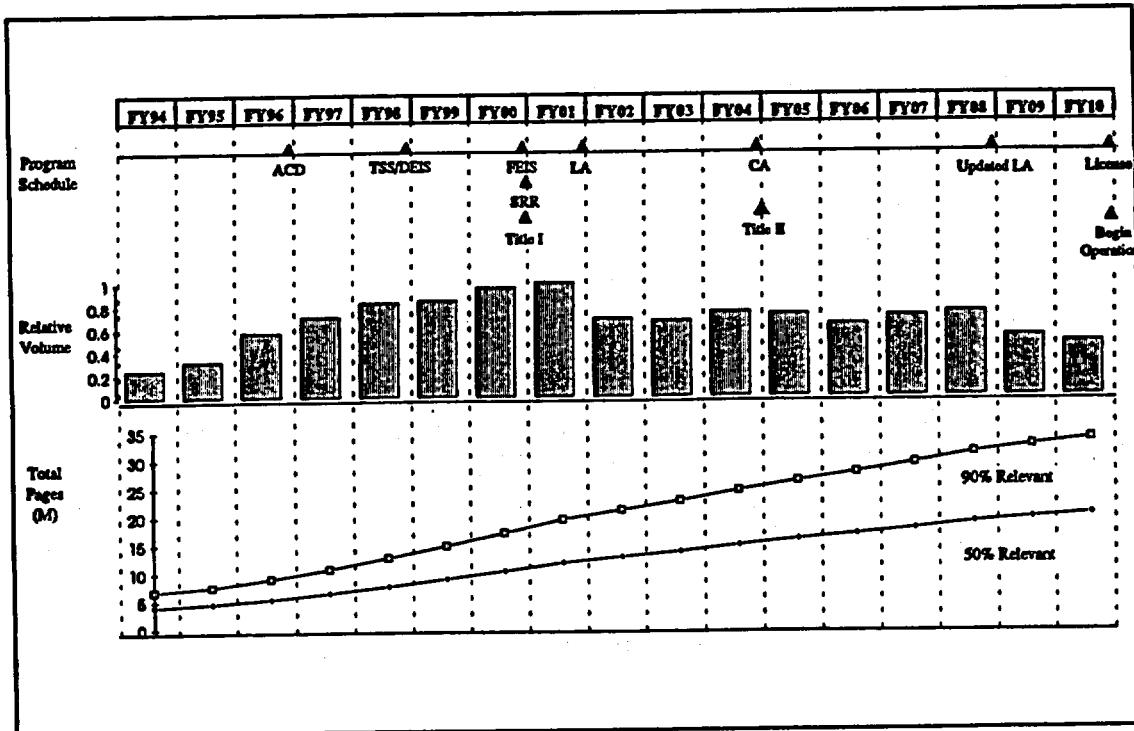


Figure 3-4. Data Volume Composite View

3.3.2 Document Relevancy

The LSS rule states that the LSS shall contain *documentary material* which is defined as "...any material or other information that is relevant to, or likely to lead to the discovery of information that is relevant to, the licensing of the.." geologic repository. Documents such as the license application, topical reports, safety evaluation reports, etc. are all clearly relevant to licensing.

However, the licensing relevancy of most other documents is much less obvious. Judgments must be made regarding the likelihood that a document will lead to the discovery of relevant licensing information. Practically, it is impossible to determine whether a document will lead to the discovery of another relevant document until after the discovery process is complete, and all contentions have been admitted to the licensing hearings. Knowledge of the scope of licensing relevant documents at this time is too late to impact the initial loading of the LSS.

Several attempts have been made to define categories and specific topics for documents to be included in the LSS. As described in Section 2.2.2, preliminary topical guidelines were published in the supplementary information accompanying the LSS rule. A draft NRC regulatory guide (DG-3009, Topical Guidelines for the Licensing Support System) has been published to supplant the preliminary guidelines. Although this guide helps to broadly define the scope of documents to be included in the LSS, it is of little practical use to those individuals who must screen documents for licensing relevancy. Inevitably, the judgment of individuals responsible for screening documents is subject to challenge from any party to the licensing proceedings that feels the LSS database is incomplete. A challenge of this nature could erode LSS user confidence and result in delays during the licensing process while OCRWM attempts to defend the document screening criteria used.

The Working Group has considered the document relevancy issue at depth and feels that the efforts to define document relevancy in the final rule and in draft regulatory guidance are inappropriate. These efforts have been *inclusionary*, that is, an attempt has been made to identify documents that should be included in the LSS. This approach is preferred when the criteria that define a licensing relevant document are clear and unambiguous. However, because of the broad definition of documentary material, the relevancy criteria are not clear and unambiguous. Therefore, an approach for identifying relevant material which considers the inherent uncertainty of the selection criteria should be adopted.

The Working Group believes that an *exclusionary* approach for defining document relevancy is best suited to satisfy the documentary material definition presented in the LSS rule. With this approach, all OCRWM records management system material would be included in the LSS *except* for document categories specifically excluded by §2.1005 of the LSS rule. This approach has the following benefits:

- Eliminates grounds for challenge that OCRWM has excluded relevant material from the LSS
- Eliminates the cumbersome administrative appeal process associated with challenges to the LSS database integrity

- Increases confidence in the contents of OCRWM contributions to the LSS database
- Eliminates the need for complicated document screening criteria
- Eliminates the time and cost associated with screening documents for licensing relevancy

The greatest benefits to this approach are the potential for reducing document capture costs, the leverage gained by eliminating (or reducing) exposure to allegations that the LSS is incomplete, and the associated boost to user confidence with the system. The primary drawbacks are the additional data volume imposed upon the LSS, and the additional cost of indexing documents that may not be licensing relevant. However, with the cost of bulk storage decreasing and the speed of computing machinery increasing with time, and with the introduction of automated indexing capabilities, these liabilities are becoming less and less significant.

3.3.3 Circulated Drafts

The submission requirements of §2.1003 generally apply only to final documents (i.e. a document bearing the signature of the originator). However, §2.1003 also requires the submission of *circulated drafts* to the LSS. A circulated draft is a document circulated for supervisory concurrence and in which the original author or others in the concurrence process have not concurred. The intent of this exception to the general rule is to capture those documents to which there has been an unresolved objection by the author or other persons in the concurrence process. If an objection is not resolved, the document must be entered into the LSS. If the objection is resolved, then the document is considered a final document that may be entered into the LSS.

All quality affecting and most significant non-quality affecting documents generated by OCRWM are reviewed according to procedures established consistent with the OCRWM Quality Assurance (QA) program. As such, comments are generated and resolved during the document *review* process. The comments and responses are documented on records that are sent to the records management system. If the author cannot resolve the commentor's objection, then by procedure, the objection is elevated to increasingly higher levels of management until the objection is resolved. Therefore, documents that have unresolved objections will generally never reach the concurrence process since all objections must be resolved during the review process.

This artifact of the QA program does not imply that dissenting opinions are muted. On the contrary, the formal QA documentation will clearly present a reviewers objections and the bases for any objections. Furthermore, if the reviewer feels strongly enough, the objection may be documented in the form of a signed letter that is forwarded to the records system.

3.4 EVALUATION OF SAIC FUNCTIONAL REQUIREMENTS DOCUMENT

Because the SAIC system-level requirements document (SAIC, 1990b) was identified as the de facto LSS functional requirements document, the Working Group evaluated the document to determine if it could be used as the LSS requirements specification for performing a "make versus buy" analysis. The document was also evaluated to determine if it could be used as part of a

Request for Proposals (RFP) if a buy decision is made, or as a requirements document if the LSS is built in-house. The results of the evaluation are presented in this section.

The evaluation suggested that as an overall specification, the requirements in 10 CFR Part 2, Subpart J are satisfied by the document. There is clearly a requirement for document capture, storage and retrieval. Capture and storage includes requirements for image, header and full-text data. Retrieval includes requirements for both full-text and header searches. However, there are several deficiencies in the document (when viewed as a system-level or software requirements specification) that would preclude its use to document a make versus buy analysis or in an RFP.

Specification of System Design

One fundamental problem with the requirements document is that it also specifies system design. For example, the document states that the "... LSS Capture System component has already been designed, and its detailed requirements and design are documented in the Capture System Design Document. The Capture System requirements are included in this document for the purpose of completeness, and not for further design considerations."

Effective software engineering principles establish system and/or software design following a requirements specification, not as part of the requirements specification. The reason that design is performed following requirements specification is that the over-specification of design in a requirements document constrains potential architectures and designs to that which is specified. This limitation prohibits an architect or designer from considering other design solutions which may provide more effective, efficient and less costly implementations. It is especially important that design not be specified in requirements issued as part of an RFP in order to allow the submission of different architectures for evaluation. There are circumstances in which requirements must be constrained due to extenuating circumstances, such as the need to embed a new system in an existing system or environment, but for the LSS there are no system constraints which would prescribe a specified design.

Specification of Procedural Requirements

Another problem identified was that the requirements document specifies procedural requirements. To be effective, system or software level requirements must be specified in a manner which can be tested. The specification of a procedural requirement which cannot be tested by software and/or hardware implementations creates difficulty in determining whether a system satisfies a specified requirement. While it is important to clearly specify procedures which are needed to perform certain functions, this should not be done in a system-level requirements document, since such procedural requirements cannot be satisfied through system implementation. For example, the requirements document states that "All documentary materials shall be submitted to the LSS Capture System in accordance with procedures established by the LSS Administrator." This is clearly procedural in nature and does not belong in a systems-level requirements document.

Ambiguous Requirements

There are also several instances of conflicting requirements in the requirements document. In addition, the document contains a mixture of verbs such as "should" and "shall". It is not clear if the word "should" specifies a hard requirement or a "desired" function, which is not a requirement. For example, the following requirements are stated in the document:

- "Hard copy of large outputs (greater than 100 pages) should be available overnight."
- "Large volumes of hard copy (thousands of pages) should be available, via remote print and distribution, within 5 working days after request."

First, the requirements conflict since "thousands of pages" is "greater than 100 pages" and it is therefore unclear if the requirement is overnight availability or within 5 working days after request. Second, the word "should" in both statements creates ambiguity as to whether the specification is actually a requirement, or a preferred objective which would not be used in an evaluation of a system implementation.

There are other examples of ambiguity in the requirements document which result in the specification of requirements which cannot be tested. For example, the document states the following:

- "Average query response time shall be less than 10 seconds."
- "Terminal response time 'to begin to respond' shall be no more than a few seconds."

It is not clear what "average" means, so such a requirement could not be tested. Also, there is no definition for "a few seconds", again creating a specification which cannot be tested. Also, these two requirements appear to conflict since "less than 10 seconds" may or may not be the same as "a few seconds". Another ambiguity is the phrase "to begin to respond". It is questionable as to what would satisfy this part of the specification. Would a message on the screen such as "Working" satisfy such a requirement? The lack of specificity to enable a test case to be established, creates ambiguity in determining how such a requirement would be satisfied.

Untestable Requirements

In addition to the above deficiencies, there are many specifications in the document which refer to user requirements which cannot be tested. For example, the document states the following:

- "The user interface must be interactive and intuitive."
- "The user interface shall be consistent."
- "The user interface shall be unambiguous."
- "The user interface shall be flexible and convenient."

While these specifications provide some indication of the intent of the user interface, the statements as requirements are untestable. Therefore, it would not be advisable to include them, as stated, in a requirements specification that would be used in the potential issuance of an RFP.

As a result of the deficiencies noted previously, the Working Group believes that the LSS System-Level Requirements Document needs revision to remove references to design, resolve ambiguities and conflicts, delete requirements which are not testable and state all requirements as "shalls". It is further suggested that the resulting requirements document be reviewed by DOE, the NRC, and other members of the LSSARP to ensure that the LSSARP has the opportunity to assess whether the requirements specified in the LSS rule are adequate.

3.5 METHODS FOR REFINING SOFTWARE SYSTEM REQUIREMENTS

Software systems are normally designed, built and tested against a set of formal or informal requirements which are used to assure that they perform the functions required by the acceptance authority or user community within specified performance and system capacity parameters. Requirements can be expressed in many forms, including written "shall" statements (the system shall ...), a variety of software engineering nomenclatures (data flow diagrams, object oriented notation, entity relationship diagrams, etc.), narratives describing user work flow scenarios, etc. All of these written representations are *abstractions* of the planned system which are traditionally used to assure that the system will perform as expected by the acceptance authority.

The software industry has a long history of system acceptance failures, overruns and schedule slips, which are well documented in literature. One significant cause of failure is poor communication of system requirements between the requirements engineer and the end user or certifying authority. In short, it is very difficult for the user to get a clear idea of how the system will function from written descriptions, even if they include static representations of user screens. The industry has therefore gone through several evolutions in requirements development approaches, starting with rapid prototyping, which was popular in the 1980's, and more recently moving to evolutionary systems development.

3.5.1 Rapid Prototyping and Evolutionary Systems Development

Rapid prototyping is the rapid development of user screen simulations, which allow the user to interact with the simulated system and provide feedback to the developers. The prototype may "look" like a real system, but is in fact a simulation of system functions. While this is an improvement over paper abstractions of the system, there are several problems with the rapid prototyping approach. First, the simulated user screens often fall short of being a true representation of the actual system, resulting in misleading user feedback. Second, there is no guarantee that the simulated screens and the functions they demonstrate can actually be implemented within the available budget and schedule. Third, when the prototyping phase is done, the actual system development normally starts from scratch, and the rapid prototype is effectively "throwaway" code.

Evolutionary Systems Development is the method most often used in modern day software development and integration efforts, particularly those which are Commercial-off-the-shelf (COTS)-intensive. Rapid screen building tools are available in many development environments which enable software developers to quickly implement real, working user screens and integrate them with underlying COTS applications and data bases. By rapidly developing basic system interactive functions the development team can have an early "prototype" of the user interface

built on top of the early version of the actual application. Then, by putting users in front of the prototype system, getting feed back, and modifying the flexible user interface, the system can be evolved into one which satisfies user requirements and expectations. This approach has many advantages: 1) users interact with an actual system, reducing the risk of miscommunication which is inherent with paper requirements specifications, 2) the user interface only represents functions which can actually be built, so that users are not disappointed when they "see the real thing", 3) the system actually exists at the level of maturity that the user sees, and can be put into production soon after users and developers converge on an agreed-to user interface and functions, and 4) developers get immediate user feedback rather than spending lots of time building functions which users later reject as inadequate.

In this development approach, the system is evolved as follows:

1. Basic system requirements are rapidly developed, often through the use of Use Case scenarios. These scenarios describe user actions and associated system responses. Requirements must be considered as goals rather than hard acceptance criteria at this point for two reasons. COTS-intensive solutions have varying degrees of flexibility and the implementation of some requirements may be beyond the capability of the COTS solution, even if the development team retains ownership of the user interface. Secondly, requirements identified early on may undergo modification at the users' request once they have had the opportunity to interact with the system.
2. Based on the initial requirements set, system threads are designed and implemented using COTS integration (the linking of various COTS applications into a seamless system, to the extent possible) into the first working version of the system.
3. Users are then brought in to interact with the system and provide feedback.
4. The user interface is then modified in conjunction with underlying system functions, subject to the limitations of the architecture, the COTS applications and the system development schedule. This is an iterative process, done in conjunction with repeated user reviews, according to the ground rules established between the development team and the certifying authority.

3.5.2 Applicability to the LSS

The evolutionary systems development approach could be effectively used for the development of the LSS. The LSS user community is primarily a legal and regulatory community which is not normally involved in software systems requirements specification and procurement. Heavy reliance upon "shall" specifications or COTS vendor specifications in this environment as a means of reaching agreement on the LSS requirements has a high risk of failure. In short, without ongoing user involvement, there is a good probability that the system implemented will not be acceptable to the LSS users. Even experienced software procurement organizations, such as those that exist in the Air Force and other Department of Defense organizations recognize that the user community must interact with a working system and have the ability to influence its

development if they are to accept the system. This is all the more true if the user community does not have experience in systems specification and procurement.

Early agreements should be reached as to the functionality and performance of the LSS. Industry consensus clearly recommends that this be done through joint, evolutionary development whereby the end users (including the LSSARP and the LSS Administrator) work with the development team and its DOE management to evolve the user interface and underlying functions of the system.

3.5.3 The Records Data Management System

The Records Data Management System (RDMS) is a high priority, rapid development effort to create a two-site, VAX based imaging and full text system for evaluation as a replacement for the current OCRWM RMS. The RDMS uses the DECimage Enterprise Image Management and Display System for document storage and management, the Fulcrum Full Text Search System for text searching and the IRIS application for document indexing. The system provides the capability to capture documents in the form of Image (TIFF Group 4 format), ASCII text (OCR-generated from the image) and Bibliographic Headers (using IRIS). The ASCII text of the document is searchable by the RDMS text search engine.

The RDMS is designed to accept document inputs in the form of paper (8-1/2 x 11 inch to "E" size drawings), CD ROM, file transfers from non-RDMS systems, and data transfer from remote RDMS systems. The RDMS supports two types of queries for document retrieval: index field queries and full text search. Once the document is located using either of these methods, the document image is displayed and (optionally) printed.

An initial operating capability (IOC) for the RDMS has been implemented in the OCRWM Records Management facility in Las Vegas. OCRWM is currently evaluating the RDMS to determine its suitability as a replacement for the OCRWM microfilm based RMS. If OCRWM elects to adopt a prototyping or evolutionary development strategy for the LSS, the RDMS would be an effective system to use. The reason is that the RDMS provides functions which are consistent with 10 CFR Part 2 Subpart J and, most important, contains a flexible, rapid screen building tool which can provide quick modifications in response to user feedback.

4. LSS OPTIONS

4.1 BACKGROUND

The LSS Working Group was chartered to evaluate the LSS requirements, examine possible LSS options and identify the costs and features associated with each option in order to craft an optimized strategy for technical and systems support for licensing under the phased licensing approach. The identification of options for the LSS was particularly called out in the Working Group charter due to the need to develop a perspective of the sensitivity of overall system cost to specific system requirements.

The Working Group has developed a range of LSS options that encompasses variations on technologies and operational features in order to explore cost sensitivities. The evaluation of cost sensitivities was done using the calculational cost model described in Appendix C.

At the outset of this activity the number of LSS options was large, however, as understanding improved and as iterations and modifications on the individual options were made a "basis set" of seven options emerged that adequately spanned technology and operational issues and that allowed testing of features for impact on system cost.

4.2 DESCRIPTION OF LSS OPTIONS

Seven options, numbered two through eight, were evaluated as viable LSS options. This numbering anomaly was introduced because at the outset the Working Group was identifying as Option 1 a model based on the current technology and methodology employed by the existing OCRWM Records Management System even though the model does not meet the requirements specified for the LSS. Due to the coupling between the OCRWM Records Management System and the LSS and the need to refer to the OCRWM RMS, the Working Group found it convenient to maintain this original nomenclature even though this model is not an option for the LSS.

There are several key variables whose possible combinations lead to the seven options under consideration. The key variables are text dissemination, image dissemination, and verification of the text generated by optically scanning documents. Figure 4-1 provides a graphical representation of the options described in this section. The text and image dissemination method associated with each option can be found by tracing the path from dissemination on the left, to the specific option on the right.

As previously indicated, Options 2 through 8 meet the LSS requirements in Subpart J. Consistent with these requirements, all options are assumed to store digital images for retrieval and for the production of searchable full-text, store a searchable full-text representation (if applicable) of a document to support document retrieval, store searchable headers to support retrieval of documents, and provide for transmittal of hard copy image by mail or facsimile when requested by the user. Features unique to each option are summarized below:

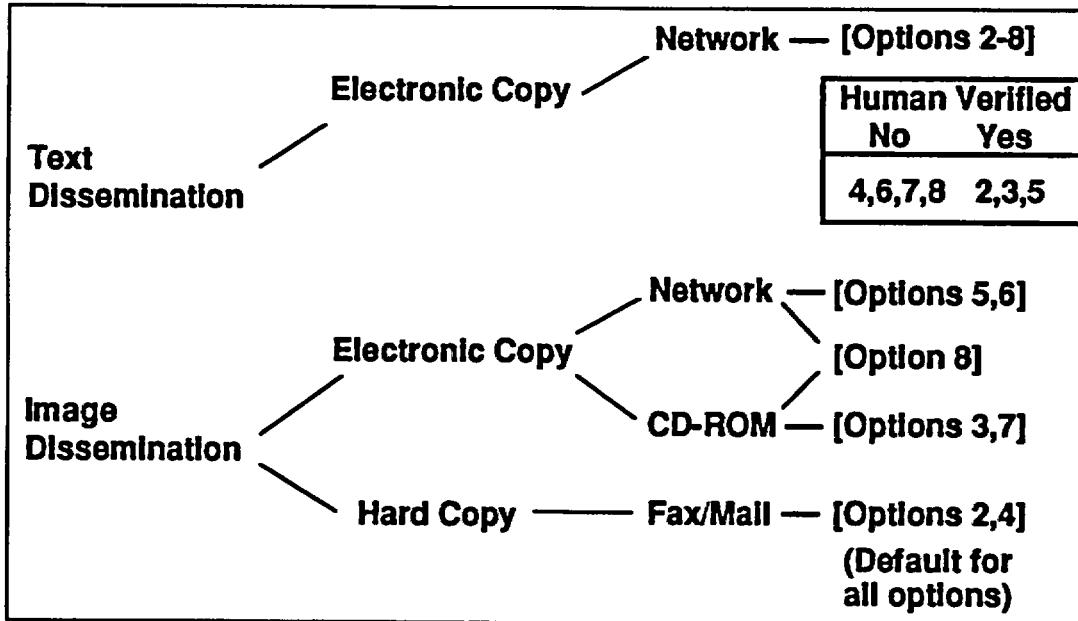


Figure 4-1. Text and Image Transmittal Characteristics

- Option 2 The text contained in this option is human-corrected. Hard copy (paper) is available at the LSS stations. There is no CD-ROM availability.
- Option 3 The text contained in this option is human-corrected. A CD-ROM library is available for image retrieval at each LSS station. CD-ROMs are also available by mail at user request.
- Option 4 The text contained in this option is corrected by machine. Hard copy (paper) is available at the LSS stations. There is no CD-ROM availability.
- Option 5 The text contained in this option is human-corrected. Digital images are available through on-line transmission.
- Option 6 The text contained in this option is corrected by machine. Digital images are available through on-line transmission.
- Option 7 The text contained in this option is corrected by machine. A CD-ROM library is available for image retrieval at each LSS station. CD-ROMs are also available by mail at user request.
- Option 8 The text contained in this option is corrected by machine. A CD-ROM library is available for image retrieval at each LSS station. Images processed since the last CD-ROM release are available through on-line transmission. This option is essentially Option 7 enhanced with on-line image transmission (Option 6).

The characteristics of these options are summarized in Table 4-1.

Table 4-1. LSS Option Features

Licensing Support System Features	Option							
	1	2	3	4	5	6	7	8
Microfilm based system	Yes	No						
Electronic images based system	No	Yes						
Electronic image on-line (electronic dissemination)	No	No	No	No	Yes	Yes	No	Yes
Image disseminated on CD-ROM library ¹	No	No	Yes	No	No	No	Yes	Yes ²
Image available as hard copy from central site (mail/fax)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Text on-line (electronic dissemination, including full text search)	No	Yes						
Human verified and corrected text	N/A	Yes	Yes	No	Yes	No	No	No
Bibliographic header on-line (electronic dissemination)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

¹ The CD-ROM library contains all LSS holdings, and is not generated as a response to particular queries. The CD-ROM contains image, text and text search index of the documents held on each individual CD.

² Electronic images will be provided via on-line transmission between CD-ROM distributions.

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5. COSTING OF LSS OPTIONS

5.1 COST MODEL

Since 1989, three models of the LSS have been developed and used to estimate the expected LSS life-cycle costs. The first of these models was developed by SAIC in the 1989 - 1990 time period. This model was developed as a part of a larger undertaking, which included implementation and operation of a prototype LSS, and provided the greatest insight into the projected costs of the LSS that had been achieved to that date. Due to thoroughness of this first effort, much of the framework for the later models were based on the information contained in the SAIC model. Briefly stated, the model was based on measurements of processing times associated with the various steps of capturing and disseminating records in one sample system architecture and work flow using 1989 and earlier computer technology. However, the model did not separate the costs of the DOE Records Management System (RMS) from those costs that were specifically attributable to the LSS.

The second model, developed by the M&O in 1992, was created specifically to address two objectives:

- Allocation and separation of costs to the RMS and the LSS respectively
- Identification of what overall cost reduction to the Nuclear Waste Fund could be realized if RMS components were re-used in the LSS.

To address these questions this second model closely followed the earlier SAIC model, except in this case, costs associated with the RMS and the LSS were identified separately. Furthermore, this model incorporated effects due to technology improvements since 1989 and new information regarding the backlog data that had accumulated in the same time period.

Three specific LSS implementation options were evaluated using the second model. The first option assumed that the developers of the LSS had access to system level documentation and "lessons learned" from the RMS implementation. Thus, this scenario assumed minimal carry over from the development of the RMS, and in particular, the LSS was presumed not to use any software or hardware components included in the RMS.

The second option assumed that the capture subsystem of the RMS was used in the LSS. The document storage, search and dissemination subsystems of the LSS and the RMS were assumed to be implemented using different components. However, the recording format and header database contents in the two systems were assumed to be "electronically compatible", that is, the transfer from the RMS to the LSS could be done with minimal human intervention.

The third option assumed full re-use of RMS software and hardware components in the LSS. The implication is that there are no development costs for the LSS, except in the area of high-volume dissemination since the RMS does not require high-volume dissemination. In the scenario as originally presented to the NRC, the RMS and the LSS were assumed to be independent systems managed by DOE and NRC, respectively. When presented to the LSSARP, however,

this assumption was modified to further reduce the cost by combining RMS and LSS functionality in a single system managed by the DOE.

The third cost model was created to support the LSS Working Group evaluation (see Appendix C). It was developed to allow better insight into effects on RMS and LSS costs when specific features of the system were included or excluded, and what the effects were due to process improvements. This was achieved by incorporating over 200 independently adjustable variables, a level of control that exceeds the two earlier models. In addition, the model separates the costs associated with:

- Capture of DOE records
- Capture of DOE LSS relevant records
- LSS specific processing expenses borne by DOE
- Capture of material submitted directly to the LSS
- Total cost of operating the LSS with material both from the stakeholders and the DOE.

The purpose for including both RMS and LSS costs in the model, even when the LSS is the object of primary interest of the study, is to evaluate the interaction between the two systems. Because of the tight coupling between the two systems, feature changes in one system could result in a significant cost impact in the other.

5.1.1 Key Assumptions

Although the values assigned each of the model variables affect the estimated cost, a number of key assumptions have a more significant impact. These key assumptions are described below.

Electronic image-based OCRWM Records Management System -- The existing microfilm-based RMS is assumed converted to an electronic image based system. This implies that the DOE records will be stored and managed as electronic images with or without the LSS. However, conversion of text page images to text within the RMS is not generally assumed in the options evaluated. Consequently, the cost of capturing the electronic images of the DOE material will always be a DOE capture cost, but the cost of creating the LSS required text files may be an LSS imposed or RMS cost depending on what option is considered. Furthermore, the assumption is that the RMS retains the records responsibility and that the LSS is furnished a copy of all LSS relevant material.

LSS page holdings -- The model assumes page holdings in the RMS and the LSS are based on the estimates of Program relevant documents created as presented in Section 3. Specifically, by FY04 DOE is presumed to have contributed 85% of all records material in the LSS, the remaining 15% is assumed to be the input from the NRC and the stakeholders. It is also assumed that the non-DOE contributed material flows into the LSS at a yearly rate proportional to the DOE LSS contribution for that year. The DOE material included in the LSS is assumed to be 90% of all the material created and included in the RMS after FY95. Of the DOE material produced prior to FY95 only 50% is assumed LSS relevant, but all of it is considered Program relevant and is assumed incorporated in the RMS.

Reprocessing of the existing backlog -- DOE has accumulated approximately 6.9 million pages which must be reprocessed to identify licensing relevant documents that must be entered into the image based RMS for later transfer to the LSS. Likewise, the NRC has accumulated approximately 0.5 million pages that must be captured in the LSS. Although partial reprocessing may start as early as FY95 within DOE, the model assumes that the backlog will not be processed until the image based RMS is fully operational, and continue for three years thereafter. Likewise, the NRC backlog processing will not commence until the LSS is operational, but not necessarily certified, and will require three years to complete. Furthermore, until reprocessing can start, the model assumes that new records are added to the existing backlog at both DOE and the NRC.

Manual input -- Some of the existing (FY94) backlogs and new document pages submitted from FY95 onwards are assumed to be of such poor quality that acceptable images cannot be obtained, or excessive Optical Character Recognition errors will result during conversion of the text images to text. For these pages, manual retying is required to enter the page into the RMS or, in the case of the NRC and stakeholder material, the LSS. It is assumed that 15% of the backlog material collected prior to FY95, and that 5% of the current material, from FY95 and beyond, will have to be entered by hand.

Dissemination -- The amount of requests for information from the LSS both prior to and during the license hearings is difficult to estimate. The amount of information requested will be greatly influenced by the cost, if any, to obtain information from the LSS and the interest the stakeholders, environmental groups, other interested parties and the population at large have in the nuclear waste repository at any time. The effects of the information flow is also dependent on the mix of data formats used to disseminate the information requested. To assess the effect of the dissemination on the cost estimate for the options identified in each case the assumption made was that 60 million pages are disseminated during the operational life of the LSS, with a larger portion of these disseminated just prior to and during the license hearings. Furthermore, the assumption was made that 80% of the pages were disseminated as text, and 20% as images. In all instances the text dissemination was assumed to be through electronic means, while the 20% disseminated as images were distributed as 15% electronic image and 5% hard copy for options that supported electronic dissemination of image.

Future Input -- It is assumed that the future material submitted to the RMS and the LSS will consist of a mixture of hard copy, electronic images and native files. Because native files allow creation of error free text and noise free images for use in the LSS, the cost estimates calculated through the model assumes increased use of native files over time. Table 5-1 and 5-2 show the distribution of new hard copy, electronic image and native files pages assumed for DOE documentation and for non-DOE documentation.

Table 5-1. Assumed Page Distribution for DOE Documents

Fraction of Total Pages	FY95	FY96	FY97	FY98	FY99
Paper Pages	90%	90%	75%	60%	45%
Electronic Image Pages	5%	5%	5%	5%	5%
Native File Pages	5%	5%	20%	35%	50%
Fraction of Total Pages	FY00	FY01	FY02	FY03	FY04
Paper Pages	30%	10%	10%	10%	10%
Electronic Image Pages	5%	5%	5%	5%	5%
Native File Pages	65%	85%	85%	85%	85%

Table 5-2. Assumed Page Distribution for Non-DOE Documents

Fraction of Total Pages	FY95	FY96	FY97	FY98	FY99
Paper Pages	100%	100%	90%	75%	60%
Electronic Image Pages	0%	0%	5%	5%	5%
Native File Pages	0%	0%	5%	20%	35%
Fraction of Total Pages	FY00	FY01	FY02	FY03	FY04
Paper Pages	50%	50%	50%	50%	50%
Electronic Image Pages	5%	5%	5%	5%	5%
Native File Pages	45%	45%	45%	45%	45%

5.2 COSTING RESULTS

5.2.1 Cost Evaluation

Using the cost model described in Section 5.1 and the assumptions described in Section 5.1.1, 10-year life-cycle costs (FY95-FY04) are calculated for each of the seven LSS options using the RMS and LSS page intake distribution shown in Appendix C (Table C-11). The cost estimates are separated into components so that the DOE and LSS components of the total Nuclear Waste Fund costs (total cost) are identified. These costs are shown in Table 5-3.

Component costs are further separated into the categories described below.

Records Management System Cost -- includes all operational labor cost directly attributable to capture, management and dissemination of DOE records, cost of facilities and services (utilities, security, etc.), cost of storage media and warehousing, and cost of system components required for implementation.

DOE Records Costs Specifically Related to LSS -- includes all operational labor cost specifically attributable to process steps required to create data in formats used within the LSS but not the RMS. Depending on the option, this may include the cost of human text verification and correction, cost of data preparation for transfer to the LSS, and cost of physical transfer of data from the RMS to the LSS.

LSS Operational Cost -- includes all operational labor cost directly attributable to capture, management and dissemination of LSS holdings, cost of facilities and services (utilities, security, etc.), cost of storage media, and cost of system components required for implementation.

LSS Development Cost -- includes all cost to integrate and develop the system components required for an electronic image based RMS and the LSS.

The costing for these categories for each option are shown in Figure 5-1. The cost difference between Options 2, 3 and 5, and Options 4, 6, 7, and 8 is attributed primarily to human text correction.

Table 5-4 describes the annual costs for LSS Option 6 (FY95-FY04) for both the RMS and the LSS. These costs include all development costs, capital costs, and operating costs. The costs in FY98-FY99 for the LSS reflect the acquisition of the LSS hardware and installation costs. The relatively constant costs in FY00-FY04 reflect the operation and maintenance of the LSS. The larger costs in FY96-FY99 of the RMS reflect reprocessing of the existing backlog, and procurement and installation of the RMS.

Table 5-3. Results of Costing Analysis - 10 Year Life-cycle Costs

Option	DOE RMS	LSS	Total Cost
2	\$96M	\$59M	\$155M
3	\$106M	\$66M	\$172M
4	\$87M	\$57M	\$144M
5	\$104M	\$64M	\$168M
6	\$95M	\$62M	\$157M
7	\$98M	\$63M	\$161M
8	\$98M	\$63M	\$161M

Table 5-4. Option 6 Cost Estimates

Option 6 Costs	FY95	FY96	FY97	FY98	FY99
DOE RMS FY cost	\$5.1	\$13.8	\$13.8	\$13.8	\$11.9
LSS FY cost	\$0.8	\$2.8	\$3.2	\$10.3	\$11.0
Waste Fund FY Total	\$5.9	\$16.6	\$17.0	\$24.1	\$22.8
Option 6 Costs	FY00	FY01	FY02	FY03	FY04
DOE RMS FY cost	\$7.9	\$7.4	\$6.8	\$6.7	\$7.8
LSS FY cost	\$7.4	\$7.3	\$6.6	\$6.1	\$6.4
Waste Fund FY Total	\$15.3	\$14.8	\$13.4	\$12.8	\$14.2

5.2.2 Cost Comparison

As shown in Table 5-3, the total cost of the LSS ranges from \$57 to \$66 million between the seven options evaluated. The relative difference between the lowest cost (Option 4) and the high cost (Option 3) is \$9 million, a difference of 16%. It is also noted that the RMS and LSS cost

projections trend together (e.g. a reduction in LSS cost yields a reduction in RMS cost). Because the Working Group cost estimates are based upon a model with a substantial number of assumptions, the difference in cost alone between options is not sufficient to select one particular LSS option over all others.

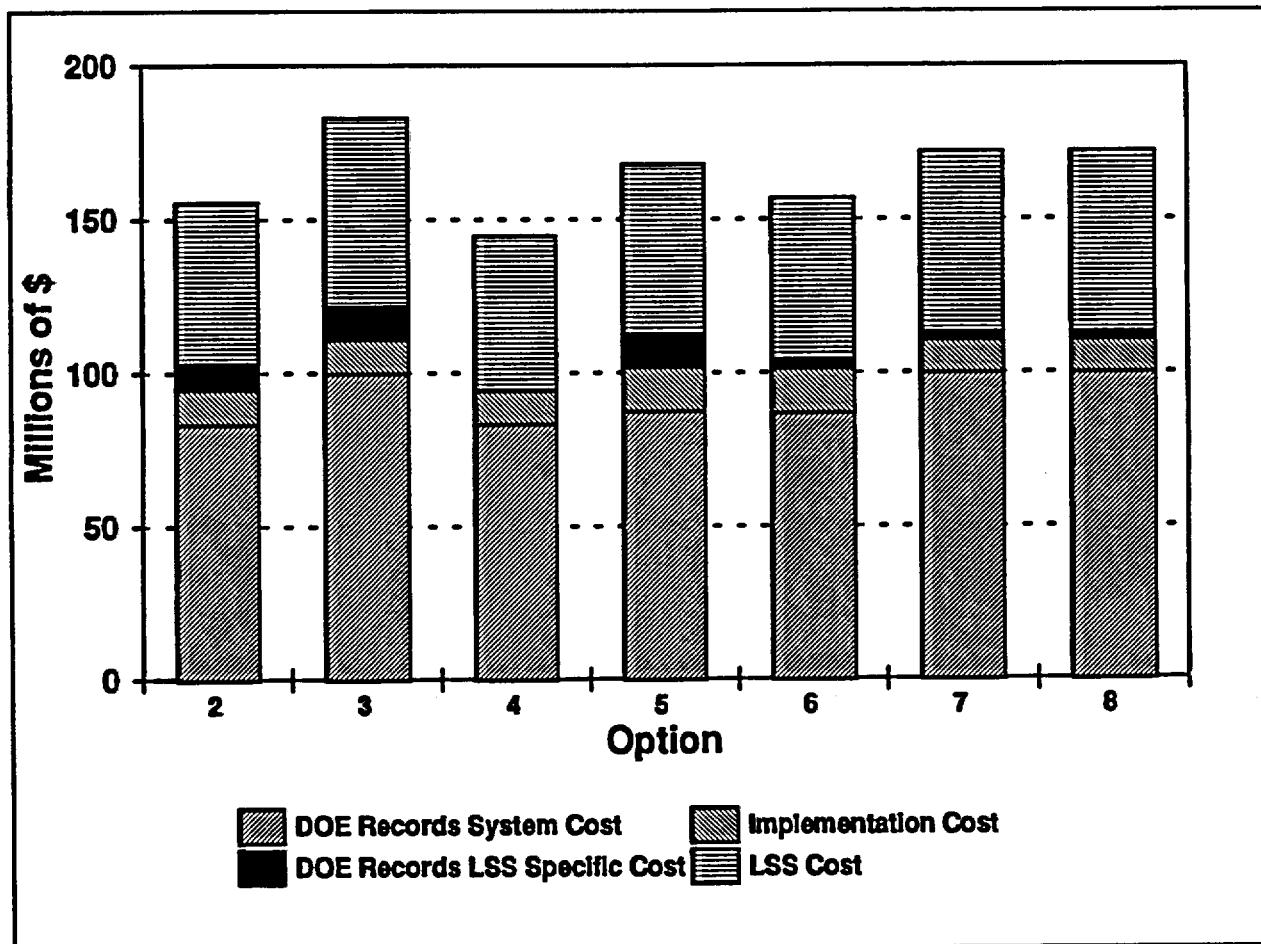


Figure 5-1. Cost Analysis Results by Category

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6. EVALUATION OF LSS OPTIONS

The LSS is intended to be an electronic information system that provides access to documents in support of the document discovery process. It is also intended to provide for the electronic transmission of filings, orders, and decisions. There is no group of subordinate functions that is unique in satisfying these goals. As a consequence, a number of alternative LSS options have been posited in order to evaluate cost sensitivities and to assess the utility and acceptability of competing avenues to arrive at an LSS. The following describes the process by which a method was developed to evaluate these LSS options and to make a selection of the most overall satisfactory option.

6.1 METHODOLOGY

Evaluation of the LSS options was predicated upon developing a number of selection criteria each of which is capable of differentiating among the options considered. All LSS options meet the specific requirements set forth in Subpart J, thus, evaluation factors having to do with meeting all or portions of these requirements will not be effective since they do not differentiate among the options. At the other end of the spectrum, evaluation factors such as "effective" or "user friendly" have no merit for differentiation among the options either. The evolved evaluation factors given below were deemed to have sufficient measurement capability of specific quantifiable features to be useful in differentiating among the posited LSS options.

The seven LSS options were evaluated based upon seven selection criteria that were representative of LSS performance plus an eighth criterion that reflected relative cost. These eight selection criteria were developed from an evaluation of a substantial list of potential criteria reflecting what originally were considered to be important and discriminatory characteristics. However, as the details of the potential criteria were considered, some of them were judged to be overlapping, others were judged not to be effective as discriminators and only the final eight selection criteria emerged from this evaluation.

The definitions of the eight selection criteria are:

Relative Cost -- This is the 10-year life-cycle cost (through FY04) as presented in Section 5.2.1.

Operational Cost Risk -- This is the risk that operational costs will be higher than the original estimate. Operational cost estimates are based on assumptions. Operational cost risk considers whether there is a high, medium or low cost impact if one or more of the principal assumptions associated with each option should prove to be incorrect during the operational phase.

Flexibility -- Flexibility is a measure of the capability of the operational concept of each LSS option to offer the widest range of additional or alternative functionality as long as possible in the LSS design and implementation process. For example, an LSS that is designed from the outset to rely on hard copy distribution of images could not be readily modified to support on-line transmission of electronic images which could be a critical feature during the licensing hearings.

Text Accuracy -- Text accuracy is the correctness, or lack of errors, in the text created by scanning a document and subsequently converting the optical image to text using optical character recognition (OCR) technology. The accuracy is measured by the number of correctly converted characters divided by the total number of characters in the original text.

Search Accuracy -- Search accuracy evaluates the projected impact of text accuracy on the success of document searches by comparing the results of identical searches in a database consisting of headers and actual LSS option text files versus a database consisting of headers and ground truth (or completely accurate) text files. Because information management research has shown that search technologies have improved to the point where some allowable and achievable (low) range of letter errors (misspellings) in text have little negative impact on retrieval results, the search accuracy criterion was less useful than other criteria in discriminating among the six LSS options.

Response Time (Image) -- Image response time is a measure of how rapidly, after a user enters an image request, the image is available at the user work station through on-line transmission, retrieval from a CD-ROM library, or mail distribution of hard copy or electronic files. Image response time assumes the image is already entered into the LSS and measures the relative speed of image transmittal/transmission options. Options that provide on-line transmission of image upon request, and options that provide hard copy or CD-ROM libraries of images at the user workstations were rated more favorably than those that rely on mail transmittal of document images.

Response Time (Printing) -- Printing response time is a measure of how rapidly, after a user enters a request for a printed text file, the printed file is available at the user workstation. Since all LSS options evaluated were capable of transmitting text files across communication lines, this criterion did not discriminate among the option response times for printing from on-line files. However, options that provide hard copy or CD-ROM libraries of document images (including text) at the user workstations were rated more favorably than those that rely on mail transmittal of documents.

Responsiveness -- Responsiveness is a measure of how rapidly, after initial loading into the LSS, the document image is available upon request at the user workstation. Responsiveness is distinct from image response time in that it measures the relative speed with which an image is processed into the LSS and available for its normal mode of distribution. If one LSS option requires that images accumulate until enough are available to merit production of a new CD-ROM, the responsiveness is less than that of an option providing images that can be sent out immediately over communication lines, or an option providing photocopies of images that can be immediately mailed to the user.

These selection criteria formed the basis for the evaluation and ranking of the LSS options by the working group. However, it was recognized that these selection criteria should not all be weighted equally as a measure of the attractiveness of an LSS option. Hence, weighting factors were developed for each criterion. These weighting factors were developed by each member of the working group assigning a value between one and ten to each selection criterion (ten being most favorable) based upon that individual's view of the importance and the utility of the criterion.

Then, for each criterion, the individual values assigned by members of the working group were summed and averaged to arrive at the assigned weighting factor. A listing of selection criteria and associated weighting factors is shown in Table 6-1.

Table 6-1. LSS Option Selection Criteria and Weighting

Selection Criterion	Definition	Weighting Factor
Cost	Economy of total cost to Nuclear Waste Fund (LSS-attributable OCRWM Records System costs plus LSS costs) over LSS life-cycle	10
Operational Cost Risk	Low risk of increase in costs due to erroneous assumptions during development or implementation	7
Flexibility	Ease in expanding LSS capabilities in response to user needs	7
Text Accuracy	Increase in user confidence with increased accuracy of text	6
Search Accuracy	Increase in search success with increased accuracy of text	6
Response Time (Image)	Responsiveness in receiving image at LSS stations	6
Response Time (Printing)	Responsiveness in printing text files at LSS stations	3
Responsiveness	Capability to provide immediate access to the most recently submitted text/image/motions	6

Each selection criterion was used as a measure of the attractiveness of each LSS option. However, as a figure of merit, it was impacted by its assigned weighting factor. The process was as follows:

- 1) For a given selection factor and a given LSS option each member of the working group assigned a value between one to ten with ten being most attractive.

- 2) The values assigned by the individual working group members were summed, averaged, and the average was multiplied by the weighting factor for that selection criterion.
- 3) The weighted average was entered into the Evaluation Matrix in Table 6-2 so that the selection criteria entries could be summed for each LSS option.

The only exception to the process was for the cost criterion. There was no choice by the members of the working group on this selection criterion. The least costly option, as derived from the cost analysis, was ranked highest using a normalizing formula. The points calculated for each option was then multiplied by the weighting factor and entered into Evaluation Matrix.

Table 6-2. Evaluation Matrix

Selection Criteria	Option						
	2	3	4	5	6	7	8
Relative Cost (10)	79	68	94	70	82	79	79
Operational Cost Risk (7)	14	42	28	35	63	70	63
Flexibility (7)	21	42	14	70	63	35	63
Text Accuracy (6)	60	60	48	60	48	48	48
Search Accuracy (6)	60	60	54	60	54	54	54
Image Display (6)	12	42	12	60	60	42	48
Image Print (3)	6	30	6	18	18	30	30
Responsiveness (6)	12	42	12	60	60	42	60
Total Score	264	386	268	433	448	400	445
Total Score Without Relative Cost	185	318	174	363	366	321	366

6.2 COMPARISON OF LSS OPTIONS

Table 6-2 presents the results of the Working Group's quantitative evaluation of each LSS option. This table includes the weighted values associated with each of the selection criteria. The various scores for each option indicate unique characteristics associated with the option. For example, the selection criterion, Text Accuracy, shows only two values for all the LSS options. This is because for three of the options, human correction of the text was assumed and for the remainder of the options, machine correction of the text was assumed. It is important to note that the evaluation is presented only as a general guide for comparison of options. Thus, the evaluation represents a useful tool to assist a decision maker in differentiating between options or groups of options.

The total scores, identifying the relative attractiveness of each of the options, clearly show that cost is not the single factor fixing the attractiveness of each option. Three or perhaps four of the options group in total score (Options 5, 6, 7, and 8) as being approximately equivalent in attractiveness. If relative cost is removed from the total scores listed in the Evaluation Matrix, Options 5, 6, and 8 still remain the most attractive options. All seven of the options meet the design requirements for the LSS and not one of them has a cost that varies more than \$5M from the average cost of the options of \$62M. The LSS working group focused on Options 5, 6 and 8 as being the most attractive options. These options represent a total savings to the Nuclear Waste Fund of greater than \$40M from earlier estimates (e.g. DOE, 1989a).

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7. LSS IMPLEMENTATION

7.1 INTRODUCTION

The Program Approach (PA) schedule fixes the sequence of actions and accomplishments that must be addressed to support site suitability determination and licensing activities. These actions and accomplishments must be in synchronization with the PA schedule.

10 CFR Part 2, Subpart J identifies the LSS as a critical path element for repository licensing. The rule states that the LSS cannot be used in the licensing process unless the LSS Administrator has certified that DOE is in substantial compliance with the provisions of the rule at least six months prior to submitting a license application. In order for DOE to be in substantial compliance with Subpart J, the LSS must be made available to the NRC and the DOE documentary material must be submitted to the LSS Administrator in the appropriate input form. Based on the PA schedule for submitting a license application (late 2001), the LSS must be certified no later than early 2001.

Although the DOE is required to ensure that the LSS is certified only six months before license application, the NRC and other potential LSS users have indicated that they strongly prefer the system be available as soon as practical. Because loading the LSS database is anticipated to take two to three years, partial database accessibility could be available as early as 1998.

By synchronizing LSS development with the PA and considering the constraints imposed on LSS development and implementation, the following sequential steps for completing the LSS have been identified:

1. Develop Functional (System-Level) Requirements
2. Perform a Make/Buy Analysis
3. Acquire an LSS (make or buy)
4. Load Data into LSS
5. Request certification of LSS

7.2 ACQUISITION CONSTRAINTS

This section provides a brief description of the OMB budgeting process, documentation requirements, procurement process and their relationship to the LSS development and operation schedule.

7.2.1 OMB Budgeting Process

In the past, the OMB Budget Submittal contained budget projections for the current and past fiscal years, and the three out-years beyond the current fiscal year. During FY94, the OMB budgeting process was modified to provide a five year projection spanning FY96 - FY00. Preliminary inputs for this submission are provided to the Chief Financial Officer (CFO) at HQ in August, with final inputs due to the CFO in October of FY95. These inputs are then forwarded to

OMB during the latter part of October, with OMB Passback to DOE for the appeal process in November.

As part of the OMB Budget Submission, funding requirements for the LSS were developed for each of the out-years in support of the PA presented to the U.S. Congress by the DOE. Details of these activities and the associated budget projections are presented in the Yucca Mountain Site Characterization Project Five-Year Plan FY96 - FY00. Funding requirements for LSS related activities in FY95 are described in the FY95 Short Range Plan and include such items as the evaluation of the RDMS prototype, Make versus Buy Analysis, and the evaluation of imaging technology.

As a result of the inclusion of budget projections for the LSS into the OMB Budgeting Process and IRM planning documents, there are no perceived constraints associated with the OMB Budget Process which would impact meeting the PA schedule. However, it should be noted that budget projections in the FY96 - FY00 plan may be subject to change and may not support cost projections developed by the LSS Working Group and should therefore be closely scrutinized.

7.2.2 DOE Documentation Requirements for ABC

OMB Circular A-130 sets forth guidance regarding the conducting of Feasibility Studies and Analysis of Benefits and Costs (ABC) which are flowed down into DOE Orders 1330.1D and 1360.1B, which deal with software management and the acquisition and management of automated data processing equipment, respectively. Specifically, these orders call for development of these supporting documents for systems costing in excess of \$1,000,000. In addition, these supporting documents serve as part of DOE's administrative record to support its LSS decisions.

7.2.2.1 Feasibility Study

The Feasibility Study includes an analysis of the objectives, requirements and system concepts, an evaluation of alternative approaches for achieving the objectives, and the identification of a proposed approach. The requirement and need for a Licensing Support System was established by 10 CFR Part 2, Subpart J. As part of its charter, the LSS Working Group has evaluated alternative operation concepts (i.e., options) necessary to satisfy 10 CFR Part 2, Subpart J requirements and has identified a proposed approach for the implementation of the LSS. The regulatory requirement for a LSS in conjunction with the evaluation of proposed approaches, and identification of a proposed approach satisfies the requirement for a Feasibility Study.

7.2.2.2 Cost/Benefit Analysis ("Make vs. Buy")

During FY95, the ABC for the LSS will be conducted. In order to carry out this analysis the LSS System-Level Functional Requirements Document must be reviewed and updated. The completed LSS System-Level Functional Requirements Document will then be used to generate a Requirements Matrix which will be used to conduct a make/buy analysis.

This make/buy analysis, which spans approximately 6 months, consists of evaluating the RDMS and commercially available systems against the requirements matrix to obtain an overall rating for

each alternative. Due to the time critical nature of the LSS, adherence to schedule constraints will be a mandatory requirement in the evaluation of alternatives. Cost will be factored and weighted as necessary.

The make/buy analysis will commence with a market survey of commercially available Document Management Systems. To accomplish this task in the most expedient manner possible, it is proposed that a Request for Information (RFI) regarding commercially available systems be solicited in the Commerce Business Daily (CBD) to obtain information from interested parties. This will be augmented by a survey of technical sources such as DataPro to obtain a comprehensive list of potential vendors. It is estimated that the market survey will take approximately two months to complete and will result in an abbreviated list of qualified vendors for final consideration. A field test of qualified products will be performed and references obtained from the current customer base. An integral part of the market survey, is the evaluation of the RDMS using the requirements matrix to obtain its relative ranking. The results of the analysis will be formally documented and will contain a recommendation regarding the proposed approach. In general, the alternative with the highest ranking within cost and schedule constraints is recommended.

7.2.3 Procurement Process

The projected time frame for the procurement process from RFP development and solicitation to contract award is approximately 20 months. An assumption of the procurement process is that the selected system will be available off-the-shelf and can be installed within 90 days after contract award. Based upon a proposed operational schedule of early 1999 for the LSS, the "buy alternative" would also appear to support schedule constraints. The schedule for the Analysis of Benefits and Costs can be reduced by approximately two months by conducting the market survey in parallel with the update and revision of the LSS System-Level Functional Requirements Document. This time savings would directly benefit the schedule for the "buy alternative". We note, however, that there are occasions when the DOE procurement process for relatively simple systems has taken several years. Therefore, there is significant uncertainty associated with any planned schedule associated with the procurement process.

The procurement process for either a "make" or "buy alternative" is fundamentally the same. Given that the dollar amount for the system is in excess of \$1M, Acquisition and Implementation Plans, per DOE Order 1360.1B, will have to be developed prior to the initiation of a procurement. These documents are typically prepared as part of the Short Range Plan submission during the June-July time frame immediately preceding the fiscal year in which the procurement will take place.

7.3 PROPOSED IMPLEMENTATION PLAN

In the course of evaluating the steps necessary to arrive at an LSS, schedules were developed based upon estimates of the time required to complete each step. These schedules identify the appropriate project milestones and are consistent with the rate at which resources will be available to support development, data loading, and operation of the LSS.

The cost analyses performed for each LSS option, and described in Section 5.0, developed not only 10-year costs, but also described the annual costs for each option. Figures 7-1 and 7-2 show the annual costs calculated for LSS Option 6 and for the OCRWM Records Management System, respectively. The annual resource availability for the RMS fixes the rate at which historical documentation can be processed for loading into the LSS. The projected LSS annual costs fix the time at which equipment can be acquired. Using these annual cost estimates and experience for estimating individual activities supporting development and loading of the LSS, Figures 7-3 and 7-4 were developed to identify the activities and associated timeframe necessary to prepare the LSS for certification regardless of whether the system is developed internally, or purchased in the open market.

Both LSS development schedules indicate that the LSS Administrator will begin evaluating DOE compliance with 10 CFR 2.1003, "Submission of material to the LSS," as soon as loading of the LSS begins. In each schedule, the LSS Administrator has the opportunity for only one review of the fully loaded system before appropriateness for certification must be judged if the License Application schedule is to be met. Thus, these schedules show that DOE has only one six month period to respond to any shortcomings that the LSS Administrator might foresee in DOE compliance.

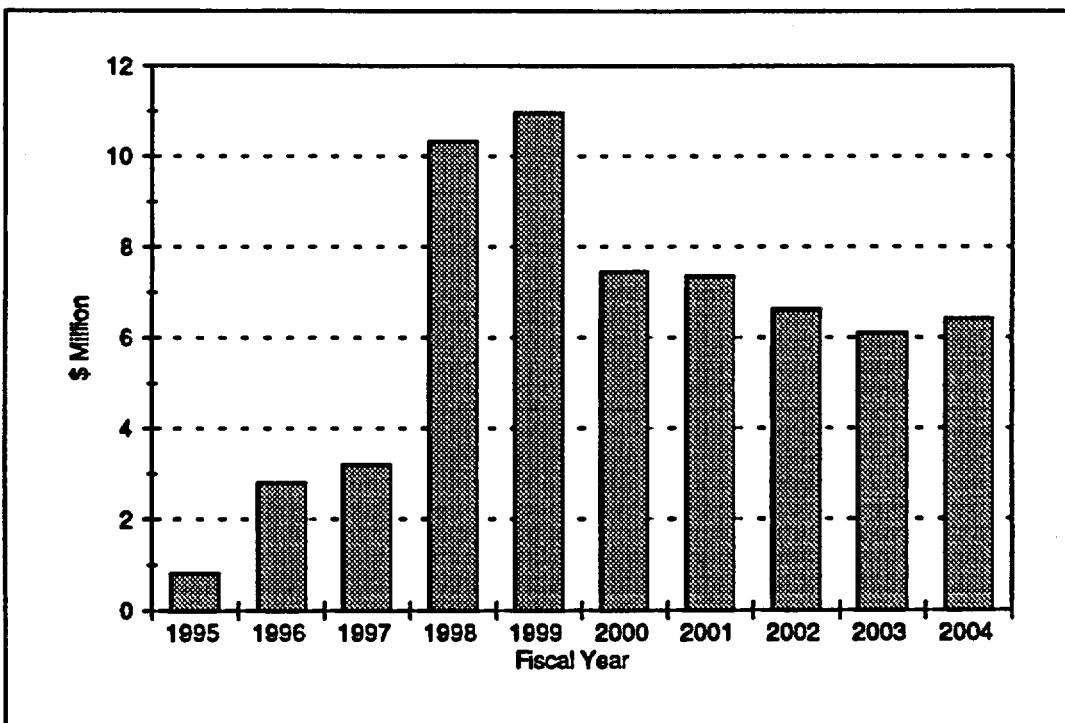


Figure 7-1. Option 6 Annual LSS Cost

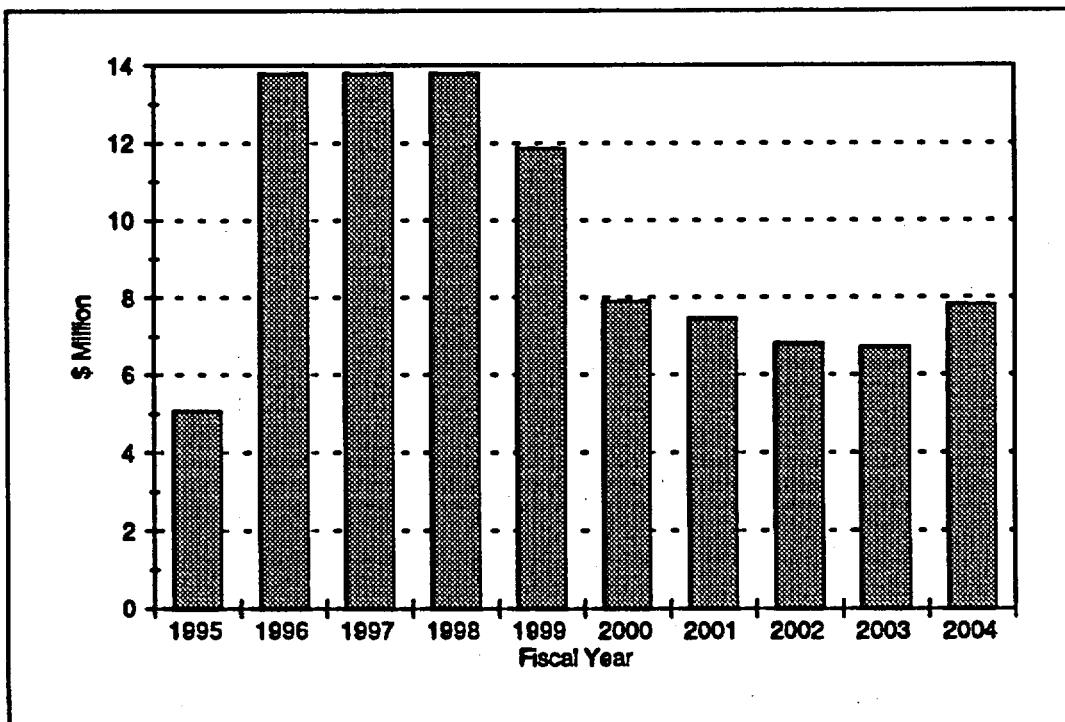


Figure 7-2. Option 6 Annual Records Management System Cost

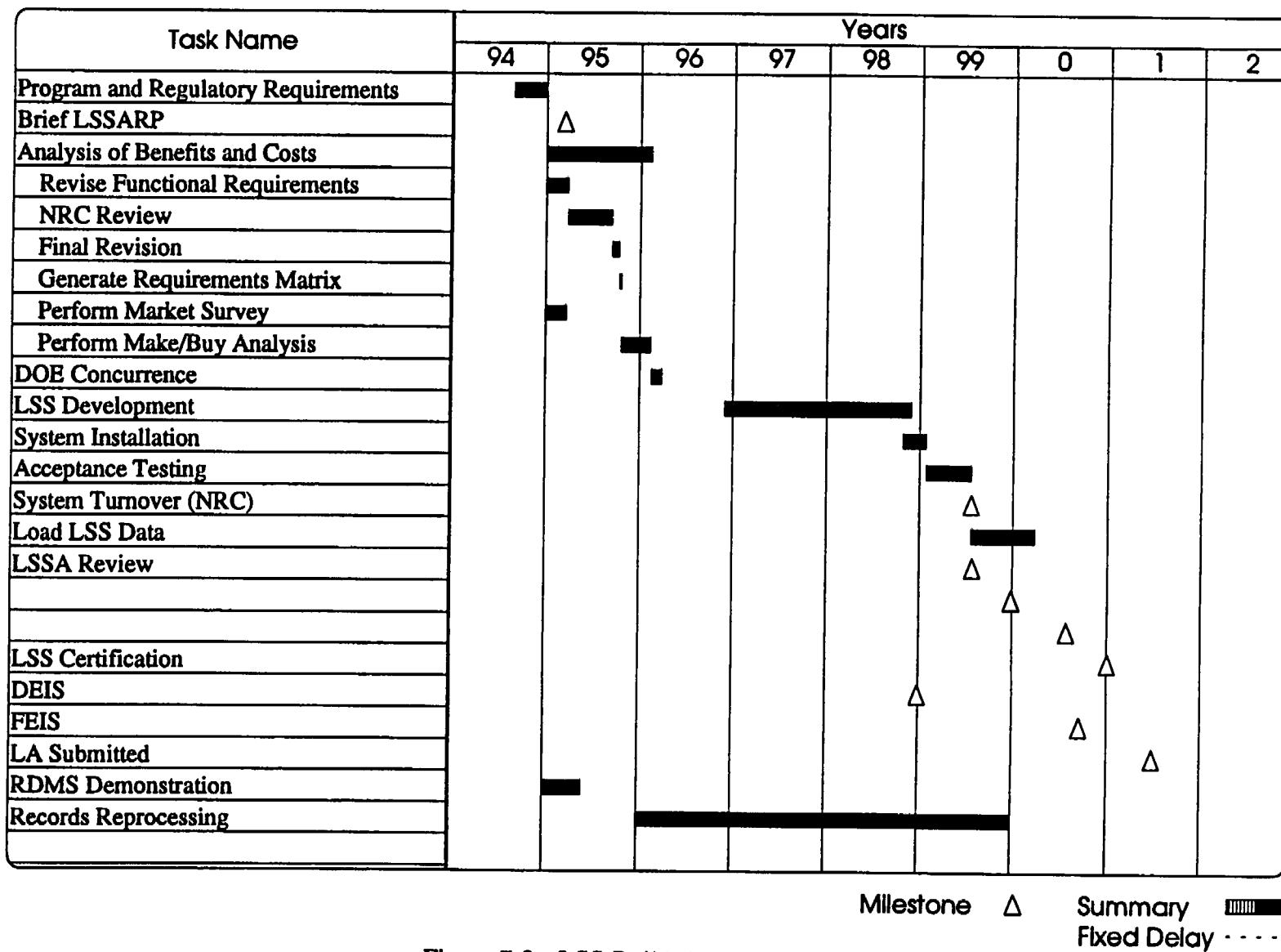


Figure 7-3. LSS Build Schedule

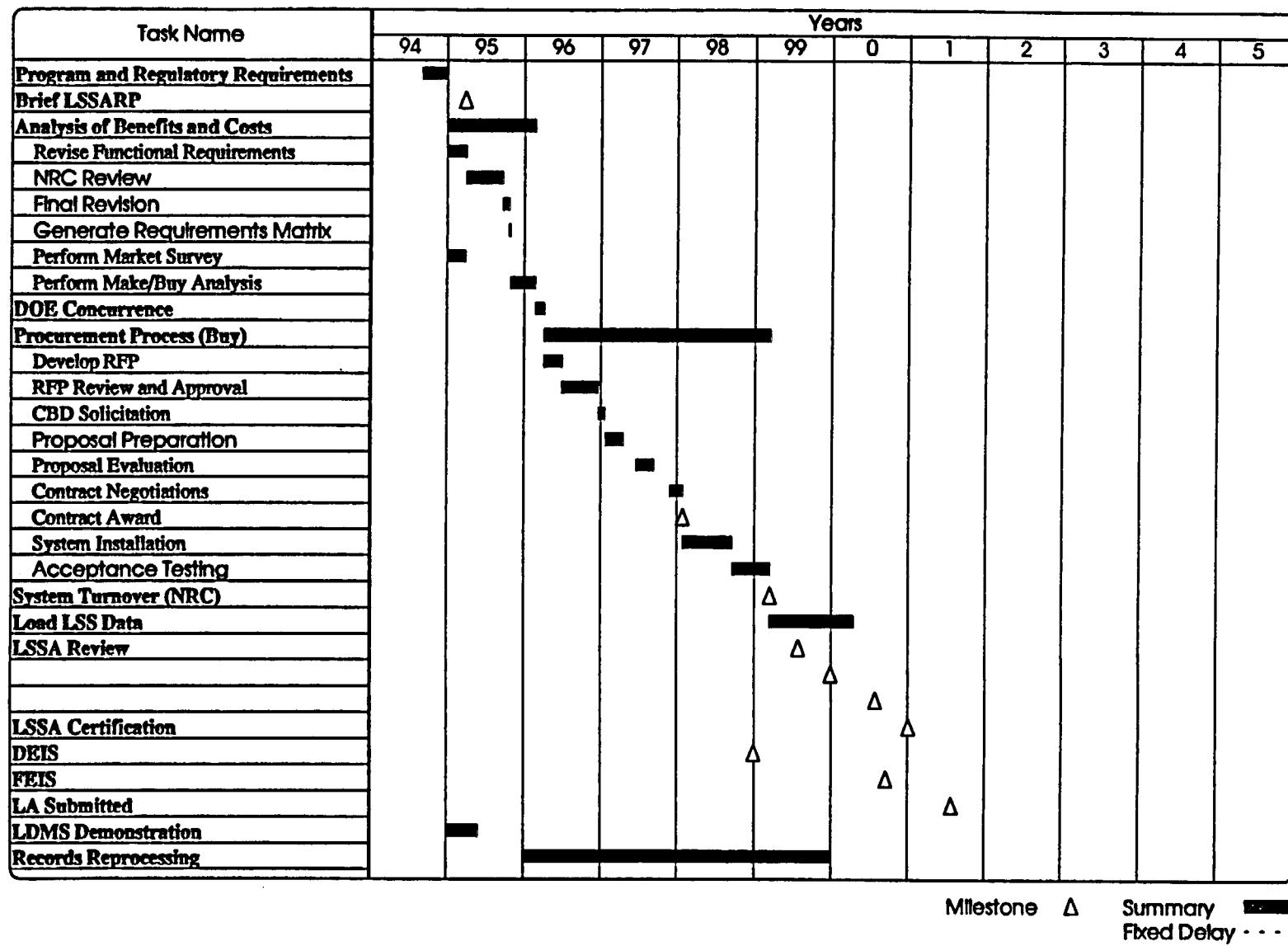


Figure 7-4. LSS Buy Schedule

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8. CONCLUSIONS AND RECOMMENDATIONS

8.1 CONCLUSIONS

There was unanimous agreement amongst the Working Group members that development and implementation of the LSS is an important component of the current Program approach. The specific conclusions reached by the Working Group are presented in this section.

- 1) A significant cost reduction from previous estimates (~\$40 million) has been recognized based on an evaluation of the principal cost drivers (data volume input, data dissemination, and human intervention), identification of cost centers and costs attributable to the RMS, and the application of improved technologies. The expected ten (10) year cost for the LSS is anticipated to be less than seventy million dollars (\$70 million). These costs are based on the major assumption that the RMS will implement an electronic image capture system; thus, the RMS will bear essentially all document capture costs.
- 2) The LSS is a critical element in the process of submitting a timely license application (LA) under 10 CFR Part 2, Subpart J, and in supporting DOE's overall licensing strategy. This conclusion is based upon regulatory requirements, past DOE commitments, realistic development and implementation schedules, and the current Program approach schedule.
- 3) Neither the build nor buy schedules will accommodate significant schedule delays without impacting the current license application submittal date of FY01.
- 4) Care must be exercised in using historical LSS analyses and design documents as a basis for decisions because earlier documentation is somewhat incomplete and some of these documents contain requirements for LSS capabilities that go beyond those that are mandated by regulations. As a result, the Working Group identified a smaller set of LSS design requirements than previously considered.
- 5) A review of the LSS history indicates that no formal analysis of benefits and cost (ABC) has been completed. One component of the ABC, the "make versus buy" analysis, is a critical path activity for the development of the LSS and should be performed to satisfy DOE and federal procurement requirements.
- 6) Under Subpart J, the DOE is required to have the LSS operational and certified by the LSS Administrator at least six months prior to LA submittal. To receive certification, the LSS should be fully loaded with all available documentation at the time of certification. Prior to certification, the LSS Administrator will evaluate DOE's compliance with documentary material submission requirements at six month intervals. This evaluation process should help to identify deficiencies that could impede LSS certification. Therefore, it would be advantageous for the DOE to have the LSS operational well in advance of LA submittal to benefit from the evaluation process and assure that the certification does not impact LA docketing.

- 7) The OCRWM RMS is separate and distinct from the LSS. The RMS will capture the DOE records for the LSS. It is anticipated that the DOE will contribute the majority of records (75 to 85 percent) to the LSS. Therefore, by increasing the compatibility of the two systems, the associated costs as well as risk to the LSS schedule should be reduced.
- 8) The definition of *relevant* documentary material included in Subpart J to limit the scope of material included in the LSS requires prior knowledge of the scope of contentions that will be admitted to the licensing hearings. Without this knowledge, considerable effort could be expended in screening documents admitted to the LSS with little assurance that the results will not be subject to time consuming and costly administrative challenge. Therefore, the exclusionary criteria specified in Subpart J could be used as the only screening mechanism for documents admitted to the LSS.
- 9) A set of eight options that included the existing RMS operation were identified. The current RMS operation does not comply with 10 CFR Part 2, Subpart J, therefore, it was not subject to further evaluation other than as a basis for costs. The remaining seven options are in compliance with Subpart J, and represent a full range of capabilities.
- 10) A set of eight (8) discriminating criteria were selected in an attempt to differentiate among the options. Four of the seven options evaluated clearly rank higher than the other three even when relative cost is eliminated as a discriminator. Three of the four higher ranking options offer significantly greater flexibility and value to the user with small cost differences. When cost is removed as a discriminator, Options 5, 6, and 8 are essentially identical. Of these three preferred options, Option 6 is least the expensive and ranks highest in the total evaluation (see Table 6-2). Option 6 was selected over Option 8 because it does not impose the additional overhead necessary to administer and control the periodic distribution of CD-ROMs. Option 6 is characterized by:
 - Electronic imaging capture and dissemination capabilities
 - Full text capture and retrieveability using optical character recognition technologies
 - Text that is electronically corrected without significant human intervention
- 11) A development and implementation schedule for the LSS has been completed that conforms to the current Program approach. A cost profile for the development and implementation of the LSS has been prepared based on the cost model refined by the Working Group. To minimize steep "spikes" in costs for FY96 and FY97, the Working Group extended the LSS development schedule. This reduced the large budget differential between fiscal years at the expense of extending the schedule and adding risk to achieving a timely LSS certification.
- 12) In recent years, the quality of optical character recognition and electronic imaging technologies have improved significantly. As a result, there exists a need to monitor changes in technology and technical issues related to the LSS in order to maintain user satisfaction and to reduce costs over the life of the LSS.

8.2 RECOMMENDATIONS

Based on the conclusions presented in Section 8.1, the Working Group prepared a set of recommendations that are offered as strategies for near-term development and future implementation of the LSS.

- 1) The DOE should proceed with development and implementation of the LSS consistent with the schedule presented in this report, and with sufficient funding. This will help assure that the LSS certification process will be completed and the LSS certified in a timely manner. Given all the other prerequisites to meeting the LA submittal, it is in the best interest of the DOE to keep the LSS off the critical path.
- 2) In Fiscal Year 1995, the DOE should complete the following in moving forward with the development of the LSS.
 - Actively pursue open issues with the LSSARP
 - Revise the LSS system-level requirements document in order to move ahead with a "make versus buy" analysis and development of the LSS
 - Demonstrate and evaluate the functionality of the Records Data Management System for its applicability to LSS as well as RMS needs
 - Conduct a "make versus buy" analysis to satisfy federal regulations and DOE Orders
- 3) It is recommended that the DOE adopt the Working Group's preferred option (Option 6) which was selected based on an evaluation of eight discriminating criteria. Option 6 complies with the requirements specified in Subpart J and should satisfy most user expectations. It also uses advanced technologies to make the system more cost effective. Option 6 has both electronic image capture and dissemination capabilities, text search and retrieval capabilities, and uses electronically corrected text capabilities to minimize human interaction.
- 4) The DOE should actively pursue interactions with the NRC and other members of the LSSARP to solidify their position on LSS related issues. Future meeting topics should include:
 - DOE's concept of the LSS and schedule for the development and implementation of the LSS.
 - Submitting a revised LSS system-level requirements document to the LSSARP for approval and acceptance.
 - Addressing the document relevancy issue, a very important decision by the LSSARP for implementing the LSS.
 - Resolving the issue of funding for LSS operations.

- Addressing the role of the LSSARP working groups in the development of the LSS.
 - Establishing acceptance criteria for LSS certification.
- 6) The DOE should take a position on the document relevancy issue that its contribution to the LSS should include all documents included in the OCRWM RMS. The RMS currently uses the exclusionary criteria specified in 10 CFR Part 2, Subpart J. This approach should minimize administrative challenges to the database completeness before the LSS Hearing Board. It should also reduce document processing costs by simplifying the document screening process.
 - 7) The OCRWM RMS should be transitioned from a microfilm based system to an electronic imaging system. This transition should take place as soon as fiscally feasible so that reprocessing may proceed and not impact development or implementation of the LSS.
 - 8) Establish a DOE technical advisory body to oversee the LSS related technology development. This body would evaluate emerging technologies relative to LSS operations, evaluate alternatives and recommend changes to improve the system, and recommend standards for open architecture.

It is the opinion of the Working Group that implementation of this strategy will allow DOE to achieve its goal of having a fully functional LSS in a timely and cost efficient manner, and assure that the LSS will not impact the current Program approach or critical path to LA submittal.

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APPENDIX A

LSS PROCEDURAL REQUIREMENTS

LSS requirements that are fixed by law are contained in 10 CFR Part 2, Subpart J. Requirements pertaining to system design have been summarized in Section 3.1 of this report. The purpose of this appendix is to identify all requirements in Subpart J including functions, procedures, and specifics related to users, responsibilities, and oversight.

Section 2.1002, High-level waste Licensing Support System

- The LSS is an electronic information management system containing the documentary material of DOE and...
- Access to the LSS provides the document discovery in the proceeding.
- The LSS provides for the electronic transmission of filings.

Section 2.1003, Submission of material to the LSS

- Submit to the LSS Administrator a computerized text file, an image, and a bibliographic header, reasonably contemporaneous with its creation or acquisition, for all documentary material.
- For graphic-oriented material submit to the LSS Administrator an image and a bibliographic header.
- For documentary material that is not suitable for entry into the LSS submit to the LSS Administrator a bibliographic header.
- Basic licensing documents generated by DOE shall be submitted to the LSS Administrator.
- Docketing of the license application shall not be permitted under Subpart J unless the LSS administrator has certified six months in advance that DOE is in compliance with the submission requirements.
- The license application may be docketed under Subpart G.

Section 2.1004, Amendments and Additions

- Within a given period after submittal of a document the submitter shall verify that the document has been entered correctly into the LSS. The fact of revisions or corrections has to noted on the original bibliographic header.

Section 2.1005, Exclusions

The following material is excluded from entry into the LSS:

- Official notice materials
- Reference book and text books
- Material pertaining exclusively to administration
- Press clipping and press releases
- Junk mail
- Preferences cited in contractor reports that are readily available
- Classified material.

Section 2.1006, Privilege

- Any document for which a claim of privilege is asserted, but is denied in whole or in part, must be submitted to the LSS Administrator.

Section 2.1007, Access

- During the pre-license application phase terminals for access to full headers for all documents and images of the non-privileged documents must be supplied at specified locations.
- After a notice of hearing has been issued, public access of the searchable full text and images of all non-privileged documents must be provided at all locations.
- Public availability of paper copies of the documents will be governed by FOIA regulations.

For LSS participants access will be provided in the following manner:

- Full text search capability through dial-up access from remote locations.
- Image access at remote locations.
- The capability to electronically request a paper copy of a document at the time of search.

Section 2.1009, Procedures

- Designate an official; establish procedures; provide training.

Section 2.1010, Pre-License Application Presiding Officer

- Officer rules on all petitions for access to the LSS.
- Officer rules on all disputes over entry of documents.

Section 2.1011, LSS management and administration

- The LSS shall be administered by the LSS Administrator.

- In consultation with the LSS Administrator, DOE shall be responsible for the design and development of the computer system to implement the LSS. And with the concurrence of the LSS Administrator, DOE shall be responsible for the follow-up redesign and procurement necessary to maintain the LSS.
- The LSS shall not be part of any computer system that is controlled by any LSS participant other than NRC or that is physically located on the premises of any LSS participant other than NRC.
- The LSS computer facility may be used for a records management system independent of the LSS.

The LSS Administrator shall be responsible for:

- Providing the necessary personnel, materials, and services for operation and maintenance of the LSS.
- Identifying and recommending to DOE any redesign or procurement actions.
- Making a concurrence decision within 30 days of any DOE recommendation for redesign or procurement.
- Evaluating and certifying compliance with submittal requirements.
- Ensuring LSS availability and the integrity of the data base.
- Maintaining security for the LSS including password security codes.
- Receiving and entering documentary material.
- Establishing access protocols.
- Maintaining the thesaurus and authority tables.
- Establishing and implementing a training program to use the LSS.
- Providing support staff to assist users of the LSS.

The LSS Advisory Review Panel is established by the LSS Administrator. Its duties include:

- Provide advice to DOE on the design and development of the computer system.
- Provide advice to the LSS Administrator on the operation and maintenance of the LSS.
- Advising on the format standards for submission of documentary material.

- Advising on the procedures and standards for the electronic transmission of filings, orders, and decisions.
- Advising on access protocols.
- Advising on a thesaurus and authority tables.
- Advising on reasonable requirements for header, the control of duplication, retrieval, display, image delivery, query response, and user friendly design.

Section 2.1013, Use of LSS during the adjudicatory proceeding

- Commencing with the docketing, the LSS Administrator shall establish a file within the LSS to contain the official record materials of the proceeding in searchable full text, or for material not suitable for entry, by header and image.
- All exhibits tendered during a hearing must have been entered into the LSS before the commencement of that portion of the hearing.
- All filings shall be transmitted electronically. Proof of service shall be shown by electronic acknowledgment.
- On-line access to the LSS shall be provided to the Presiding Officer.

Section 2.1017, Computation of time

- This 'computation of time' is impacted by the details of the availability of the LSS.

Section 2.1019, Depositions

- Depositions shall be submitted to the LSS Administrator.

The following material is excluded from initial entry into the LSS but is subject to derivative discovery:

- Personal records
- Travel vouchers
- Speeches
- Preliminary draft
- Marginalia.

APPENDIX B
REPOSITORY LICENSING PROCESS

**OUTLINE OF NRC HEARING PROCEDURES APPLICABLE TO THE
LICENSING OF THE HIGH-LEVEL RADIOACTIVE WASTE REPOSITORY**

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1. BACKGROUND

This discussion is designed to assist technical managers in better understanding the U.S. Nuclear Regulatory Commission's current licensing process for the high-level radioactive waste (HLW) repository. Particular emphasis has been given to the adjudicatory hearing that will be conducted by the NRC on the license application submitted by the U.S. Department of Energy.

The existing statutory and regulatory framework requires a dual-phase NRC licensing process for HLW repository construction and operation. In the first phase, DOE will file a license application with the NRC, and must obtain "construction authorization"¹ from the Commission as a prerequisite to commencing construction of a geologic repository operations area.² For a construction authorization to issue, the NRC must determine that the safety and environmental requirements of 10 CFR § 60.31 have been met, and that the site and repository design comply with the performance objectives and criteria in 10 CFR Part 60, Subpart E. The Nuclear Waste Policy Act of 1982, as amended (NWPA), requires the NRC to review DOE's application and issue a final decision approving or disapproving that application for construction authorization within three years after the date that it is submitted.³

The second phase of the licensing process occurs after DOE has received NRC construction authorization and has completed the repository. At that time, DOE must obtain an NRC license to receive and possess source, special nuclear, or byproduct material at the geologic repository operations area.⁴ For this license to issue, the NRC must find that the requirements of 10 CFR § 60.41 have been met, including satisfaction of all applicable environmental requirements in 10 CFR Part 51.

NRC regulations require that an adjudicatory or "trial-type" hearing be held concerning the issuance of Commission construction authorization for the repository.⁵ The NRC also may authorize a hearing on the issue of emplacement of waste at the repository.⁶ The Commission has formulated new procedures in 10 CFR Part 2, Subpart J (hereafter "Subpart J regulations")

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1. A construction authorization is not a license in itself, because it does not authorize possession or use of licensed nuclear material. But a failure by DOE to apply for and obtain a construction authorization would constitute grounds for denial of the license that DOE would later need to receive HLW at the repository. 53 Fed. Reg. 44411, 44414 (Nov. 3, 1988).
 2. 10 CFR § 60.3(b). NRC regulations define a "geologic repository" as a system that is intended to be used for, or may be used for, the disposal of radioactive wastes in excavated geologic media. A "geologic repository operations area" is part of the repository. It is defined as a high-level radioactive waste facility, including both surface and sub-surface areas, where waste handling activities are conducted. 10 CFR § 60.2.
 3. Nuclear Waste Policy Act of 1982, as amended, § 114(d)-(e)(2), 42 U.S.C. § 10134(d)-(e)(2). A twelve-month "slippage" in this licensing schedule is allowed under certain conditions. To obtain a twelve-month extension in the licensing schedule, the NRC must submit a written explanation to DOE and to Congress.
 4. Section 60.3(a).
 5. Section 2.101(f)(8).
 6. Section 2.105(a)(9). See 53 Fed. Reg. at 44414 (Nov. 3, 1988).

to apply specifically to its review of DOE's repository license application. These procedures will be used during any hearings in connection with that application.⁷

The "Subpart J" hearing procedures are designed to enhance the Commission's ability to meet the strict time limits imposed under the NWPA for the HLW repository licensing process, while concurrently providing for a thorough technical review of the novel, complex issues that will be involved. To the extent that they do not replace pre-existing NRC "rules of general applicability" for hearings in 10 CFR Part 2, Subpart G, the Subpart J regulations are intended to mesh with the older, broader NRC formal hearing procedures.⁸ The discussion that follows will integrate these two regulatory schemes where relevant.

Section 2 of this appendix, below, provides a general chronological overview of the NRC adjudicatory hearing process applicable to the repository license application. Section 3 contains a more detailed, phase-by-phase discussion of significant aspects of that process. Attachment B-1 provides a schedule of the licensing proceeding, which may be helpful in highlighting the time that will be required for various pre-hearing activities as well as the hearing itself.

7. 53 Fed. Reg. 44411, 44414 (Nov. 3, 1988).

8. See 10 CFR § 2.1000.

2. OVERVIEW OF NRC LICENSING PROCESS FOR THE HLW REPOSITORY

In focusing upon the starting point for the NRC repository licensing process, we emphasize as a preliminary matter that DOE's work on its license application must begin years before that application is submitted to the NRC. Indeed, the NRC Staff and DOE are already attempting to narrow and/or resolve numerous technical and regulatory issues relevant to DOE's receipt of construction authorization from the Commission.

For purposes of this discussion, however, the licensing proceeding for the HLW repository formally begins with DOE's submittal to the NRC of its license application to receive and possess waste at the repository.⁹ A Safety Analysis Report and an Environmental Impact Statement ("EIS") must accompany the application. If and when the NRC determines that this license application is complete and acceptable for docketing, the NRC will publish a notice in the *Federal Register* announcing the formal docketing of DOE's application, identifying the location of the potential geologic repository operations area, announcing the availability of an NRC public hearing on DOE's license application, and reciting other important preliminary information such as the names of the NRC Atomic Safety and Licensing Board members that the Commission has designated to preside during the licensing proceeding.

Within thirty days after this notice of docketing (also referred to as a notice of hearing) is published, persons "whose interests may be affected" by the HLW licensing proceeding must file written petitions to intervene if they wish to participate as parties to the proceeding. A petition to intervene must explain the petitioner's interest in the licensing proceeding, and how that interest will be affected by the proceeding. Additionally, the petition must provide a list of the proposed contentions, or issues, that the petitioner wishes to litigate in the licensing proceeding if he or she is allowed to intervene and become a party. At this time, petitions seeking status as an "interested government participant" must also be filed by affected States and/or localities.

DOE (as the applicant), the NRC (as the licensing agency), and the ultimate host state for the repository will be parties to the licensing proceeding regardless of the number of intervenors that are ultimately admitted as other parties to the licensing proceeding. Accordingly, DOE and NRC will have an opportunity to file answers to the petitions to intervene and petitions to participate as an interested government entity. These answers will be due within twenty days after any such petitions are filed.

The first "pre-hearing conference" will be held approximately seventy days after the notice of hearing is published. The presiding officer will direct the parties, the interested government participants, and any petitioners for intervention (who are potential parties to the proceeding) to appear at a specified time and place for a meeting (conference) with the Licensing Board. Typically, the parties and potential parties are represented by legal counsel during the pre-hearing conference.

9. The NWPA differentiates between DOE's application for a construction authorization and its application for a license, see NWPA Sections 114(b)-(d). By contrast, NRC regulations in 10 CFR Part 60 refer solely to a license to receive and possess waste. However, Part 60 makes clear that the NRC will first issue a construction authorization and then, provided that DOE makes an appropriate showing, issue a license to receive and possess licensed material at the repository. See 10 CFR §§ 60.32(d), 60.33, 60.41. The NRC has stated that it "considers this differentiation to lack any substantive significance." 53 Fed. Reg. at 44414 (Nov. 3, 1988).

The first pre-hearing conference has several important functions. First, the Licensing Board will consider all intervention petitions (which it will have received previously), and will issue a written order (within thirty days after the pre-hearing conference, if possible) ruling on the admissibility of those petitions. Thus, the pre-hearing conference order should determine who will be admitted as an additional party to the repository licensing proceeding. Second, the Board will attempt to identify and narrow the key issues to be adjudicated in the licensing proceeding. This is done by ruling on the proposed contentions, or issues, proffered by the petitioners. In addition, the Board will likely use the first pre-hearing conference to establish a schedule for the parties to conduct discovery, as well as an overall schedule for the hearing.

The Board's first pre-hearing conference order will likely be issued approximately thirty days after the pre-hearing conference. Around this time (or perhaps even before the order is issued), the parties admitted to the licensing proceeding will begin the process of "discovery." In legal terminology, discovery describes the pre-trial phase during which the parties, following various types of prescribed procedures, seek and obtain from one another information and documents that they believe will be useful to their position in the licensing proceeding. For example, information may be exchanged during the discovery process by a party filing written questions ("interrogatories") that opposing parties must answer within a certain time.

Parties may also take "depositions"--oral examinations in which one party asks a representative of another party a series of questions, which must be answered under oath. Through discovery, parties can narrow the issues to matters that are truly disputed, obtain evidence for their own use at trial, and obtain information about the existence of evidence that may be used by other parties during the hearing. The scope of information subject to discovery is generally very broad. (A matter need not be admissible itself in order to be a legitimate area of discovery.)

In addition to the traditional methods of discovery, a unique feature of the Commission's HLW licensing proceeding will be its heavy reliance on what is called the "Licensing Support System" ("LSS"). The LSS will consist of an electronic information management system. The LSS will contain the documentary material of DOE (and its contractors) and all other parties to the proceeding and interested government participants. In this instance, "documentary material" refers to any material or other information generated by, or in the possession of, an LSS participant, that is relevant to, or likely to lead to the discovery of information that is relevant to, the licensing of the likely candidate site for a geologic repository.

Under procedures that will be further developed by the NRC at the appropriate time, parties and potential parties to the repository licensing proceeding will begin submitting documentary material to the LSS up to six months *before* DOE submits its license application. In theory, the early availability of the LSS should enable the parties and potential parties to identify significant hearing issues in advance, and perhaps resolve some issues and questions without actually litigating them. An NRC official will be appointed to supervise the input of documentary material, and to facilitate the functioning of the LSS.

According to the Commission's schedule for Subpart J licensing activities (see Attachment A to this memorandum), the NRC will issue its Safety Evaluation Report ("SER") approximately 18 months after the license application is noticed in the *Federal Register*. A second pre-hearing conference will be scheduled thirty days after the SER is available. At that pre-hearing

conference, the Licensing Board and the parties will finalize the issues to be litigated at the hearing, identify witnesses, establish a further discovery schedule (if needed), and set a hearing schedule for the proceeding, taking into account the three-year time period established by the NWPA.¹⁰ The Board will issue a second pre-hearing conference order approximately thirty days after the conference ruling on these issues.

At around the same time (approximately 22 months into the licensing proceeding), the parties will prepare motions for "summary disposition" in an effort to dispose of some of the contested contentions on the pleadings, rather than litigating them in full in the hearing. The basis for seeking summary disposition on a contention is that the contention does not reflect a genuine issue or dispute, and that the moving party is therefore entitled to a decision in his favor as a matter of law. The last practical date for filing summary disposition motions is around thirty days before discovery closes. Opposing parties will then respond in writing to those motions, and the Board will issue an order granting or denying the motions.

Around the time that the Board rules on summary disposition motions, the discovery process will formally end. The parties will then focus more intensely upon the upcoming hearing, by preparing their witnesses to testify, and by submitting pre-filed testimony (for their own witnesses) and cross-examination plans (for opposing parties' witnesses) to the Board. This should occur around the 23rd month after the notice of hearing is filed. Then, approximately 24 months into the licensing proceeding (under the NRC estimate), the evidentiary hearing will begin. The NRC contemplates that the hearing will last ninety days, ending approximately 27 months into the proceeding. During this time, all of the parties will present testimony, using expert witnesses, and will cross-examine the witnesses presented by opposing parties.

After the hearing ends, the parties must prepare written proposed findings of fact and conclusions of law. The Licensing Board will then issue its initial decision around 32 months after the proceeding begins. The NRC schedule then allows an additional 5-6 months for the completion of the NRC appeal process. In theory, the NRC will issue the repository construction authorization to DOE around 35 months into the proceeding, before the appeal process is exhausted.

¹⁰. Section 2.1022.

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3. DISCUSSION OF SIGNIFICANT PHASES OF THE HEARING PROCESS

3.1 DOCKETING THE REPOSITORY LICENSING PROCEEDING

When DOE submits the repository license application to the NRC, the NRC will first determine whether the tendered license application is "complete and acceptable for docketing."¹¹ The required contents of the license application are addressed in 10 CFR § 60.21 as noted above. In addition to the general information required, DOE must provide a Safety Analysis Report as part of its application. DOE's Environmental Impact Statement ("EIS") must also accompany the application.¹²

If DOE's tendered application is acceptable, the NRC will assign a docket number and additional copies of the application and the accompanying environmental impact statement will be submitted by DOE.¹³ Copies of the tendered application must also be supplied to officials in the county and/or municipality where the repository is located.¹⁴ After these additional copies have been submitted, the NRC formally dockets the application.¹⁵

3.1.1 Publication of the Notice of Docketing (DAY 0)¹⁶

After the series of events described above, the NRC Office of Nuclear Material Safety and Safeguards (NMSS) significant for several reasons. First, the NRC notice will announce the docketing of the license application and identify the location of the proposed geologic repository operations area.¹⁷ The notice of docketing will further state that "the Commission finds that a hearing is required in the public interest, prior to issuance of a construction authorization."¹⁸ The notice will also contain other important information concerning the hearing,¹⁹ including the time, place and nature of the hearing or pre-hearing conference, the authority under which the hearing

11. Section 2.101(f)(2)-(3).

12. 10 CFR §§ 60.21(a); 60.22(a). See also Section 114(f) of the NWPA, 42 U.S.C. §10134(f).

13. Section 2.101(f)(3),(5).

14. *Id.*

15. Section 2.202(f)(6).

16. The designation of "Days" in this and successive sections of this outline refers to the approximate number of days after the publication of the NRC notice of docketing/notice of hearing in the *Federal Register*. This reference provides a convenient means of indicating the length of the licensing proceeding. Thus, the day of publication of the notice is "Day 0."

17. Section 2.101(f)(8).

18. Section 2.101(f)(8). During the second phase of the licensing proceeding, the NRC could determine that the public interest does not require a hearing on DOE's application for a license to receive and possess licensed nuclear material at the repository. In that case, the NRC *Federal Register* notice announcing its receipt of DOE's licensing application would be issued not under Section 2.101(f)(8), but rather under Section 2.105(a)(5). As a practical matter, of course, the NRC anticipates that a public hearing will be requested and held on both stages of the HLW repository license. Under Section 189a.(1)(A) of the Atomic Energy Act of 1954, as amended, the NRC is obligated to provide *an opportunity for a hearing* in connection with the issuance of NRC licenses; however, the Commission is not obligated to hold a hearing if one is not requested.

19. The information to be recited in the notice of docketing is that set forth in Section 2.104(a). See Section 2.101(f)(8).

is held, the matters of fact and law to be considered, and the time within which answers to the NRC notice must be filed.²⁰

Finally, the notice may designate one or more Commissioners, a named officer, or (most likely) an NRC Atomic Safety and Licensing Board ("Licensing Board") to preside during the hearing on the construction authorization application.²¹ (If the Commission does not appoint a Licensing Board in the *Federal Register* notice, it will do so shortly thereafter in a separate NRC order.) An NRC Licensing Board is typically comprised of a panel of three individuals. The Chairman of the Licensing Board is usually an attorney, who rules on issues and disputes during the proceeding much like a trial judge. The remaining two members of the Board are assigned based upon their technical expertise.

3.2 THE INTERVENTION PROCESS (DAY 30)

3.2.1 Petitions to Intervene in the HLW Licensing Proceeding

DOE, as the license applicant, the NRC, as the licensing agency, and the host state for the repository will participate as parties in any hearings conducted as part of the repository licensing proceeding. But the right of other entities to participate as additional parties to the NRC HLW repository licensing proceeding is not automatic.

Rather, individuals and entities that wish to participate as parties must follow Subpart J procedures governing hearing "intervention." Any person (1) "whose interest may be affected" by the repository license proceeding under Part 60 *and* (2) who desires to participate as a party to that proceeding, must file a written petition for leave to intervene.²² A petition for leave to intervene and/or request for a hearing must be filed within 30 days after the NRC publication of the *Federal Register* notice announcing the docketing of the application and the availability of a hearing on the application.²³ Parties or interested government participants may file an answer to a petition for leave to intervene within 20 days after the service of the petition.²⁴

3.2.2 Showing Required in a Petition to Intervene

A petition to intervene must set forth "with particularity" the petitioner's interest in the proceeding, and how that interest may be affected by the results of the proceeding, including the reasons why the petitioner should be permitted to intervene. Additionally, the petitioner must provide a list of the contentions that it seeks to have litigated in the proceeding. (A "contention"

20. Section 2.104(a). See also Section 2.703 (made applicable by Section 2.1000), which requires similar information in the notice of hearing).

21. Section 2.704(a).

22. Section 2.1014(a)(1).

23. In a proceeding noticed under Section 2.105 of the NRC regulations, such individuals may also request a hearing. Section 2.1014(a)(1). But the NRC may itself notify the public of its own determination that a hearing on the repository license application is required in the interest of public health and safety. See Section 2.101(f)(8).

24. Section 2.1014(b).

is an assertion or argument that an individual or organization wishes to litigate in the licensing proceeding.)

With respect to each proposed contention, a petition to intervene must provide:

- A specific statement of the issue of law or fact to be raised or controverted
- A brief explanation of the basis of the contention
- A concise statement of the alleged facts or expert opinion that support the contention and on which the petitioner intends to rely improving the contention at the hearing
- Sufficient information to show that a genuine dispute exist with the applicant on a material issue of law or fact
- The specific regulatory or statutory requirement to which the contention is relevant.²⁵

The Licensing Board rules on petitions to intervene. Petitioners whose proffered contentions fail to satisfy these requirements will not be permitted to intervene, and thus may not participate as parties to the licensing proceeding.²⁶

This standard, as written in NRC regulations, is a stringent one. It is designed to eliminate proposed contentions that are too vague or broad or irrelevant to the licensing proceeding, and proposed contentions based solely on speculation that lack any factual or scientific basis. However, to the extent that NRC precedent in other types of licensing proceedings is indicative, we should expect the Licensing Board in the repository hearing to go to great lengths to find that a potential party is qualified to intervene, and that the proposed contentions proffered by that party are admissible.

3.2.3 Relevant Factors in NRC Rulings on Petitions to Intervene

The NRC is required to permit intervention in the hearing by "an affected unit of local government" as defined in Section 2(31) of the NWPA, 42 U.S.C. 10101.²⁷ In all other circumstances, however, the presiding officer is to consider certain factors in ruling on petitions to intervene. Those factors include:

- The nature of the petitioner's rights under the Atomic Energy Act to be made a party to the proceeding

25. Section 2.1014(a)(2)(iii).

26. Section 2.1014(3).

27. Section 2.1014(c).

- The nature and extent of the petitioner's property, financial, or other interest in the proceeding
- The possible effect of any order that may be entered in the proceeding on the petitioner's interest
- The failure of the petitioner to participate as a potential party in the Licensing Support System
- In determining whether a genuine dispute exist on a material issue of law of fact, whether the contention, if proven, would be of no consequence in the proceeding because it would not entitle petitioner to relief.²⁸

The granting of a petition for leave to intervene does not normally change or enlarge the issues specified in the NRC Notice of hearing.²⁹ The other parties may appeal to the Commission a Board order granting a petition to intervene, but must do so within ten days after service of that order.³⁰

3.2.4 Untimely Petitions to Intervene

As noted above, a petition for leave to intervene and/or request for a hearing must be filed within 30 days after the NRC publication of the notice of hearing in the *Federal Register*. Untimely petitions to intervene will not be entertained unless the presiding officer (or the Commission) determines that the petition and/or request for a hearing should be granted, based upon a balancing of certain factors set forth in NRC regulations.

The criteria that the NRC applies in evaluating untimely petitions to intervene are:

- The existence of good cause, if any, for failure to file on time
- The availability of other means whereby the petitioner's interest will be protected
- The extent to which the petitioner's participation may reasonably be expected to assist in developing a sound hearing record
- The extent to which the petitioner's interest will be represented by existing parties
- The extent to which the petitioner's participation will broaden the issues or delay the proceeding.³¹

^{28.} Section 2.1014(c)(1)-(4).

^{29.} Section 2.1014(g).

^{30.} Section 2.1015(b).

^{31.} Section 2.1014(a)(1)(i)-(v).

If the Licensing Board determines that petitioner's interest is limited to one or more of the issues involved in the proceeding, any order allowing intervention will limit that petitioner's participation accordingly.³²

3.2.5 Limited Appearances

Individuals who are not admitted as parties to the licensing proceeding may still be allowed to make a "limited appearance" in the proceeding by making oral or written statements of their position on the issues at designated sessions of the hearing, or at any pre-hearing conference, as reasonably regulated by the presiding officer. Such individuals may not otherwise participate in the hearing.³³

In particular, the presiding officer will allow representatives of an interested State, County, municipality, and/or agencies thereof, a "reasonable opportunity to participate and to introduce evidence, interrogate witnesses, and advise the commission without requiring the representative to take a position with respect to the issue." Such participants may also file proposed findings. The presiding officer may require such representatives to indicate in advance to the hearing the subject matter on which they desire to participate.³⁴

3.3 THE FIRST PRE-HEARING CONFERENCE (DAY 70)

Pre-hearing conferences, a standard feature of other types of NRC licensing proceedings, are also used in Subpart J. Within seventy days after the notice of hearing is published (or at such other time as the presiding officer orders), the parties, the interested government participants, and any petitioners for intervention (whose petitions have not yet been granted or denied), will be directed to appear at a specified time and place for a pre-hearing conference.³⁵ This conference is traditionally a pivotal event in NRC licensing proceedings. In Subpart J proceeding, the first pre-hearing conference will be used to:

- Permit identification of the key issues in the proceeding
- Take any steps necessary for further identification of the issues
- Consider all intervention petitions (and thus make a preliminary or final determination as to which intervenors will be admitted as parties to the proceeding)
- Establish a schedule for further action in the proceeding

32. Section 2.1014(e).

33. Section 2.715(a).

34. Section 2.715(c).

35. Section 2.1021.

- Establish a discovery schedule for the proceeding, taking into account the three-year time limit set forth in the Nuclear waste Policy Act.³⁶

The conference will be stenographically recorded.³⁷

The Licensing Board will issue a pre-hearing conference order approximately thirty days after the first pre-hearing conference is held (in theory, around 100 days into the licensing proceeding). This order will recite the Board rulings made during the conference, the schedule for further actions in the proceeding, and any agreements by the parties. This order will also identify the key issues to be litigated in the proceeding, make a preliminary (or final) determination as to the parties and the interested government participants in the proceeding, and provide for the submittal of status reports on discovery.³⁸ Appeals, if any, from the Board's first pre-hearing conference order must be filed within ten days after service of the order.³⁹

3.4 THE DISCOVERY PROCESS (DAY 100)

3.4.1 The Role of Discovery

The "discovery" process in NRC proceedings (which is modelled after the discovery process under the Federal Rules of Civil Procedure) is designed to enable the parties to the licensing proceeding to "discover" useful information and then winnow that information for use during the hearing. By using discovery procedures, parties can (1) narrow the issues (so that during the hearing only evidence on *disputed* matters need be produced); (2) obtain evidence for use at trial; (3) secure information about the existence of evidence that may be used during the hearing, and ascertain how and from whom such evidence may be procured.⁴⁰

The scope of information subject to discovery is generally very broad. Using any one of the discovery methods discussed below, the parties may obtain discovery of "any matter, not privileged, which is relevant to the licensing of the likely candidate site for a geologic repository, whether it relates to the claim or defense of the person seeking discovery or to the claim or defense of any other person."⁴¹ A party may not object to discovery on grounds that the information sought will be inadmissible at the hearing, provided that such information "appears reasonably calculated to lead to the discovery of admissible evidence."⁴²

36. Section 2.1021(a)(1)-(5).

37. Section 2.1021(c).

38. Section 2.1021(d).

39. Section 2.1015(b).

40. Wright and Miller, *Federal Practice and Procedure*, § 2001, p. 15.

41. Section 2.1018(b)(1).

42. Section 2.1018(b)(1).

As discussed below in connection with the LSS, a frequent source of delay in earlier NRC licensing proceedings has been the time needed for parties to produce, send, receive, and review documents during the discovery process. The use of the LSS in the HLW repository licensing proceeding is designed to reduce such delays. But certain other, more traditional forms of discovery will also be allowed in this proceeding, to enable the parties to obtain information.

3.4.2 Types of Discovery

In particular, parties, potential parties, and interested governmental participants in the repository licensing proceeding may obtain discovery by one or more of the following methods:

- Access to the Licensing Support System
- Entry upon land for inspection, access to raw data, or certain other purposes⁴³
- Access to copies of documentary material for which only bibliographic headers have been submitted
- Depositions upon oral examination⁴⁴
- Requests for admission
- Informal requests for information not available in the LSS (such as the names of witnesses and the subjects those witnesses plan to address)
- Interrogatories.⁴⁵

Some discovery involving the use of the LSS will begin early in the licensing proceeding, during the pre-license application phase. Other discovery methods, including sending and answering interrogatories, taking depositions by written questions, and taking depositions by oral examination, may be filed only after the issuance of the first pre-hearing conference order under Section 2.1021, and must be limited to the issues defined in that order.⁴⁶ The NRC schedule for Subpart J activities calls for a long period (almost twenty months) of deposition discovery (non-

43. See Section 2.1020.

44. In a "deposition upon oral examination," an individual is asked a series of oral questions by a representative of another party. The deponent (that is, the person being deposed) must answer each question under oath, and his or her responses are recorded verbatim by a court reporter. The deponent usually has an attorney present. When the testimony has been transcribed, the deponent signs the transcript, certifying that it accurately reflects his remarks. Depositions on oral examination are addressed in Section 2.1019.

45. Section 2.1018(a)(1). "Interrogatories" are written questions propounded by one party that must be answered in writing by another party. No direct meeting between the parties is required as in a deposition; thus, interrogatories are usually less expensive. Individual(s) providing answers to interrogatories must attest to the accuracy and completeness of their responses, and are under a continuing duty to supplement their answers as appropriate. Section 2.1018(e).

46. Section 2.1018(b)(1).

LSS discovery). Discovery is scheduled to begin approximately 100 days into the licensing proceeding and end approximately 690 days (23 months) into the proceeding.

Note that parties required to respond to interrogatory requests, or parties whose deposition will be taken, are frequently required to produce relevant documents in their possession or under their control. The production of documents may be compelled by subpoena. If the Board decides to require that sensitive information (such as proprietary data, for example) be produced in discovery, appropriate measures will be taken to protect that information.⁴⁷ The presiding officer is authorized to appoint a "special master" to resolve disputes between the parties concerning informal requests for information.⁴⁸

3.5 THE LICENSING SUPPORT SYSTEM

3.5.1 What Is the LSS?

A unique feature of the NRC repository licensing regime is the use of an electronic information management system known as the Licensing Support System, or "LSS." The LSS is designed to contain the technical information supporting the DOE application, as well as potentially relevant documents generated by NRC, DOE, DOE contractors, interested government participants, and all other parties and potential parties to the licensing proceeding, in a standardized electronic format. All parties to the proceeding will have access to the LSS through electronic full text search capability, designed to provide the flexibility of searching any word or word combinations within a document. This system thus facilitates the rapid identification of relevant documents and issues.

To maximize the effectiveness of the LSS, documents containing potentially relevant licensing material would be added electronically to the LSS, and electronic access to the LSS would be provided to parties and potential parties, as early as practicable *before* DOE submits its license application. LSS participants will submit an ASCII file, a bibliographic header, and an image for the LSS documents in their possession or control.⁴⁹ Commission regulations envision that DOE or NRC documents created or acquired on or before the LSS is available are to be submitted no later than six months before the license application is submitted. Documents created or acquired after these parties have LSS access are to be submitted at the time they are created or acquired by DOE or NRC.⁵⁰ Similar rules apply to the submission of documentary material by other potential parties to the proceeding.⁵¹ (The NRC encourages LSS participants to submit this material for entry as soon as possible after they have been given access to the LSS.)

47. Section 2.1018(c).

48. Section 2.1018(g).

49. Section 2.1003 addresses the submission of material to the LSS.

50. Section 2.1003(b).

51. Section 2.1003(a)(1).

3.5.2 The Functions of the LSS

Although the usefulness of the LSS is untested, and was initially questioned by some members of the nuclear industry, the NRC is currently committed to employing this system in the repository licensing proceeding. The Commission takes the position that the LSS will provide for more timely review of the repository license application in several ways:

- The LSS will eliminate the most burdensome and time consuming aspect of the current system of document discovery -- the physical production and review of documents after the application has been filed - by allowing the identification and submission of discoverable documents before the license application is submitted.
- The LSS will eliminate burdensome Freedom of Information Act requests for the same information that both DOE and the NRC will likely receive if the LSS is not used.
- The LSS will facilitate the comprehensive and early technical review by DOE and NRC staff of millions of pages of relevant licensing materials. The electronic full text search capability will allow for quick identification of relevant documents and issues.
- The LSS will allow potential parties to the proceeding to review the millions of pages of licensing materials in a comprehensive and timely fashion, so as to permit the earlier submission of better-focused contentions. This should result in a substantial savings of time during the hearing.
- The LSS will permit the electronic transmission of all filings during the hearing, thereby reducing delay.⁵²

In theory, therefore, this system should enhance the ability of potential parties to identify and resolve licensing issues early, and prepare more effectively for the hearing, thus facilitating the NRC ability to complete its review of DOE's license application as quickly and efficiently as possible.⁵³ The parties' access to the LSS will largely take the place of document discovery during the repository licensing proceeding.⁵⁴

3.5.3 What Goes into the LSS?

The NRC expects all proposed participants in the licensing proceeding to make a good faith effort to identify the documentary material that should be placed in the LSS.⁵⁵ "Documentary material" to be incorporated into the LSS includes any material or other information generated by, or in the possession of, an LSS participant, that is relevant to, or likely to lead to the

52. 54 Fed. Reg. 14925, 14926 (April 14, 1989).

53. 53 Fed. Reg. 44411 (Nov. 3, 1988) (notice of proposed rulemaking concerning the LSS).

54. Section 2.1002(a).

55. A "rule of reason" will be applied to an LSS participant's obligation to identify all documentary material within the scope of NRC topical guidelines. 54 Fed. Reg. at 14934.

discovery of information that is relevant to, the licensing of the likely candidate site for a geologic repository.⁵⁶ The NRC has issued topical guidelines to assist parties in identifying the documentary material that should be submitted by LSS participants for entry into the LSS.⁵⁷ These topical guidelines will also be used by the Pre-License Application Licensing Board for evaluating petitions for access to the LSS during the pre-license application phase.⁵⁸

As a general rule, all documentary material in the LSS is to be in searchable full text. However, the rules provide for some exceptions, such as for "graphic-oriented documentary material" -- (including raw data, computer runs, computer programs and codes, field notes, laboratory notes, maps, and photographs which have been printed, scripted, handwritten or otherwise displayed in any hard copy form) -- which may be captured and submitted to the LSS Administrator in any form of image.⁵⁹ NRC regulations governing the LSS also address documentary material that is not suitable for entry into the Licensing Support System in either image or searchable full text. Such material is to be described in the LSS by means of a sufficiently descriptive bibliographic header.

Both "final documents" (that is, documents bearing the signature of an employee of an LSS participant or its contractors) and "circulated drafts" must be submitted to the LSS.⁶⁰ A "circulated draft" means a nonfinal document circulated for supervisory concurrence or signature and in which the original author or others in the concurrence process have nonconcurred.⁶¹ Provisions are made for excluding privileged documents.⁶² Categories of documents excluded from entry into the LSS are described in Section 2.1005 of NRC regulations. (This includes, for example, official notice materials, reference and text books, materials pertaining exclusively to administration or procurement, press clippings, junk mail, and classified material.)⁶³ NRC regulations also provide for making amendments and additions to the LSS.⁶⁴

56. Section 2.1001. The NRC (will provide) guidance on identifying material that is within the universe of "relevant to, or likely to lead to the discovery of information that is relevant to, the licensing of the likely candidate site for a geologic repository." 54 Fed. Reg. at 14933-34 (April 14, 1989).

57. Although NRC topical guidelines will guide the selection of relevant information for entry into the LSS, they will not be used for the purpose of determining the scope of contentions that can be offered in the HLW proceeding.

58. 54 Fed. Reg. 14925, 14943 (April 14, 1989).

59. Section 2.1003(c).

60. Section 2.1003(a)(1)-(2), (b)(1)-(2).

61. 54 Fed. Reg. at 14934 (April 14, 1989). The intent of this exception to the general rule for final documents is to capture those documents to which there has been an unresolved objection by the author or other person in the internal management review process (the concurrence process) of an LSS participant or its contractor. In effect, the Commission and other government agencies who are LSS participants are waiving their deliberative process privilege for these circulated drafts.

62. In general, the traditional discovery privileges recognized in NRC adjudicatory proceedings, and the exceptions from disclosure recognized by Section 2.790, may be asserted by the parties to protect documents from inclusion in the LSS. Disputes will be resolved by the Pre-License Application Board. Section 2.1006.

63. Section 2.1005.

64. Section 2.1004.

3.5.4 Administration of the LSS

The Licensing Support System will be managed and administered by the LSS Administrator, who will be an NRC employee.⁶⁵ In consultation with the LSS Administrator, DOE is responsible for designing and developing the computer system necessary to implement the LSS, including the procurement of computer hardware and software.⁶⁶ (The LSS may not be part of any computer system controlled by any party or potential party.)

In addition, NRC regulations address the possibility that, given the novelty and complexity of the LSS, disputes will arise concerning the use of this system, particularly during the pre-license application stage when no Licensing Board has been named. Accordingly, the Commission will designate a "Pre-License Application Presiding Officer" six months before access to the LSS is scheduled to become available.⁶⁷ This Presiding Officer will:

- Rule on requests for access to the LSS during the pre-license application phase
- Resolve disputes concerning the entry of documents into the LSS and the exclusion of documents (on the basis of privilege, for example) from the LSS during the pre-license application phase⁶⁸
- Resolve pre-license application discovery disputes
- Resolve disputes concerning the development and implementation of the LSS by DOE and the LSS Administrator.⁶⁹

To gain access to the LSS during the pre-license application phase, an LSS participant must agree to comply with all orders of the Presiding Officer (and all applicable regulations governing the LSS).

3.5.5 Ensuring Compliance with the LSS

To ensure that progress is made in designing, developing and loading the LSS, NRC regulations provide that DOE's license application cannot be docketed under Subpart J unless the LSS Administrator certifies at least six months before the application is submitted that DOE has complied with its obligations relating to the LSS.⁷⁰ (Although § 2.1003(h)(1) requires the

65. See Sections 2.1001, 2.1011(a), (d).

66. Section 2.1011(b)(1).

67. Section 2.1010.

68. Section 2.1010. The Pre-License Application Board will also possess all of the general powers given to NRC licensing boards under 10 CFR § 2.718.

69. The powers and obligations of the Pre-License Application Presiding Officer are discussed in Section 2.1010.

70. Section 2.1003(h)(1). The LSS Administrator's decision on DOE compliance may be reviewed by the Pre-License Application Presiding Officer pursuant to § 2.1010.

certification decision six months before submission of the DOE license application, the Commission anticipates that the LSS participants will have access to the LSS well before the license application is submitted.) Additionally, DOE compliance with LSS requirements will be evaluated periodically.⁷¹ The LSS Administrator must also evaluate and certify parties' compliance with the LSS requirements.⁷² In sum, if potential parties fail to comply with the LSS provisions, they could lose the benefits of using Subpart J licensing provisions.⁷³

3.6 THE SECOND PRE-HEARING CONFERENCE (DAY 578)

The Board will hold a second pre-hearing conference in the HLW licensing proceeding within thirty days after the NRC issues its Safety Evaluation Report (SER). According to the NRC Subpart J schedule, this should be about 19 months into the proceeding. Discovery will still be ongoing. In general, the purposes of this pre-hearing conference are to:

- Consider any amended contentions
- Simplify, clarify, and specify the issues
- Obtain stipulations and admissions of fact, and deal with procedural matters concerning the authenticity of documents
- Identify witnesses, consider limiting the number of expert witnesses, and take other steps to expedite the presentation of evidence
- Set a hearing schedule
- As necessary, establish a schedule for any additional discovery in the proceeding.⁷⁴

As with the first pre-hearing conference, the presiding officer will issue an Order reciting the actions taken and the issues resolved at the conference.⁷⁵ Any appeals taken from the Board's second pre-hearing conference order must be filed within ten days after that order is served, and must be accompanied by a written brief in support of the motion.⁷⁶ Opposing briefs must be filed within ten days thereafter.⁷⁷ A Commission order ruling on appeals from the second pre-hearing

71. Section 2.1003(h)(2).

72. Sections 2.1011(d)(6); 2.1012(b)(1).

73. In the event that the LSS Administrator cannot certify DOE compliance with Subpart J, DOE may either postpone the filing of the application until compliance is certified, or can file the application for docketing under 10 CFR Part 2, Subpart G. See Section 2.1003(h)(3).

74. Section 2.1022(a)(1)-(7).

75. Section 2.1022(c).

76. Section 2.1015(b).

77. Section 2.1015(b).

conference will be issued approximately thirty days after the briefs are filed. (This will be approximately 22 months into the licensing proceeding.)

3.7 SUMMARY DISPOSITION (DAY 660)

The filing of motions for summary disposition by the parties provides a mechanism for disposing of some contested issues on the pleadings so that they will not have to be adjudicated during the hearing.⁷⁸ The basis for a party to seek summary disposition on a contention is that the contention contains no genuine issue or dispute to be heard and ruled upon by the Licensing Board, and, therefore, that the moving party is entitled to a decision in its favor as a matter of law.

Summary disposition may be used "only for the determination of specific subordinate issues;" that is, this procedure may not be used to determine the ultimate issue of whether the licensing authorization for the HLW repository operations area should be issued.⁷⁹ Motions for summary judgment may be filed at any time during the repository licensing proceeding. (Typically, such motions are not submitted until after the parties have had an opportunity to ascertain, through the discovery process, the factual bases for opposing parties' contentions.)

In the HLW licensing proceeding, any party may file a summary disposition motion seeking a decision by the Licensing Board in that party's favor as to one or more of the contentions to be litigated in the proceeding. Along with its motion, the moving party must provide a "separate, short, and concise statement of the material facts as to which the moving party contends that there is no genuine issue to be heard."⁸⁰ Motions for summary disposition must be supported by affidavits.

Answers to summary disposition motions may be filed by the non-moving parties within twenty days after the motion is filed. A party opposing a motion for summary disposition may not simply deny the allegations made. If the opponent of the motion does not affirmatively show, through its answer, "specific facts showing that there is a genuine issue of fact," the proponent of the motion will succeed and the contention will be dismissed.⁸¹

The NRC schedule calls for discovery to end by the end of the 23 month after the notice of hearing is filed. The Board will rule on summary disposition motions shortly thereafter.⁸² The parties may file appeals from that Board order, and the Commission will rule on those appeals.⁸³

78. Summary disposition is addressed in Section 2.1025.

79. Section 2.1025(c).

80. Section 2.1025(a).

81. Section 2.1025(b).

82. 10 CFR Part 2, Appendix D.

83. Section 2.1015(b).

Concurrently, the parties will likely submit pre-filed testimony and cross-examination plans to the Board.

3.8 THE HEARING (DAY 720)

According to the NRC schedule, the hearing on DOE's license application will commence 24 months after the licensing proceeding has been initiated.⁸⁴ In theory, this will be almost six months after the NRC has issued the SER. Presumably, the Staff would also have issued its EIS on the construction authorization for those portions of DOE's EIS that were not adopted before the hearing commences.

DOE, as the applicant, has the burden of proof in the licensing proceeding.⁸⁵ The hearing will be open to the public,⁸⁶ and will be recorded stenographically (or by other means), so that a written transcript can be created.⁸⁷ Only "relevant, material, and reliable evidence which is not unduly repetitious will be admitted." Immaterial or irrelevant parts of an admissible document will be segregated and excluded if possible.⁸⁸

3.8.1 Preparing for Testimony by the Parties' Witnesses

The parties will likely be required to pre-file the written direct testimony of their witnesses with the Licensing Board, and with one another, approximately fifteen days before that testimony is scheduled to be presented.⁸⁹

NRC regulations contemplate the use of expert witnesses in the hearing.⁹⁰ The Licensing Board may examine the qualifications of a proffered expert, and will allow that individual to testify upon finding that:

- The individual is qualified by scientific or technical training or experience to contribute to the development of an adequate decisional record in the proceeding by testifying or by cross-examining another witness
- The individual has read any written testimony and/or documents to be used or referred to in the course of his testimony or cross-examination

⁸⁴. In NRC power reactor licensing proceedings, the date that the NRC Staff completes and makes available the SER (and SER supplements) has often controlled the hearing commencement date.

⁸⁵. Section 2.732.

⁸⁶. Section 2.751.

⁸⁷. Section 2.750.

⁸⁸. Section 2.743(c).

⁸⁹. Section 2.743(b)(1).

⁹⁰. Section 2.733.

- The individual has prepared himself to conduct a "meaningful and expeditious examination or cross-examination."⁹¹

The Board may also require the parties to submit in advance requests to cross-examine another party's witness. Along with this request, the party must provide a cross-examination plan indicating the issues on which cross-examination will be conducted, the proposed line(s) of questioning, and the objective to be achieved by cross-examination.⁹²

3.8.2 The Possibility of a Bifurcated Hearing

The NRC regulatory scheme contemplates that the hearing on the repository construction authorization will last no more than ninety days.⁹³ (This limitation reflects the Commission's response to the schedule constraints imposed by the NWPA.) The duration of the hearing will be determined primarily by the number and the complexity of the contentions to be litigated.

Assuming, as we do, that the license application will be contested, the presiding Licensing Board may find it difficult -- although not impossible -- to limit the hearing time as NRC regulations prescribe. In an attempt to complete the hearing earlier, the Commission may opt (as it has in a number of NRC power reactor licensing proceedings) to appoint a second Atomic Safety and Licensing Board to conduct separate but concurrent hearings on a designated group of issues. For example, in order to meet the statutory deadline, the NRC could hold two concurrent hearings on safety and environmental issues affecting the HLW repository.⁹⁴ The NRC has traditionally adopted such a "bifurcated," dual-track hearing approach after the workload of the original Licensing Board has reached barely manageable proportions.

Bifurcation of the licensing hearing is intended to increase the Board resources devoted to a particular case, thus allowing for an earlier hearing completion date. In practice, however, the second Board faces a fairly steep learning curve, and makes initial progress rather slowly. There may also be a tendency for the Board to view its appointment as a reflection on the facial validity of the contentions assigned to it, and such a Board may demand a level of detail that consumes a great deal of time and resources in both preparation and presentation of evidence. In addition, bifurcating the hearing requires the issuance of several partial initial decisions by the various Boards rather than a single initial decision. All of these circumstances work to increase the resources devoted to the hearing process.

91. Section 2.733.

92. Section 2.743(b)(2)(i)-(iii).

93. Presumably the NRC contemplates running the hearing continuously from start until finish, rather than intermittently (as many hearings for power reactor licenses have been held in the past).

94. Other possible approaches to allocating the issues are also possible. For example, some safety issues, such as those dealing with the above-ground portions of the GROA, could be adjudicated in one safety hearing, while other safety issues associated with the underground repository could be litigated in a second proceeding.

3.9 THE POST-HEARING LICENSING PROCESS (DAY 810)

3.9.1 Submittal of Proposed Findings of Fact and Conclusions of Law (DAY 840 - 865)

After all of the parties' testimony has been presented, the Licensing Board will close the hearing record. This action triggers the running of the clock for the parties to prepare their proposed (written) findings of fact and conclusions of law.⁹⁵ In its "proposed findings," a party will set forth the factual findings that it believes are supported by the record concerning each issue in contention, as well as the legal conclusions that the party believes should be drawn with regard to those contentions. (In other words, each party's proposed findings represent the position of that party on the issues adjudicated, and will reflect that party's recommended version of the Board's final decision.)

As the license applicant, DOE files its proposed findings first, within thirty days after the record is closed.⁹⁶ Other parties may file their proposed findings within forty days after the record is closed; the NRC Staff has fifty days in which to submit its proposed findings.⁹⁷ Because it bears the burden of proof, the applicant may then submit reply findings (responding to the proposed findings of other parties) within five days after the findings of the other party are submitted.⁹⁸ Requirements governing the preparation of proposed findings are addressed in NRC regulations.⁹⁹ Note that proposed findings "must be confined to the material issues of fact presented on the record," and that the parties must provide citations to the transcript pages and exhibits which support their proposed findings.¹⁰⁰ An intervenor's proposed findings must be confined to those "issues which that party placed in controversy or sought to place in controversy in the proceeding."¹⁰¹

If the hearing has been bifurcated and several partial initial decisions are to be issued, the Licensing Board (or Boards) typically requires the parties to submit separate proposed findings for each contention or group of contentions addressed in each hearing.

3.9.2 Issuance of the Licensing Board's Initial Decision (DAY 955)

After considering the parties' proposed findings of fact and conclusions of law, the Licensing Board will issue its initial decision ruling on the matters adjudicated in the construction

95. The schedule provided for the parties' submittal of proposed findings of fact and conclusions of law is a stringent one, particularly where there are a number of contested issues in the proceeding. To meet the NRC deadline, legal counsel for the parties will likely have to begin drafting proposed findings before the hearing is closed.

96. Section 2.754(a)(1).

97. Section 2.754(a)(2).

98. Section 2.754(a)(3).

99. Section 2.754(c).

100. Section 2.754(c).

101. Section 2.754(c).

authorization hearing. This initial decision, which should be issued around 32 months after the licensing proceeding begins,¹⁰² is analogous to a decision by a trial court ruling on the merits of the case. If the proceeding has been bifurcated, as discussed above, several "partial initial decisions" may be issued by the Licensing Boards convened to preside over the various aspects of the hearing. Should this occur, some delay in the overall schedule would not be unusual.

The nominal schedule provided for the issuance of the Board's initial decision is within 35 days after receipt of the parties' proposed findings in a contested proceeding.¹⁰³ In reality, this deadline has almost never been met by Licensing Boards in power reactor licensing proceedings. By analogy, we think it unlikely that the Licensing Board presiding over the repository construction authorization proceeding will be able to render a decision within this short time.

Presumably, the Licensing Board's decision (or decisions) will reach a determination in favor of the issuance of a construction authorization pursuant to 10 CFR § 60.31. (In the alternative, the Board could deny the construction authorization, or rule that it is to be issued only after certain conditions are met.) Assuming that the Board's initial decision authorizes issuance of the construction authorization, it should be anticipated that those parties who oppose such a Board decision will appeal it.

3.9.3 "Immediate Effectiveness" of the Initial Decision (DAY 965)

Under NRC regulations, a Licensing Board initial decision favoring issuance of a repository construction authorization will not be immediately effective upon its issuance.¹⁰⁴ After the Licensing Board enters its initial decision, the Commission is required to conduct "a supervisory examination" of the contested issues in the proceeding, to ascertain "whether there is any significant basis for doubting that the facility will be constructed or operated with adequate protection of the public health and safety," and whether the Commission should suspend or condition the effectiveness of the Board's decision.¹⁰⁵ The Commission is also required to review those issues (if any) that have not been contested in the proceeding but about which NMSS must make appropriate findings prior to issuance of a construction authorization. The Commission must then notify the Director of NMSS in writing when its examination has been completed, indicating whether, in the Commission's view, the issuance of the construction authorization is appropriate.¹⁰⁶

Once the Commission has fulfilled this obligation, the NRC Director of Nuclear Material Safety and Safeguards, after making the appropriate licensing findings, is to "promptly" issue the

102. Section 2.760.

103. 10 CFR Part 2, Appendix A, Section VI(d).

104. Section 2.1023.

105. Section 2.1023(c).

106. Section 2.1023(c)(1)-(2). Although this supervisory examination of contested issues and Commission review of uncontested issues is technically not part of the adjudicatory proceeding (see Section 2.1023(c)(1)-(2)), time for this activity must nevertheless be factored into any scheduling estimate.

construction authorization following an affirmative initial decision of the Board.¹⁰⁷ (The only exception to this would be if the Board or the Commission has granted a motion for a "stay" filed by one of the parties, as described below.)¹⁰⁸ Under the NRC schedule, the construction authorization would be issued around day 1055 (month 35) of the licensing proceeding. Note that at this point, the initial decision will still be subject to review on appeal, and subject to a final decision by the Commission.¹⁰⁹

3.9.4 Appeals from the Initial Decision

Any parties to the licensing proceeding who disagree with the Licensing Board's initial decision may (and almost certainly will) file notices of appeal from that decision with the Commission within ten days after service of the initial decision.¹¹⁰ (This would occur around month 32 of the licensing proceeding.) Each of the parties must then file written briefs supporting their position on appeal (supporting or opposing the Board's decision).¹¹¹ Oral argument on the appeal(s) will be held before the Commission during month 35 of the licensing proceeding, and the Commission will issue a decision on the appeal approximately 37 to 38 months into the licensing proceeding. At the time that this final Commission decision is issued, the construction authorization may already have been issued to DOE by the NRC Staff, subject to possible reversal by the Commission.

3.9.5 Motions for a Stay from the Commission

A stay motion would ask the Commission to stay (temporarily suspend) the effectiveness of the Board's initial decision pending the filing of, and a decision on, a petition for review.¹¹² Stay motions must be filed within ten days after service of the initial decision.¹¹³ Opposing parties are then entitled to file answers to the stay motion, and the Commission will rule on the motion within twenty days.¹¹⁴ In general, it is quite difficult for the moving party to make the factual showing necessary for the granting of a stay of the Board's initial decision. In essence, that party must demonstrate that it is likely to prevail on the merits in its appeal, and that it will be

^{107.} Section 2.1023(b).

^{108.} See Sections 2.1023(b)(2); 2.788.

^{109.} Section 2.1023(a).

^{110.} Section 2.1015(c).

^{111.} The appellant's brief supporting its position on appeal must be filed within thirty days after the filing of the notice of appeal. This schedule is extended to forty days if the NRC Staff is the appellant. Section 2.1015(c)(2). Other parties then file their briefs ("responsive briefs") in support of or in opposition to the appeal within thirty days after the deadline for the appellant's brief. (Again, the NRC Staff has forty days in which to file its responsive brief.) Section 2.1015(c)(3).

^{112.} Section 2.788(a).

^{113.} Section 2.788(a).

^{114.} 10 CFR Part 2, Appendix D; Section 2.788.

irreparably injured if a stay is not granted.¹¹⁵ The NRC schedule for Subpart J activities calls for the Commission to rule on stay motions around day 1055 (month 35) of the licensing proceeding.

¹¹⁵. Stay requirements are addressed in Section 2.788.

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ATTACHMENT B-1

**SCHEDULE FOR NRC PROCEEDING ON APPLICATION
FOR A LICENSE TO RECEIVE AND POSSESS HLW AT A
GEOLOGIC REPOSITORY**

TIME ELAPSED (in days)¹¹⁶	ACTION
Approximately 365 days	Parties and potential parties receive electronic access to the LSS. (§2.1003).
180 days	LSS Administrator certifies that DOE has complied with its obligations concerning the LSS (§2.1003 (h) (1)).
0	DOE submits to the NRC its license application, Safety Analysis Report and EIS. The NRC determines that the application is complete and acceptable, NRC publishes a <u>Federal Register</u> notice announcing the docketing of the application and the availability of a public hearing on the application. Members of the presiding NRC Licensing Board are named. (§2.101 (f) (8); (§2.105(a) (5)).
30	Petitions to intervene/requests for hearing along with proposed contentions, are filed with NRC (§2.1014 (a) (1)). Petitions for status as interested government participant & interested government participant petitions are filed. (§2.715 (c)).
50	Answers to intervention & interested government participant petition are filed. (§2.1014 (b)).
70	The Board conducts 1st Prehearing Conference. (§2.1021).
100	The Board issues 1st Prehearing Conference Order which identifies participants in hearing admits contentions, and sets discovery and other schedules. (§2.1018 (b) (1)) Deposition discovery begins. (§2.1019).
110	Parties may file appeals from 1st Prehearing Conference Order, w/briefs. (§2.1015 (b))

¹¹⁶. Day Zero (0) represents the publication of the Federal Register notice announcing the NRC's docketing of the license application.

120	Parties may file briefs in opposition to appeals. (§2.1015 (b)).
150	The Commission issues order ruling on appeals from 1st Prehearing Conference Order.
548	The NRC Staff issues SER on license application.
578	The Board holds 2nd Prehearing Conference. (§2.1022).
608	The Board holds 2nd Prehearing Conference Order finalizing contentions for hearing and setting schedule for pre-filed testimony and hearing.
618	Parties may file appeals from 2nd Prehearing Conference Order, w/briefs. (§2.1015 (b)).
628	Parties may file briefs in opposition to appeals. (§2.1015 (b)).
658	The Commission issues order ruling on appeals from 2nd Prehearing Conference Order.
660	Last practicable date for filing motions for summary disposition.
680	Replies to last practicable motions for summary disposition.
690	Discovery complete. (Supp. Info)
700	Board issues order on last practicable motions for summary disposition.
710	Parties may file appeals from last practicable summary disposition order w/briefs. (§2.1015 (b)).
720	Evidentiary hearing begins. Parties may file briefs in opposition to appeals from last practicable summary disposition orders. (§2.1015 (b)).
810	Evidentiary hearing ends.
840	Applicant files proposed findings. (§2.754 (a) (1)).
850	Intervenor files proposed finds. (§2.754 (a) (2)).
860	NRC Staff files proposed findings. (§2.754 (a) (2)).
865	Applicant files reply to proposed findings. (§2.754 (a) (3)).
955	Board issues initial decision. (§2.760).
965	Parties may file any stay motions responding to Commission notices of appeal. (§2.788 (a), §2.762 (a), §2.1015 (c)).

975	Parties may file replies to stay motions (§2.788 (d)).
995	Commission issues ruling on stay motion.
	Appellant files brief before Commission. (§2.786).
1005	Stay motions to Commission. (§2.788 (a)).
1015	Replies to stay motions. (§2.788 (d)).
1025	Appellee files brief before Commission. (§2.786)
1045	NRC Staff brief before Commission.
1055	Completion of NMSS and Commission supervisory review; Commission ruling on any stay motions; issuance of construction authorization; NWPA 3-year period tolled. (§2.1023 Supp. Info).
1065	Commission hears oral argument on appeal are heard by Commission. (§2.763).
1125	Commission issues decision on construction authorization. (§2.1023).

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APPENDIX C

LSS COST MODEL

Cost Model Description

The model was constructed to estimate the ten year cost of implementing and operating the DOE Records Management System (RMS) and the LSS in support of the OCRWM mission. As built the model is a flexible tool to estimate the cost and the allocation of the cost elements between the RMS and the LSS as characteristics of the processes and the volume of data handled within the systems changes. A large number of adjustable parameters that reflect the anticipated modes of operation are used to calculate cost estimates spanning the range of the cost of individual process steps within the DOE RMS and the LSS to the total cost to the Nuclear Waste Fund.

The model includes twelve major sections, several of which are subdivided into system or process segments. The sections and their key functions are:

Parameter Section: This section contains all the adjustable parameters, except the option definition parameters and a few model control values. The parameters are structured into several major groups, such as: model control; labor parameters; facility parameters; storage media characteristics; document characteristics; process characteristics; and system components characteristics. Most of the parameters are single valued parameters, but a few are multi-valued parameters where the specific value used in the calculation changes by fiscal year. The complete set of parameter values used to calculate the cost estimates provided in the LSS Working Group Final Report are shown in Tables C-1 through C-6.

Option Section: In this section the key characteristic parameters are defined and set to indicate whether the feature is used in the option or not. These parameter values are used to guide the flow of model calculations for that particular option. Table C-7 includes the definition on the option features that can be controlled within the model, and Tables C-8 through C-11 shows the values used in the study.

Volume Section: Here the volume of pages and records processed through the DOE Records Management System and the LSS are defined. An initial estimate of the number of record pages that will be generated by OCRWM and the program participants per fiscal year was made by a group of individuals intimately familiar with the OCRWM program. This served as the baseline page volume for the model from which the expected LSS holdings and other pertinent page holdings were estimated using the distribution assumptions shown in the parameter section and volume section.

The LSS will receive documents from the DOE RMS, and the NRC, which includes materials submitted by other parties to the NRC. The submissions from DOE is assumed to be the largest fraction of LSS documents, and consist of the LSS relevant documents processed by the DOE RMS. Using the assumption that the DOE submissions follow the baseline, the yearly LSS

holdings in the LSS can be estimated along with the LSS relevant and non-LSS relevant records page holdings in the DOE RMS.

In practice the amount of pages processed is always higher than the number of pages stored in a system, as a number of records submissions are likely to be duplicates or rejected for other reasons. This necessitates accounting for number of pages assumed to be processed in the DOE RMS and the LSS respectively is inflated using rejection factors specified in the parameter section to account for duplicates and rejects that will be in the input stream to the two systems. Additionally, the input pages are assumed distributed between the different input media types (paper, microfilm, electronic image, and native file) as indicated in the parameter section.

The calculations in this section result in a matrix of input pages by media type and fiscal year to the DOE RMS and the LSS. This matrix is used to drive the calculations of all costs associated with capture of the pages, record storage and media warehousing costs. Ultimately it also determines the size and complexity of the capture and storage components of both the DOE RMS and the LSS. The volume section used for the cost estimates reported in the LSS Working Group Final Report, is shown in Tables C-12 through C-14.

Capture Time Section: This section is used to calculate the labor time required to execute the various steps in the process of capturing the input pages. The section is divided into four segments one each for capture of:

- A. Non-LSS relevant records in the DOE RMS
- B. LSS relevant records in the DOE RMS including both RMS and LSS required operations
- C. LSS relevant records in the DOE RMS including only RMS required operations
- D. LSS relevant records in the LSS (NRC input).

Within each segment the time to capture is calculated separately for paper, microfilm, electronic image, and native files. The process time assumed for each of the steps is set by the adjustable parameters in the parameter section. The resulting matrices of time per fiscal year and process step is mapped into the capture cost section for further processing.

Additionally the full time equivalent (FTE) personnel required to capture and edit the input pages are estimated for each segment. This estimate does not include supervisory or administrative staff, which are accounted for in another section of the model.

Capture Cost Section: In this section the amount of time for each capture process step within each fiscal year is multiplied with the labor and overhead rate for the specific task performed in the step. The result is shown in five segments, one each for:

- A. Non-LSS relevant records in the DOE RMS
- B. LSS relevant records in the DOE RMS including only RMS required operations
- C. LSS relevant records in the DOE RMS including only LSS required operations
- D. LSS relevant records in the LSS (NRC input)
- E. All LSS relevant records capture cost combining the costs from the RMS and the LSS.

In each segment the cost of capture is calculated by process step, fiscal year, and input media type. Additionally the capture cost in each fiscal year by input media type and for all media types are calculated by adding the costs of each process step.

Capture Summary Section: Here the cost of each process step is accumulated across the input media types for each fiscal year, to give insight into the cost of each process step. This cost summary is done separately for:

- A. Non-LSS relevant records in the DOE RMS
- B. LSS relevant records in the DOE RMS including only RMS required operations
- C. LSS relevant records in the DOE RMS including only LSS required operations
- D. LSS relevant records in the LSS (NRC input)
- E. All records capture in the RMS and LSS
- F. LSS records capture within the RMS and LSS.

Holdings Summary Section: In this section the holdings are summarized by media type, system and LSS relevancy. Fiscal year totals and accumulated totals are calculated and separate accounting is done for non-LSS relevant records in the RMS, LSS relevant records in the RMS, NRC records in the LSS, and all LSS holdings in the LSS.

Storage and Warehousing Section: This section is divided into five segments:

- A. Storage and warehousing cost for DOE non-LSS relevant records in the RMS
- B. Storage and warehousing cost for DOE LSS relevant records in the RMS
- C. LSS specific storage and warehousing cost for DOE LSS relevant records
- D. Storage and warehousing cost for NRC and stakeholder records submitted to the LSS
- E. Storage and warehousing cost for LSS holdings.

Each segment bases the calculation of storage and warehousing on the total number of pages held within the system domain, including required copies. The total page count is used to calculate how many record containers such as paper boxes, microfilm reels, and optical disks, as the case may be, are required to hold the required original and copies. With this known, the amount of storage space required to warehouse the records and the required copies is estimated, excluding the on-line media as appropriate. Furthermore the total cost of the storage media, copy and verification cost, and the cost of the required storage space per fiscal year is calculated. The calculation of the cost of storage assumes that DOE RMS retains all the records responsibilities for the LSS relevant records, and only a copy of the RMS LSS relevant holdings are transferred to the LSS. Therefore, the records holding cost within the LSS applies only to records captured

into the LSS by the NRC, as the copy given to the LSS is on-line and accounted for in the system component costs.

Retrieval Section: The costs associated with retrieval of information from the DOE RMS and the LSS is calculated in this section, as are the minimal system component resources required to support the retrievals, storage and management of the holdings. The section is divided into four segments, which address:

- A. Internal DOE and freedom of information act retrievals, and minimum system resources required for DOE RMS non-LSS relevant record holdings and internal retrievals
- B. Internal DOE retrieval, and minimum system resources required for the DOE RMS LSS relevant record holdings and internal retrievals
- C. Public access and supporting NRC retrieval and minimum system resources required for the NRC captured LSS record holdings and retrievals against the NRC holdings
- D. Public access and supporting DOE and NRC retrievals and minimum system resources required for storage of all the holdings and retrieval of information from the LSS.

Each segment restates the fiscal year page holdings by media type from previous sections. The number of header database and text search queries are estimated per fiscal year from the particular segment addressed. The estimate of the number of pages disseminated is based on a fixed number of pages disseminated over the lifetime of the RMS and LSS respectively, with appropriate weights applied to reflect the total holdings within each segment of the retrieval section of the model. The number of pages disseminated from a particular segment is distributed among the various types of dissemination media used according to the relative fraction of use of these media as specified in the parameter section. With the media distribution known it is possible to calculate the amount of distribution media required per fiscal year and the cost of that media. Additionally, based on values from the parameter section it is possible to calculate the total labor time required for each process step, the total labor cost, and the full time equivalent personnel is required to support the dissemination operation.

At this point, the capture, storage and retrieval estimates are complete in sense that the volume of material and transactions that must be handled by the system components supporting a particular segment of holdings as described above are known. Therefore, an estimate on the minimum number of system components required for each segment modelled is made at this point.

Systems Section: The systems section is divided into four segments aggregating the estimates done in the earlier sections which affect:

- A. The DOE RMS
- B. The LSS specific components or costs of the RMS

- C. The subset of the LSS components and cost associated with the NRC captured records
- D. The full LSS.

Each segment in this section start by summarizing the holdings by media type and fiscal year, the accumulated number of "storage containers", the number of queries per fiscal year, and the pages by media type distributed per fiscal year.

This is followed by an estimate of the number of system components of each type that is required for each segment. The estimate is based either on the minimal component count required to support the storage and provide the required process service, as estimated in the retrieval section of the model, or the number of facility sites specified in the parameter section. These component estimates are used to calculate the cost of the system components by fiscal year, and the associated maintenance cost. Cost of facilities and the associated cost of security and utilities are also estimated. This is summarized in a total recurring and non-recurring system costs within each model segment.

Each segment concludes with an aggregation of labor costs for the capture, and dissemination efforts. Added to this is an estimate of the performers required to support the installed system base both in terms of day to day operations at each site, and central maintenance of the system software applications. This is estimated separately for each activity by fiscal year, and cost of supervision and administrative management at each facility is added for each of the three activities according to the values set in the parameter section.

The estimated cost of text correction, potentially a significant line item, is also reported separately.

Miscellaneous Section: Provides estimates for costs not conveniently covered elsewhere. The costs include:

- A. Costs associated with transfer of data from the DOE RMS to the LSS
- B. Cost of system integration and development
- C. Installation cost for RMS, LSS specific RMS, and LSS components.

The transfer costs are estimated by system, DOE RMS and LSS, and includes the cost of transfer media, labor associated with gathering material to be transferred from the RMS to the LSS, and cost at the LSS associated with receipt and entry of such material in the system.

Installation costs are estimated by fiscal year based on a flat rate for each component type installed specified in the parameter section.

Summary Section: This section provides a summary of volumes and cost elements for the six options modeled in terms of DOE processing relevant, LSS specific DOE processing relevant, and LSS processing relevant estimates. In each case the amount of material held and disseminated is summarized and the capture and total cost per page held shown. The media

distribution of the intake material and the page dissemination is shown for the various options studied. The process costs are reported and the cost of system components, facilities, and other recurring costs are also shown for each component.

Finally the estimated cost of the DOE RMS, the LSS and the total cost to the Nuclear Waste fund is shown.

The cost model includes additional sections which consist of material from the other sections structured to support generation of graphs or special tabular output formats for inclusion in the LSS Working Group Final Report. Additionally the model contains a number of macros used to simplify the mechanics of generating the output required for the Final Report and a number of briefings held during the period when the LSS Working Group was active.

Table C-1. Parameter Definitions and Values Used for Estimates

Parameter	Value	Comment
Model Control Parameters		
Option	6	Controls the option for which the cost is estimated. Value range [1..8]
Use electronic transfer to the LSS	Yes	Controls if data is moved from the DOE RMS. Yes implies electronic transfer. No transfer by means of optical disk.
Electronic image on WORM	No	Controls if images are stored on optical WORM disk or CD-R. Yes implies optical WORM disk. No implies images are stored on CD-R and under some options distributed on CD-ROM.
Labor Parameters: Assumed labor cost by function		
Receiving clerk pay (\$/year)	\$18,000	
Index clerk pay (\$/year)	\$20,000	
Capture clerk pay (\$/year)	\$20,000	
Edit clerk pay (\$/year)	\$20,000	
Quality Control/Verification clerk pay (\$/year)	\$25,000	
Dissemination clerk pay (\$/year)	\$18,000	
Shipping clerk pay (\$/year)	\$15,000	
Capture supervisor pay (\$/year)	\$40,000	
Dissemination supervisor pay (\$/year)	\$40,000	

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
Labor Parameters: Assumed labor cost by function (Cont'd)		
Server supervisor pay (\$/year)	\$50,000	
Capture system support personnel pay (\$/year)	\$35,000	Capture system support personnel required only if capture facility is not collocated with a server facility
Server support personnel pay (\$/year)	\$45,000	
Application support personnel pay (\$/year)	\$60,000	Application support personnel is required at one server site to maintain the code in the RMS and LSS.
Capture system manager and administration pay (\$/year)	\$70,000	The combined salary for the facility administrator and administration clerk. One of each is used at each capture site.
Dissemination manager and administration pay (\$/year)	\$70,000	The combined salary for the facility administrator and administration clerk. One of each is used at each dissemination site.
Server manager and administration pay (\$/year)	\$80,000	The combined salary for the facility administrator and administration clerk. One of each is used at each server site.
Labor Parameters: Personnel Assignments		
Workers per supervisor	8	The model uses the assumption that a separate supervisor is not needed if the number of performers is less than five at a facility.

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
Labor Parameters: Personnel Assignments (Cont'd)		
Capture system support personnel per capture facility	1	This position is needed only if the capture system is not collocated with a server facility. The estimates made for the LSS Working Group assumes that when possible the server and capture facilities are collocated.
Server support personnel server site	8	
Application support personnel	6	For central maintenance of all RMS and LSS application code
Labor Parameters: Other Labor Parameters		
Burden rate	200%	
Work year duration (days)	280	This value was obtained from TIMA study estimates
Effective work minutes/year per FTE	130,133	This value was obtained from TIMA study estimates
Work shift duration (minutes/shift)	465	This value was obtained from TIMA study estimates
Number of shifts per day	1	
Facility Parameters: Facility related cost		
Yearly storage facility cost (\$/sq. foot)	\$17	
Yearly system facility cost (\$/sq. foot)	\$20	
Server facility yearly operations cost (util, maint, security)	\$200,000	

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
Facility Parameters: Facility related cost		
Capture facility yearly operations cost (util, maint, security)	\$150,000	
Server facility preparation (cost/site)	\$600,000	Cost of preparing computer room at server site
Capture facility preparation (cost/site)	\$20,000	Cost of preparing capture system area
Server component installation (cost/component)	\$2,000	Assumes major component installation, such as server, storage system, etc.
Capture component installation (cost/component)	\$15,000	Assumes that the complete capture system is installed as one component
Work station component installation (cost/component)	\$500	
Facility Parameters: Facility physical characteristics		
Collocated capture and server facilities	Yes	Capture systems collocated with the server system at a site. Does not imply in the same working space. Co-location results in lesser maintenance personnel head count
Records storage facility ceiling height (ft)	8	Used to estimate stacking height for storage containers
Work station space (sq. ft)	70	
Capture facility size (sq. ft)	1,800	

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
Facility Parameters: Facility physical characteristics (Cont'd)		
Server facility size (sq. ft)	12,000	
Storage Parameters		
Records system microfilm copies required	11	Two of these are archival copies, the remaining are participant distribution copies. Not used for the LSS Work Group Study
LSS microfilm copies required	3	Assumed need for archival purposes in scenarios that use microfilm based LSS. Not used for the LSS Work Group Study
RMS optical disk media copies required	3	One on-line copy, a site backup copy and a off-site backup copy
LSS optical disk media copies required	3	One on-line copy, a site backup copy and a off-site backup copy
Document Capture Parameters: Submission characteristics		
Backlog paper LSS relevancy (%)	50%	Fraction of existing DOE paper backlog that is LSS relevant
Backlog microfilm LSS relevancy (%)	50%	Fraction of existing DOE paper backlog that is LSS relevant. Not used in the LSS Work Group Study as all backlog assumed to be in paper form
Record submissions rejected (DOE) (%)	5.0%	

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
Document Capture Parameters: Submission characteristics (Cont'd)		
Record submissions rejected (NRC) (%)	20.0%	Because the NRC submissions include a significant amount of material contributed by the public, the assumption is that the rejection rate due to duplicate submissions and poor quality will be high
Header records without document (%)	10.0%	This value is based on current experience. Records with no corresponding document usually reference physical items
Document Capture Parameters: Document and page characteristics		
Number of pages per typical document	13	This value is based on current experience.
Characters per page	2500	
Pages containing text (%)	85%	
Images with text converted to ASCII (%)	90%	
Document Capture Parameters: Retype parameters		
Backlog paper pages to retype (%)	15%	
Backlog microfilm pages to retype (%)	20%	
New paper pages to retype (Records System) (%)	5%	
New paper pages to retype (LSS) (%)	5%	

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
Document Capture Parameters: Retype parameters		
New image pages to retype (Records System) (%)	5%	
New image pages to retype (LSS) (%)	5%	
Retype typing rate (6 char words per minute)	60	
Document Capture Parameters: Image quality control parameters		
Fraction of images, microfilm and text verified (%)	100%	
Fraction of microfilm reel copies verified (%)	100%	
Document Capture Parameters: Rework parameters		
Image rework fraction (% of pages)	10%	Fraction of individual pages that must be recaptured and their images inserted in the document image file
Microfilm rework fraction (% of rolls)	30%	Fraction of individual pages that must be recaptured and their images stored on microfilm. No accounting is made of the fact that one image in error on a reel result in recapture of up to 4000 pages
Document Capture Parameters: Capture step processing times		
Receiving (minutes/document)	2	

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
Document Capture Parameters: Capture step processing times (Cont'd)		
Initial processing (minutes/document)	5	Based on current processing experience at Dunn Loring
Records System initial processing with IS (minutes/document)	2	Native files are presumed submitted with an InfoSTREAMS like electronic header, resulting in index processing consisting primarily of verification, not index entry
LSS initial processing minutes (minutes/document)	5	
Reject processing (minutes/document)	2	
Full treatment header (enter, QC) (time/document)	13	Based on actual measurements at the Dunn Loring Records Center on a batch of 30 documents
LSS full treatment header (enter, QC) (time/document)	13	
Partial treatment header (enter, QC) (time/document)	10	Based on actual measurements at the Dunn Loring Records Center on a batch of 30 documents
InfoSTREAMS header, Full Treatment (time/document)	3	
Improved work flow header (time/document)	8	Reduction in the number of fields will result in less indexing time required. This parameter was not applied during in the LSS Working Group Study

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
Document Capture Parameters: Capture times for input media		
Quality control (image, text, microfilm) (time/page)	0.05	
Load image file (minutes/page)	0.008	This is effectively an unattended operation. Load is started by the operator and proceeds under computer control
Load native file (minutes/page)	0.015	This is effectively an unattended operation. Load is started by the operator and proceeds under computer control
Scan paper to image (minutes/page)	0.128	
Scan microfilm to image (minutes/page)	0.2	
Convert native file to image and sort pages (minutes/page)	0.115	Assumes use of "electronic" slide sorting table
Document Capture Parameters: Convert to text		
Convert native file to text (minutes/page)	0.006	This is effectively an unattended operation. Load is started by the operator and proceeds under computer control in large batches
Convert image to text (minutes/page)	0.006	This is effectively an unattended operation. Load is started by the operator and proceeds under computer control in large batches
Document Capture Parameters: Edit and retype		
OCR edit (minutes per error)	0.083	

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
Document Capture Parameters: Edit and retype (Cont'd)		
Retype backlog pages (paper) (minutes/page)	6.944	
Retype new pages (paper) (minutes/page)	6.944	
Retype microfilm backlog pages (minutes/page)	6.944	
Retype image pages (image) (minutes/page)	6.944	
Document Capture Parameters: Microfilm capture		
Paper to microfilm (minutes/page)	0.128	
Image to microfilm (image) (minutes/page)	0.017	Assumes compute output microfilm (COM) in which the process is started by the operator but controlled by computer. Full reel batch is assumed.
Native file to microfilm (minutes/page)	0.017	Assumes compute output microfilm (COM) in which the process is started by the operator but controlled by computer. Full reel batch is assumed.
Document Capture Parameters: Rework processes		
Image re-scan and sort (minutes/page)	1	
Microfilm batch rework (minutes/doc)	4	

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
Document Capture Parameters: Archival copies		
Microfilm copy and verification (minutes/reel)	185.455	This is an average per reel for DOE current processing
Electronic copy and verification (minutes/disk)	0.167	Operator initiates the process computer controls and completes verification of copy to original CD
RMS, LSS data transfer: RMS data transfer to the LSS		
Create header file for transfer (minutes/record)	1	Assumes automatic header collection initiated by operator query
Create Microfilm copy for transfer (minutes/reel)	190.455	
Create CD-R copy for transfer (minutes/disk)	5	Assumes operator initiated automatic build from transfer header data
Create electronic transfer package (minutes/package)	0.167	Assumes automatic assembly at operator request
Document Capture Parameters: Data receipt at the LSS		
Physical media handling transfer receipt (minutes/item)	8	
Header verification (minutes/record)	5	
Accept microfilm (minutes/reel)	60	
Accept CD-R/WORM (minutes/disk)	2	

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
Document Capture Parameters: Data receipt at the LSS (Cont'd)		
Accept electronic transfer package (minutes/package)	1	Assumes automatic operator initiated process
Electronic transfer bandwidth (kb/s)	100	
Dissemination Parameters: Hardcopy dissemination		
Hardcopy microfilm blowback per document (minutes/doc)	5	
Hardcopy printing from electronic document(minutes/doc)	0.167	Operator initiate automatic process
Dissemination Parameters: Hardcopy dissemination (Cont'd)		
Hardcopy handling per document (minutes/doc)	5	Collect output of microfilm blowback or electronic document printing.
Printing paper pages per box (pages/box)	5,000	Industry standard printing paper package unit
Cost of box of paper (\$/box)	\$18.00	Current discounted retail price for 5000 pages 20 lbs paper
Dissemination Parameters: Electronic dissemination		
Average Image and Text Page size (KB)	100	Upper limit for typical compressed bitonal letter size image, text file, and index segment.
Average Text Page size (KB)	4	Observed on typical WordPerfect files
Average Index Size (%of text size)	30%	Vendor claim

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
Dissemination Parameters: Electronic dissemination (Cont'd)		
Average header database record size (KB)	2	Observed average header data record size
Electronic transmission overhead (% of transmission size)	10%	
External link capacity (kb/s)	100	
Size of electronic transfer package (records/package)	100	
Dissemination Parameters: CD related costs		
Optical disk/CD-R generation (minutes/document)	0.227	Calculated based on current technology capability
Optical disk/CD-R handling (minutes/disk)	5	
CD-ROM manufacturing cost per copy (\$/disk)	\$3	Trade press estimate of mid FY95 cost
CD-ROM copies per issue (disks/issue)	1,000	Number of batch copies made for each unique disk when a new batch is made
CD-ROM Package (unique disks/mailing set)		Size of the set of unique disks distributed at a time (CD-ROM based distribution only)
Manufactured CD-ROM handling (minutes/set)	30	Estimated time required to assemble a set including packaging for distribution
CD-ROM manufacturing setup (\$/original disk)	\$150	Trade press estimate of mid FY95 cost
CD-ROM update period (months)	3	Months between new releases of CD's

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
Media mailing costs		
Hardcopy document mailing cost (\$/document)	\$2.00	
Microfilm reel mailing cost (\$/reel)	\$5.00	
Optical disk mailing cost (\$/disk)	\$3.00	Estimated cost to mail a single optical WORM or CD-R, including packing materials
CD ROM set mailing cost (\$/disk set)	\$15.00	Estimated cost of material and overnight shipment of a set of CD-ROM
RMS query parameters		
Number of Records System users (count)	50	Internal OCRWM users supporting the OCRWM program information requests and Freedom of Information Act requests
Structured queries/day per Records System user (count)	10	Queries per user against the header database per day
Text queries per Records System user (queries/day/user)	2	Queries per user against the text search engine per day
Record System hits per structured query (hits/query)	5	
Record System hits per text query (hits/query)	25	
Records System fraction of document hits disseminated (% of hits)	20%	

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
LSS query parameters		
Number of LSS users (count)	200	External or public users accessing the LSS for information and litigation support
Number of OCRWM LSS users (count)	5	OCRWM users accessing the LSS for information
Number of NRC LSS users (count)	2	NRC users accessing the LSS for internal support and information
Structured queries per LSS user (queries/day/user)	5	
Text queries per LSS user (queries/day/user)	30	
LSS hits per structured (hits/query)	50	
LSS hits per text query (hits/query)	100	
LSS fraction of document hits disseminated (% of hits)	0%	
Dissemination media distribution: DOE RMS users		
Records User: Hardcopy of existing backlog disseminated (% of total pages)	100%	Fraction of existing paper backlog disseminated as paper.
Records User: Hardcopy disseminated (% of total pages)	5%	Fraction of total holdings, less the fraction of existing backlog disseminated as hardcopy

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
Dissemination media distribution: DOE RMS users (Cont'd)		
Records User: Electronic text disseminated (% of total pages)	80%	Fraction of total holdings, less the fraction of existing backlog disseminated as hardcopy, disseminated as electronic text on communications paths
Records User: Electronic image disseminated (% of total pages)	0%	Fraction of total holdings, less the fraction of existing backlog disseminated as hardcopy, disseminated as electronic image on communications paths
Records User: Electronic text and image disseminated (% of total pages)	15%	Fraction of total holdings, less the fraction of existing backlog disseminated as hardcopy, disseminated as electronic image, text and index on communications paths
Records User: CD-R disseminated (text, image, index) (% of total pages)	0%	Fraction of total holdings, less the fraction of existing backlog disseminated as hardcopy, disseminated as electronic image, text and index on CD-R
Dissemination media distribution: LSS users		
LSS User: Hardcopy of existing backlog disseminated (% of total pages)	100%	
LSS User: Hardcopy disseminated (% of total pages)	5%	
LSS User: Electronic text disseminated (% of total pages)	80%	

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
Dissemination media distribution: LSS users (Cont'd)		
LSS User: Electronic image disseminated (% of total pages)	0%	
LSS User: Electronic text and image disseminated (% of total pages)	15%	
LSS User: CD-R Disseminated (text, image, index) (% of total pages)	0%	
Communications related costs		
Yearly fixed cost of nominal 100 kbps link (\$/link)	\$900.00	
Cost per minute for nominal 100 kbps link (local) (\$/minute)	\$0.22	
Yearly fixed cost of T1 or equivalent (\$/link)	\$14,400.00	
Cost per minute for T1 link (VA-LV) (\$/minute)	\$1.50	Estimated future use cost for T1 link between Washington D.C. and Las Vegas
System Sizing Parameters		
Maximum number of users per Header Database server (users/server)	100	
Maximum number of Header Database records per server (records/server)	1,000,000	
Maximum number of structured queries (queries/day/server)	2,880	

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
System Sizing Parameters (Cont'd)		
Maximum number of users per text server (users/server)	40	
Maximum number pages per text server (pages/server)	2,057,143	Calculated based on maximum index sizes
Maximum Number of Text Queries/day/Text Server	2,880	
Maximum number of jukeboxes server (jukeboxes/server)	2	
Maximum number of optical disks/jukebox (disks/jukebox)	144	
Size of database magnetic storage system unit (GB/unit)	40	
Effective print rate (pages/minute/printer)	8	
Maximum number of printers per server (printers/server)	2	
CD write rate (image, text, index) (pages/minute)	120	
Number of DOE off-network access sites (count)	4	
Number of LSS off-network access sites (count)	19	
Number of access devices per off-network site (count/site)	2	
Capture system capacity (pages/minute)	30	

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
System Sizing Parameters (Cont'd)		
Microfilm capture system capacity (pages/minute)	40	
Microfilm to image system capacity (pages/minute)	40	
Image to microfilm system capacity (pages/minute)	40	
System Component Cost Parameters		
Header database server cost (\$/unit)	\$150,000	
Text server cost (\$/unit)	\$50,000	
Storage server cost (\$/unit)	\$160,000	
Print server cost (\$/unit)	\$90,000	
CD server cost (\$/unit)	\$50,000	
Infrastructure cost per server (\$/server)	\$20,000	
Dumb terminal cost (\$/unit)	\$1,500	
Client cost (\$/unit)	\$7,000	
Edit client cost (\$/unit)	\$10,000	
Infrastructure cost per client (\$/client)	\$2,000	
Jukebox cost (\$/unit)	\$80,000	
Magnetic storage system cost (\$/unit)	\$50,000	

Table C-1. Parameter Definitions and Values Used for Estimates (Continued)

Parameter	Value	Comment
System Component Cost Parameters (Cont'd)		
Capture system cost (\$/system)	\$364,000	
Microfilm capture station cost (\$/station)	\$250,000	
Microfilm to image station cost (\$/station)	\$250,000	
Image to microfilm station (\$/station)	\$250,000	
System maintenance cost (% of installed base cost)	15%	
Communications terminator (\$/unit)	\$3,500	
Spares cost (% of procurement price)	20%	
Sunk LSS Costs		
SAIC LSS work (\$)	\$8,500,000	Cost of LSS related work performed by SAIC prior to 1991

Table C-2. Storage Container Size and Space Requirements

Storage Container	Dimensions (inches)			Storage Area (sq ft) ¹	Unit Stack Count ²
	Height	Width	Length		
Paper box	10	16	25	2.78	7
Microfilm reel	4.25	1.25	4.25	0.04	18
WORM (130 mm)	5.25	0.5	5.75	0.02	14
CD-R and CD-ROM (120 mm)	5.25	0.5	5.75	0.02	14

¹ Foot print area for a stack of storage containers, used to calculate storage space required

² Number of storage containers that will fit vertically in the storage facility space

Figure C-3. Estimated Cost of Storage Containers by FY

Storage Container Cost	FY95	FY96	FY97	FY98	FY99
Paper box for paper storage	\$1	\$1	\$1	\$1	\$1
Microfilm reel (including developing)	\$54	\$54	\$54	\$54	\$54
130 mm WORM ¹	\$113	\$101	\$200	\$180	\$162
120 mm CD-R ¹	\$29	\$26	\$50	\$45	\$41
	FY00	FY01	FY02	FY03	FY04
Paper box for paper storage	\$1	\$1	\$1	\$1	\$1
Microfilm reel (including developing)	\$54	\$54	\$54	\$54	\$54
130 mm WORM ¹	\$250	\$225	\$203	\$182	\$164
120 mm CD-R ¹	\$70	\$63	\$57	\$51	\$46

¹ The cost increased in these storage media is due to an increase in storage capacity over the years. The cost of the storage volume is actually decreasing over the years.

Table C-4. Estimated Storage Container Capacity by Year

Container Storage Capacity	FY95	FY96	FY97	FY98	FY99
Pages per storage box	2,500	2,500	2,500	2,500	2,500
Pages per microfilm reel	4,000	4,000	4,000	4,000	4,000
Pages per image medium (130 mm WORM)	13,312	13,312	26,624	26,624	26,624
Pages per image medium (120 mm CD)	6,861	6,861	13,722	13,722	13,722
Text pages per image medium (130 mm WORM)	363,506	363,506	727,013	727,013	727,013
Text pages per image medium (120 mm CD)	187,346	187,346	374,691	374,691	374,691
	FY00	FY01	FY02	FY03	FY04
Pages per storage box	2,500	2,500	2,500	2,500	2,500
Pages per microfilm reel	4,000	4,000	4,000	4,000	4,000
Pages per image medium (130 mm WORM)	53,248	53,248	53,248	53,248	53,248
Pages per image medium (120 mm CD)	27,443	27,443	27,443	27,443	27,443
Text pages per image medium (130 mm WORM)	1,454,025	1,454,025	1,454,025	1,454,025	1,454,025
Text pages per image medium (120 mm CD)	749,382	749,382	749,382	749,382	749,382

Table C-5. Assumed Design, Integration and Implementation Costs for RMS and LSS Components (No cost beyond FY99)

Customization, Integration and Development	FY95	FY96	FY97	FY98	FY99
Records System Engineering and Design	\$0k	\$200k	\$200k	\$0k	\$0k
LSS System Engineering and Design	\$0k	\$700k	\$800k	\$200k	\$0k
Bibliographic database server implementation	\$0k	\$1,000k	\$400k	\$200k	\$0k
Capture system implementation	\$0k	\$800k	\$400k	\$0k	\$0k
Records System electronic image management enhancement	\$0k	\$800k	\$800k	\$200k	\$0k
LSS electronic image management system	\$0k	\$800k	\$800k	\$0k	\$0k
Records System text search system implementation	\$0k	\$600k	\$500k	\$0k	\$0k
LSS text search system enhancement	\$0k	\$600k	\$600k	\$200k	\$0k
Records System electronic and CD-R dissemination system	\$0k	\$100k	\$0k	\$0k	\$0k
LSS electronic and CD-R dissemination system	\$0k	\$200k	\$100k	\$0k	\$0k
Deployment support and training	\$0k	\$400k	\$800k	\$1,200k	\$800k

Table C-6. Pages Disseminated by the RMS and LSS in Millions per FY

Pages disseminated in millions	FY95	FY96	FY97	FY98	FY99
DOE RMS page dissemination	0.0	0.1	0.4	0.6	0.7
LSS page dissemination	0.0	0.0	0.0	2.4	3.6
	FY00	FY01	FY02	FY03	FY04
DOE RMS Page Dissemination	1.5	1.5	1.3	1.0	0.7
LSS page dissemination	7.5	15.0	13.5	10.5	7.5

Table C-7. Option Parameter Description

Parameter	Comment
System specific features	
System electronic image based	"Yes" indicates that the system stores holdings as electronic images. "No" indicates the system uses microfilm as storage medium
System hybrid (backlog microfilm)	"Yes" indicates that the system uses electronic image for new material, microfilm for the existing backlog. "No" indicates all holdings are electronic image or microfilm as indicated by the "System electronic image based" parameter. This parameter can be "Yes" only when the system uses electronic images
Hardcopy dissemination of backlog microfilm/paper	"Yes" if backlog material is disseminated only as hardcopy. "No" indicates backlog is disseminated as electronic image. This parameter is always "No" if system is electronic image based
Hardcopy distribution of new material	"Yes" if new material can be disseminated as hardcopy. "No" if new material cannot be disseminated as hardcopy
Electronic image on-line	"Yes" if electronic images are on-line, if "No" electronic images are stored off-line. Text is always assumed to be on-line in systems based on electronic images
Electronic dissemination of images	"Yes" indicates that the electronic images are predominantly disseminated by means of telecommunications
CD-R distribution material	"Yes" indicates that users have the option to request dissemination on CD-R. "No" indicates this option is not available
Full text search system	"Yes" indicates that the system includes a full text search capability. "No" indicates this feature is not included in the system
Edit OCR output	"Yes" indicates that OCR errors are human corrected and verified. "No" indicates that text is entered into the system using only machine correction
Use native files in system	"Yes" indicates that the system accepts native file input. These files are converted to error free image and text by electronic means. "No" indicates that the system accepts only paper, microfilm, or electronic images as input to the capture subsystem

Table C-7. Option Parameter Description (Continued)

Parameter	Comment
System specific features (Cont'd)	
Microfilm Reprocess	"Yes" indicates that existing microfilm is reprocessed to electronic image and text. "No" indicates that existing material is input into the system as paper
System CD-ROM Library	"Yes" indicates that the system holdings is published on CD-ROM, and in the case of the LSS is disseminated in this form. "No" indicates that CD-ROM is not used as storage and dissemination medium
Electronic transfer from the RMS to the LSS	"Yes" indicates that material from the RMS is transferred by means of telecommunications to the LSS
Common system features	
Retype new pages (paper/image)	"Yes" indicates that new material is retyped if the page cannot be converted to text by means of OCR. "No" indicates that pages that cannot be converted to text by automatic means are entered as image only into the system
Retype backlog paper pages	"Yes" indicates that backlog paper material is retyped if the page cannot be converted to text by means of OCR. "No" indicates that pages that cannot be converted to text by automatic means are entered as image only into the system
Retype microfilm pages	"Yes" indicates that material input as microfilm is retyped if the page cannot be converted to text by means of OCR. "No" indicates that pages that cannot be converted to text by automatic means are entered as image only into the system
CD/Electronic Distribution	"Yes" indicates that images recently entered into the system for which a CD has not been issued are accessed on-line. Older images are accessed from CD. The "Yes" choice is only valid for options with CD distribution.
Facility distribution	
Separate NRC server facility in Las Vegas	"Yes" indicates that there is a LSS server facility in Las Vegas. "No" implies that the LSS functionality is incorporated in the RMS
Separate NRC capture facility in Las Vegas	"Yes" indicates that there is a LSS capture facility in Las Vegas. "No" indicates there is no LSS capture facility in Las Vegas
Separate NRC capture facility in DC	"Yes" indicates that there is a LSS capture facility in Washington D.C. "No" indicates there is no LSS capture facility in Washington D.C.

Table C-7. Option Parameter Description (Continued)

Parameter	Comment
Facility distribution (Cont'd)	
Separate LSS server configuration	"Yes" indicates that a separate LSS server facility exists
Separate NRC capture configuration	"Yes" indicates that at least one separate LSS capture facility exists
DOE server facility in Las Vegas	"Yes" indicates that there is a RMS server facility in Las Vegas.
DOE server facility in Vienna	"Yes" indicates that there is a RMS server facility in Vienna.
DOE capture facility Las Vegas	"Yes" indicates that there is a RMS capture facility in Las Vegas
DOE capture facility Vienna	"Yes" indicates that there is a RMS capture facility in Vienna
DOE capture facility HQ	"Yes" indicates that there is a RMS capture facility in Headquarters

Table C-8. RMS Option Feature Allocation

DOD Records System	2	3	4	5	6	7	8
System electronic image based	Yes						
System hybrid (backlog microfilm)	No						
Hardcopy dissemination of backlog microfilm/paper	Yes						
Hardcopy distribution of new material	Yes						
Electronic image on-line	No	No	No	Yes	Yes	No	No
Electronic dissemination of images	Yes						
CD-R distribution material	No						
Full text search system	Yes						
Edit OCR output	No						
Use native files in system	Yes						
Microfilm Reprocess	Yes						
System CD-ROM Library	No	Yes	No	No	No	Yes	Yes
Electronic transfer from the RMS to the LSS	No	Yes	No	Yes	Yes	Yes	Yes

Table C-9. LSS Option Feature Allocation

NRC Licensing Support System	2	3	4	5	6	7	8
System electronic image based	Yes						
System hybrid (backlog microfilm)	No						
Hardcopy dissemination of backlog microfilm/paper	Yes						
Hardcopy distribution of new material	Yes						
Electronic image on-line	No	No	No	Yes	Yes	No	No
Electronic dissemination of images	Yes						
CD-R distribution material	No						
Full text search system	Yes						
Edit OCR output	Yes	Yes	No	Yes	No	No	No
Use native files in system	Yes						
Microfilm Reprocess	Yes						
System CD-ROM Library	No	Yes	No	No	No	Yes	Yes

Table C-10. RMS and LSS Common Features

Parameters Applicable to Both Systems	2	3	4	5	6	7	8
Retype new pages (paper/image)	Yes						
Retype backlog paper pages	Yes						
Retype microfilm pages	Yes						
Client server architecture	Yes						
CD/Electronic Distribution	No	No	No	No	No	No	Yes

Table C-11. RMS and LSS Facility Locations

Facility Distribution by Scenario	2	3	4	5	6	7	8
Separate NRC server facility in Las Vegas	Yes						
Separate NRC capture facility in Las Vegas	Yes						
Separate NRC capture facility in DC	No						
Separate LSS server configuration	Yes						
Separate NRC capture configuration	Yes						
DOE server facility in Las Vegas	Yes						
DOE server facility in Vienna	Yes						
DOE capture facility Las Vegas	Yes						
DOE capture facility Vienna	Yes						
DOE capture facility HQ	Yes						

Table C-12. Assumed Media Distribution of RMS Input Pages by FY

Fraction of Total Pages	FY95	FY96	FY97	FY98	FY99
Paper Pages	90%	90%	75%	60%	45%
Electronic Image Pages	5%	5%	5%	5%	5%
Native File Pages	5%	5%	20%	35%	50%
	FY00	FY01	FY02	FY03	FY04
Paper Pages	30%	10%	10%	10%	10%
Electronic Image Pages	5%	5%	5%	5%	5%
Native File Pages	65%	85%	85%	85%	85%

Table C-13. Assumed Media Distribution of LSS Input Pages by FY

Fraction of Total Pages	FY95	FY96	FY97	FY98	FY99
Paper Pages	100%	100%	90%	75%	60%
Electronic Image Pages	0%	0%	5%	5%	5%
Native File Pages	0%	0%	5%	20%	35%
	FY00	FY01	FY02	FY03	FY04
Paper Pages	50%	50%	50%	50%	50%
Electronic Image Pages	5%	5%	5%	5%	5%
Native File Pages	45%	45%	45%	45%	45%

Table C-14. RMS and LSS Intake Pages per FY

Hardcopy paper (including backlog processing)	FY95	FY96	FY97	FY98	FY99
DOE non-LSS relevant pages	0k	1,516k	1,520k	1,512k	95k
DOE LSS relevant pages	0k	2,539k	2,582k	2,507k	858k
LSS pages	0k	0k	0k	944k	890k
Electronic Image	FY95	FY96	FY97	FY98	FY99
DOE non-LSS relevant pages	0k	7k	9k	10k	11k
DOE LSS relevant pages	0k	64k	80k	93k	95k
LSS pages	0k	0k	0k	20k	20k
Native file	FY95	FY96	FY97	FY98	FY99
DOE non-LSS relevant pages	0k	7k	35k	73k	106k
DOE LSS relevant pages	0k	64k	319k	653k	953k
LSS pages	0k	0k	0k	78k	140k
Accumulated totals	FY95	FY96	FY97	FY98	FY99
DOE non-LSS relevant pages	0k	1,530k	3,094k	4,689k	4,901k
DOE LSS relevant pages	0k	2,667k	5,648k	8,901k	10,807k
LSS pages	0k	0k	0k	1,042k	2,092k
Total Holdings	FY95	FY96	FY97	FY98	FY99
Total DOE RMS holdings	0k	4,197k	8,742k	13,590k	15,708k
Total LSS holdings	0k	2,667k	5,648k	9,943k	12,899k

Table C-14. RMS and LSS Intake Pages per FY (Continued)

Hardcopy paper (including backlog processing)	FY00	FY01	FY02	FY03	FY04
DOE non-LSS relevant pages	72k	25k	17k	17k	18k
DOE LSS relevant pages	647k	225k	154k	150k	166k
LSS pages	226k	235k	162k	157k	174k
Electronic image	FY00	FY01	FY02	FY03	FY04
DOE non-LSS relevant pages	12k	12k	9k	8k	9k
DOE LSS relevant pages	108k	112k	77k	75k	83k
LSS pages	23k	24k	16k	16k	17k
Native file	FY00	FY01	FY02	FY03	FY04
DOE non-LSS relevant pages	156k	212k	146k	142k	157k
DOE LSS relevant pages	1,401k	1,909k	1,311k	1,275k	1,414k
LSS pages	203k	212k	145k	142k	157k
Accumulated totals	FY00	FY01	FY02	FY03	FY04
DOE non-LSS relevant pages	5,141k	5,390k	5,562k	5,729k	5,913k
DOE LSS relevant pages	12,963k	15,209k	16,751k	18,251k	19,914k
LSS pages	2,544k	3,015k	3,338k	3,653k	4,001k
Total Holdings	FY00	FY01	FY02	FY03	FY04
Total DOE RMS holdings	18,104k	20,599k	22,313k	23,980k	25,827k
Total LSS holdings	20,648k	23,614k	25,651k	27,633k	29,828k