



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

DEC 02 1993

MEMORANDUM FOR: John C. Hoyle
Assistant Secretary of the Commission

FROM: Arnold E. Levin
Licensing Support System Administrator

SUBJECT: TECHNICAL WORKING GROUP REPORT

In response to requests raised at the October 5-6, 1993, meeting of the Licensing Support System Advisory Review Panel (LSSARP), I am providing a copy of the Licensing Support System Technical Working Group's Preliminary Report dated February 24, 1992. This report can be provided to the LSSARP members.

It should be noted that the Working Group relied heavily on cost figures and technical information developed for the Department of Energy as part of a 1989 study by Science Applications International Corporation (SAIC). Significant technological advances have occurred in this area since the SAIC study was completed. The original SAIC design also was driven, in part, by compliance with the LSS rule (10 CFR 2, Subpart J). For these reasons, cost figures presented in the Working Group's report differ somewhat from more recent figures presented to the Commission (SECY-93-107).

It should also be noted that some of the documents cited in the Technical Working Group's report may not yet be available to the public.

If you have questions regarding this information, please contact me at 492-7649.

A handwritten signature in cursive script, appearing to read "Arnold E. Levin".

Arnold E. Levin
Licensing Support System Administrator

Enclosure:
As stated

cc: H. Thompson, Jr., DECS

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Original Signed By:

Arnold E. Levin
 Licensing Support System Administrator

NOTE TO: Moe Levin

Enclosure:
 As stated

FROM: John Voglewede

cc: H. Thompson, Jr., DEDES

This is a revision of our November 24, 1993, memorandum to John Hoyle.

Distribution:
 w/o enclosure: G. Cranford
 J. Shields
 D. Drapkin
 E. Shelburne

Gerald discovered a slightly more recent (by 3 days) edition of the LSS Technical Working Group's Report, which is included with this transmittal.

The new version does not include the letter from DOE. It also deletes References 12-18 (informal correspondence between Lloyd Donnelly and the Commission), and adds References 22 (ASLBP comments) and 24 (citation from INFOTECH '91).

DOCUMENT NAME: P:\LSSARP2.INF

This is a revision of a memorandum dated 11/24/93 with a more recent attachment.

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LICENSING SUPPORT SYSTEM
WORKING GROUP

PRELIMINARY REPORT

February 24, 1992

LICENSING SUPPORT SYSTEM

Introduction

In an August 29, 1991 letter (Ref. 1) to the Nuclear Regulatory Commission (NRC), the Department of Energy (DOE) proposed a joint DOE/NRC reexamination of the current design, development, implementation and operational aspects of the Licensing Support System (LSS). The LSS is a conceptual electronic information management system proposed for use in the licensing proceedings for a national high-level radioactive waste repository. NRC and DOE have determined that this system is necessary to meet the three year repository licensing schedule established by the Nuclear Waste Policy Act of 1982, as amended (NWPA).

The DOE proposal recognized the many evolutionary changes in the civilian high-level radioactive waste program, a revision in the schedule for repository license application, and the concept of the LSS as part of a comprehensive, integrated information management system used to support the development and review of that application.

In response (Ref. 2), the NRC agreed with the DOE proposal to reexamine the LSS design "with the objective of developing a system that is responsive to the needs for improved information management and retrieval, yet more cost-effective than that initially proposed." The regulatory oversight and auditing mission of the NRC was also recognized, as was the opportunity to cooperatively reassess a large (multi-year) system development initiative to ensure that it is both technically sound and cost effective for all participants in the licensing process.

To develop this cooperative analysis, a technical working group was formed (Ref. 3) to reexamine the LSS design. The Working Group, which included representatives from NRC and the DOE's Office of Civilian Radioactive Waste Management (OCRWM), was comprised of the individuals listed below.

Gerald Cranford (Chairman)	NRC/IRM
Dave Drapkin	NRC/IRM
Dan Graser/Barbara Cerny	DOE/OCRWM
Jim Shields	NRC/LSSA
Donna Sitterson/Ray Godman	TRW (DOE Contractor)
John Voglewede	NRC/IRM

After the Working Group was formed, the Secretary of the Commission provided a representative (John Hoyle/Andy Bates). Other individuals from both DOE and NRC have also participated in the discussions of the Group. Representatives from major NRC Offices (ACNW, ADM, ASLBP, LSSA, OGC, NMSS, RES, SECY) have presented their views on the LSS to the Working Group for consideration.

Technical Review

The Working Group's technical review of the LSS included a number of documents prepared either by the Department of Energy (Refs. 4-5) or for DOE by Science Applications International Corporation (SAIC, Refs. 6-11). The documents were part of a larger collection of information that describe the proposed design, design considerations, and costs of the LSS.

The Working Group also reviewed documents prepared by the NRC Office of the Licensing Support System Administrator (LSSA) including proposed LSS development strategies and schedules presented to the LSSARP in July 1991 (Refs. 12-13). Under the terms of the LSS rule (10 CFR Part 2, Subpart J, Refs. 14-15), DOE is responsible for design and development of the LSS and NRC is responsible for system management, including operation and maintenance.

LSS Working Group Charter

In responding to the DOE/NRC agreement, the Working Group has adopted the following guidelines:

- Examine the original SAIC-proposed LSS design to determine if it remains technically sound, if it conforms to current technology, and if the design supports cost reduction measures.
- Examine INFOSTREAMS to determine if all or parts of that system can be applied to handle the LSS requirements. INFOSTREAMS is a system currently being developed by DOE/OCRWM to automate the collection, storage, and retrieval of records generated and used within the OCRWM organization.
- Evaluate various cost-reduction/reallocation measures to determine if they are technically acceptable and feasible.
- Consult NRC office representatives to determine whether enactment of the cost reduction measures would compromise the functionality of the LSS to the extent it would not meet their needs.
- Make recommendations to the Commission that would minimize development and operational costs of the LSS.

The SAIC Design

The Working Group has examined the preliminary design for the LSS proposed by SAIC. SAIC's preliminary design was developed under a multi-year DOE contract to be responsive to the LSS rule (10 CFR 2, Subpart J). SAIC conducted an extensive requirements study, data scoping, conceptual design, feasibility analyses and developed and operated a prototype system. This prototype included processing, cataloging, scanning and loading 100,000 pages of LSS documents into a text and image database that typical users then accessed in a controlled environment. Based on the results of these tests and analyses, SAIC developed system-level requirements and preliminary design documents in conjunction with OCRWM and NRC technical staff.

The Working Group found that the original SAIC design is thorough and consistent with automatic data processing system design methods and practice. The original SAIC design reflects specifications resulting from compliance with the LSS rule.

Although the SAIC study was completed in 1989, this does not seriously compromise the LSS design. DOE has provided evidence (Refs. 16-17) of its continuing efforts to stay abreast of the technology involved in the LSS program; particularly advances in optical character recognition, user interface design, and the operation of large full-text databases; and will continue to monitor this environment for cost saving techniques resulting from advances in technology.

Processing data structures such as text, voice and images is currently an issue of great interest among software and hardware developers. The Working Group believes that cost reductions will be achieved in the automation of text and image processing as the development of the LSS proceeds.

- The Working Group concludes that, given the anticipated size of the relevant document collection and the constraints of the LSS rule, the SAIC-design is appropriate and the system designed by SAIC, is not loaded with features that can be deleted to achieve measurable cost savings without significant reduction of the functionality and coverage of the system.
- Based on the Working Group's review of the SAIC design, and the continuing efforts of the DOE to monitor this technology, it was concluded that an examination of other government and industry offerings would duplicate previous efforts and would not result in the accumulation of significant new information.
- The Working Group believes that technological breakthroughs in the automation of text and image processing will result in lower costs over the life cycle of the LSS. For example, the projected cost of the original SAIC model was reduced by \$14 million with the introduction of differential (multiple) optical character recognition methods (Ref. 11).

INFOSTREAMS

The DOE Office of Civilian Radioactive Waste Management has identified the need to automate the collection, storage and retrieval of records generated and used within the OCRWM organization. A subset of these records would be identified for inclusion in the LSS. DOE has contracted with TRW Environmental Safety Systems (TRW) to provide such an automated system. A description of the proposed Information Storage/REtrieval/Access Management System (INFOSTREAMS) concept has been presented to the LSSARP (Ref. 18), the Commission, and the LSS Working Group (Ref. 19). DOE has proposed that INFOSTREAMS be used instead of the LSS to convert its LSS documents into the electronic form needed for loading into the LSS database. The LSSA has suggested that software and procedures developed for INFOSTREAMS be examined for application to LSS and NRC needs (Ref. 20).

The INFOSTREAMS design, based on DOE/OCRWM document management system requirements, has some features in common with the SAIC design for the LSS. INFOSTREAMS will be capable of serving as the capture station for DOE's share of the proposed LSS database (80 - 86 percent). However, the capabilities of the two systems (INFOSTREAMS and LSS) are not identical. INFOSTREAMS will provide a bibliographic index to documents tracked by OCRWM. Digital images will be provided for some of those documents. A smaller subset will be available in full text. The collection of documents in full text will change over time as new documents are added and older documents are retired (i.e., archived and no longer available on-line). This design requirement may be contrasted with the LSS design in which (according to the LSS rule) all information (20 million pages by 2001; 32 million by 2004) will be indexed and made available in full text and on-line image throughout the life of the system.

- The Working Group recognizes a substantial similarity among the document processing and retrieval needs of NRC's high level waste program, OCRWM and the potential parties to the repository licensing proceeding.
- INFOSTREAMS has been designed to meet DOE/OCRWM internal document management requirements and provide input for DOE documents to the LSS. The extent to which INFOSTREAMS hardware and software designs are applicable to the LSS (or to NRC document management requirements) has not yet been determined although INFOSTREAMS (as planned) does provide many of the functions required by the LSS and NRC document management systems.

NRC/DOE Office Views

The Working Group invited several major NRC Offices (ACNW, ADM, ASLBP, LSSA, OGC, NMSS, RES, SECY) and DOE/OCRWM to present their views on the LSS. Although the offices interviewed indicated that some features of the LSS were more important to them than others and that they had less need for some features than other offices might, no office recommended that any major feature of the LSS e.g., full text search, image retrieval, bibliographic descriptors, pre-hearing availability of the database, electronic mail, and so forth could be eliminated without undesirable impact on the pre-licensing review or the proceeding itself.

While affirming the expected usefulness of the LSS in the licensing review process, NMSS did point out that the relevant information required by the technical staff may be considerably less than the total backlog of potentially discoverable documents currently planned for inclusion in the LSS database.

NMSS, ACNW, and RES believe that the ability to search the full text of technically relevant documents will be useful. NMSS and ACNW asserted that access to on-line digital images, or other readily available forms of graphic information, is an important attribute and that eliminating this capability from the LSS would impair its use in the technical review process.

NMSS also noted that if the LSS is not available to the technical staff until late in the program, then it will not be of much use in the prelicense application phases. They indicated that, for the technical review process, it would be beneficial to implement a fully functional LSS as soon as possible, even if it were necessary to limit the number of documents in the database in order to do so. It was suggested that such a limitation could be accomplished by restricting the processing of backlogged documents to some more recent start date (e.g., the publication date of the Site Characterization Plan). NMSS also noted that although an early license application is not presently expected, it would be prudent to have a contingency plan for such an event (Ref. 21).

The Office of the Secretary suggested a very different course of action -- that consideration be given to delaying the implementation of the LSS as long as possible because of anticipated funding constraints and technological uncertainties, and limiting the LSS when implemented to a "core" database. Non-core documents would be made available to parties by placing them in the public domain well in advance of the hearing as they are generated. Copies could be given to each party if requested. The parties could review indexes of these documents periodically and determine whether certain ones should become "core" documents in the LSS. The LSS would not have to be brought on-line until needed for searching core documents. Implementing this suggestion would offset the total document burden of the LSS by placing information into the hands of interested parties through local and agency Public Document Rooms, thereby reducing the number of documents in the LSS and lowering LSS costs.

OGC and ASLBP noted that the LSS feature most critical to them was full text access to docket material, but that other participants would likely have broader needs. Both offices also voiced the opinion that non-federal LSS participants would react negatively to any proposal by NRC to limit the scope or availability of the LSS.

ASLBP reaffirmed their belief that it would not be possible to meet the Congressionally-mandated hearing schedule without an LSS of the SAIC-type design, and that making relevant information equally available to all participants will shorten the hearing process.

In an October 29, 1991 follow-up memorandum (Ref. 22), ASLBP recommended that: (1) IRM conduct a cost benefit study to verify ASLBP's assertion that the LSS original design would effect enormous savings; and (2) future IRM or NRC investigation and study of the LSS should be conducted jointly with representatives of potential parties because the configuration of the LSS will be so closely intertwined with the procedural and due process.

DOE expects that its staff and contractors will use the LSS to access the documents of other LSS participants as well as some DOE documents (because DOE does not plan to keep all the documents that it processes for inclusion in the LSS permanently on-line in INFOSTREAMS). DOE does not believe any major function of the SAIC design should be eliminated.

DOE has offered to make INFOSTREAMS technology available to NRC if requested. DOE has noted, however, that INFOSTREAMS is being designed to meet OCRWM's internal needs and is not being functionally designed to meet the LSS needs nor is it scaled to handle the LSS' size requirements. INFOSTREAMS is being designed to use DOE's existing Digital Equipment Corporation VAX/VMS hardware and BASISPLUS software. DOE note that additional customization would be needed to re-develop relevancy ranking algorithms embedded in INFOSTREAMS' content/relevancy based retrieval software. Furthermore, the Department of Energy's contractor (TRW) has emphasized that scaling requirements are a serious concern for migration of the INFOSTREAMS software to the LSS and DOE agrees with this assessment. Only selected information will be made available in image and full-text format to DOE users at any given point in time. Unlike the LSS, which will maintain all relevant high level master repository licensing material on-line for access, INFOSTREAMS will maintain only that portion of information currently being evaluated and will replace that information when a particular need has been met. Moreover, DOE has no plans for permitting outside access to INFOSTREAMS as a substitute means of accessing the text or images of LSS documents.

All the organizations consulted were unanimous in the opinion that any significant deviation 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 renegotiation with uncertain results.

Potential Measures to Reduce or Reallocate LSS Costs

Based upon the Working Group's interest to identify opportunities for possible cost reductions, the Working Group examined a number of options affecting the cost of the LSS program, including options identified by the LSS Administrator (Ref. 23). Following is a list of these options.

1. Capture DOE's LSS material using INFOSTREAMS versus the LSS
2. Adapt INFOSTREAMS search and retrieval capability to the LSS
3. Remove LSS telephone connect charges from the LSS Budget
4. Remove local LSS costs (workstations/other) from the LSS Budget
5. Remove costs to "pre-process" material for input to the LSS
6. Eliminate one of two training/user support locations
7. Use existing infrastructures (rather than LSS) to provide paper copies of LSS documents on demand
8. Minimize non-DOE document capture costs:
 - a. DOE capture all non-DOE LSS material; or

- b. LSS capture non-DOE LSS material using software adapted from INFOSTREAMS
9. No on-line images/limited on-line images
- a. Digital images of all pages stored off line in LSS; paper copies of requested pages mailed to individual users; or
 - b. No digital images (off line or on line) in LSS; microform images of all pages sent to key user locations; or
 - c. Digital images of "graphic" pages only stored on line in LSS; digital images of text pages sent to key user locations
10. Eliminate some documents from LSS database and place them in NRC/DOE public document rooms in a timely manner
- a. Establish a cutoff date unless to be relied upon; or
 - b. Include only "core documents" in the database
11. Reduce early availability of the LSS database
- a. Limit use and size of the database from early 1996 until early 1998; or
 - b. Don't make database available until early 1998

Impact of Working Group Recommendations

The chart on the next page (Figure 1) summarizes the LSS concept/design alternatives considered by the Working Group and provides additional information regarding cost reduction, the benefit reduction (if any) to potential LSS users, the impact on the LSS rule and shows whether or not the alternatives are recommended by the Working Group for adoption.

To assess the overall cost impact of its recommendations, the Working Group used \$193 million as a cost baseline. This baseline was prepared in June 1990 by the LSS Administrator relying almost exclusively on the SAIC revised cost analysis (Ref. 11). It encompasses LSS program costs from FY 1987 through FY 2000 irrespective of who's budget they might fall into. To arrive at a budget for the future development and operational costs of the LSS, the Working Group has reduced the \$193 million estimate as shown below:

\$193.0M	Baseline program costs through FY 2000
-73.6	Reallocate most of the LSS capture costs to the DOE budget - - DOE recommends that its LSS material be processed through INFOSTREAMS; DOE would perform most of this processing for its own internal purposes regardless of LSS needs
-9.3	Savings -- Working Group recommendations to take advantage of software developed through INFOSTREAMS and to delay availability of full LSS
-9.0	Reallocate non-DOE capture from LSS to DOE budget (INFOSTREAMS)
-7.9	Reallocate telecommunication charges, LSS workstations, and document pre-processing to LSS participant budgets
-8.9	Delete analysis and design funds already spent by DOE

\$ 84.3M	Future LSS development and operation budget through FY 2000

LSS Concept/Design Alternatives Summary

	Concept/Design Alternative	LSS Budget Reduction* (\$M)		LSS Benefit Reduction	Impact on the LSS Rule			Recommended by Working Group
					None	Minor	Major	
1.	Capture DOE LSS material using INFOSTREAMS versus LSS	73.6		None		■		Yes
2.	Adapt INFOSTREAMS search and retrieval capability to LSS	<1.0		None	■			Yes
3.	Remove LSS telephone connect charges from the LSS Budget	1.8		None	■			Yes
4.	Remove local LSS costs (workstations/other) from the LSS Budget	3.1		None	■**			Yes
5.	Remove costs to "pre-process" material for input to the LSS	3.0		None	■			Yes
6.	Eliminate one of two training/user support locations	2.5		Small	■			No
7.	Use existing infrastructures (rather than LSS) provide paper copies of LSS documents on demand	3.9		Small		■		No
8.	Minimize non-DOE capture costs:							
	a. DOE capture all non-DOE LSS material; or	14.0		None			■	See text
	b. LSS capture non-DOE LSS material using capabilities adapted from INFOSTREAMS		<1.0	None	■			Yes***
9.	No on-line images/limited on-line images							
	a. Digital images of all pages stored off line in LSS; paper copies of requested pages mailed to individual users; or	-1.3		Large			■	No
	b. No digital images (off line or on line) in LSS; microform images of all pages sent to key user locations; or		3.1	Large			■	No
	c. Digital images of "graphic" pages only stored on line in LSS LSS; digital images of text pages sent to key user locations			-0.8	Medium		■	No
10.	Eliminate some documents from LSS database and place them in NRC/DOE public document rooms in a timely manner:							
	a. Establish a cutoff date unless to be relied upon; or	0.3 per million pages excluded		Small			■	No
	b. Include only "core documents" in the database			Large			■	No
11.	Reduce early availability of LSS database:							
	a. Limit use and size of database from early 1996 until early 1998; or	3.3		Small	■**			Yes
	b. Don't make database available for use until early 1998		5.7	Medium	■**			No

*Combination of cost savings and budget reallocations, FY 1991 - 2000

**Modify expectations of LSS participants

***Not required if 8a is adopted

A detailed discussion and evaluation of each of the proposed alternatives shown in the table is presented below:

1. Capture DOE LSS material using INFOSTREAMS versus LSS

DOE has proposed to use the capabilities of its INFOSTREAMS system to convert its LSS documents into electronic format that will be compatible with the needs of the LSS. This processing would be in lieu of similar processing that was originally planned as a component of the LSS and included in the SAIC cost estimate.

The Working Group supports the concept of substituting INFOSTREAMS processing of DOE's LSS material for LSS processing if DOE agrees to meet both LSS standards and production schedules. Using INFOSTREAMS, DOE would unitize materials, prepare a full header for each unit, eliminate duplicates, set record pointers, maintain audit trails, clean up ASCII text, create bit-mapped images and meet any other LSS capture requirements. No indexing or other capture functions (beyond quality assurance, document correction and hearing support) will need to be performed in the LSS for DOE's LSS material. Also, INFOSTREAMS annual production volumes for LSS material will be reasonably consistent with the expected quality assurance and database loading capacities/requirements of the LSS, so that over the 1995-2001 timeframe, material can be quality assured and the database can be loaded six months before the receipt of DOE's license application. If prioritized loading of specific materials is deemed to be a requirement, INFOSTREAMS will produce documents consistent with such a loading schedule. Only a minor change would be required to the LSS rule and there would be no loss of benefit to LSS users if this alternative is adopted.

Using INFOSTREAMS to process DOE's LSS materials will result in a significant shift of costs from the LSS budget to OCRWM's internal IRM budget. The resultant reallocation from the LSS budget if this alternative is adopted would be \$73.6 million. This is the estimated cost for processing these documents in the LSS (\$76.3M) less additional costs that must be incurred by the Office of the LSS Administrator in FY 1994-FY 1995 to receive this electronic data from DOE and assure its quality prior to its entry into the LSS database (\$2.7M).

RECOMMENDATION: ADOPT

2. Adapt INFOSTREAMS search and retrieval capability to the LSS

Although the INFOSTREAMS search and retrieval software (both commercial off-the-shelf and application software) has not yet been specified by DOE, the capabilities being examined by DOE appear to be powerful and easy to use. Since there is reason to believe that this software could be used in the

LSS, albeit with some modification, this alternative has the potential for reducing LSS software development costs. The Working Group recommends this alternative if DOE agrees to develop upgraded search and retrieval software (for both text and image) on a scale and schedule that will permit its timely evaluation for use in the LSS. The estimated cost savings for this alternative are difficult to assess because the extent of the required modifications to the INFOSTREAMS software are not known, but the savings would be \$1.0 million or less.

RECOMMENDATION: ADOPT

3. Remove LSS telephone connect charges from the LSS Budget

Although LSS telephone connect costs (\$1.8 million) were included in SAIC's LSS program costs, the LSS rule makes telephone connect charges the responsibility of individual LSS participants. Therefore, they should not be included in future LSS budget estimates.

RECOMMENDATION: ADOPT

4. Remove local LSS costs (workstations/other) from the LSS Budget

The LSS rule makes individual participants responsible for the cost of their "individual computer facilities to have remote access to the LSS (10 CFR 2 §2.1007)." This includes the costs of all hardware and software needed to connect to the LSS wide area network and to search the LSS database. LSS workstations were included in SAIC's LSS program costs, at a cost of \$3.1 million for their purchase and maintenance.

Given that the LSS rule makes LSS participants responsible for the cost of these workstations, their cost should not be included in future LSS budget estimates. Even though participants would pay for their workstations, it may be advantageous for them to be purchased through the LSS contract.

DOE and NRC will ensure that adequate terminal access facilities are provided at the public document rooms.

RECOMMENDATION: ADOPT

5. Remove costs to "pre-process" material for input to the LSS

The LSS rule makes all LSS participants responsible for "pre-processing" their material for submission to the LSS where it would be processed and then loaded into the LSS database. The \$193 million baseline includes \$8.1 million for LSS participants' "pre-processing." Of the \$8.1 million, \$5.1 million was removed from the LSS budget by

virtue of it being included in the \$73.6 million removed from the LSS budget by Alternative 1. The remaining \$3.0 million is removed under this alternative.

RECOMMENDATION: ADOPT

6. Eliminate one of two training/user support locations

The LSS Administrator's current plan for the LSS is to have both Eastern U.S. and Western U.S. training facilities and user support functions to train and assist end users. By doing so, these functions will be provided at locations and times convenient for most users, regardless of their geographic location. Under this alternative, the Eastern U.S. training and support operation would be eliminated, which would save \$2.5 million. The Western U.S. operation would be retained at its currently projected size, by concentrating more on training the trainers, than on training end users. LSS participants in the Eastern U. S. would have to travel greater distances to be trained, perform more of their own end-user training and would receive help desk support only between the hours of 10:30 a.m. and 6:00 p.m., Eastern time.

The Working Group does not recommend adopting this alternative. High quality training and user assistance are both viewed as vitally important functions to the success of the LSS. Eliminating the Eastern U. S. training and support operation would result in a significant reduction in services. The savings associated with this alternative are not sufficient to warrant the reduction in services to LSS participants and to the public. Moreover, projected savings could be offset substantially by the additional burdens placed on the system by insufficiently trained and supported users.

RECOMMENDATION: DO NOT ADOPT

7. Use existing infrastructures (rather than LSS) to provide paper copies of LSS documents on demand

While paper copy distribution of agency documents are inherent responsibilities of DOE and NRC (through the Freedom of Information Act and PDR activities), the LSS rule (10 CFR 2 §2.1007) specifies that LSS users can order paper copies on-line and expect to receive them without charge from the LSSA. This alternative considers shifting the responsibility back to the organizations that produced or acquired the information stored in the LSS.

The Working Group does not recommend adopting this alternative. Although it might seem that the use of existing infrastructures would be more cost effective than creating a new function within the LSS, the cost to DOE, NRC and others would likely be more than the \$3.9 million

projected for the LSS. DOE, NRC and others would each have to provide the equipment, staff and other resources required to generate paper copies from the LSS database. Thus performing this function on a decentralized basis (and on a smaller scale at each site) would likely increase costs rather than reduce them.

RECOMMENDATION: DO NOT ADOPT

8a. Minimize non-DOE capture costs - DOE capture all non-DOE LSS material

Although DOE has proposed to electronically process its LSS material through INFOSTREAMS (about 80 - 86 percent of all LSS material), there is another 14 - 20 percent from NRC and other LSS participants that must also be electronically processed. The SAIC design called for this processing to be done in a central capture facility operated by the LSS Administrator. This alternative considers having DOE process NRC's and other participants' LSS material through INFOSTREAMS.

The Working Group sees this as a technically feasible way to reduce costs. Given that INFOSTREAMS can mirror LSS processing requirements and will be doing so on a very large scale, it would be more economical for DOE to assume responsibility for the other 14 - 20 percent than to establish a separate small scale operation in the LSS to do so. If this alternative were adopted, the LSS could be limited to document receipt, quality assurance, hearing support, database loading and information dissemination and the LSS budget could be reduced by \$14 million. This alternative would remove from the LSS budget the \$9 million cost of labor, facilities, equipment and maintenance for processing NRC and other participants' materials. In addition economies of scale to be achieved in INFOSTREAMS may permit DOE to perform this processing for less than the cost of doing it in the LSS. The \$5 million cost of designing, developing, testing, operating and maintaining LSS capture software and procedures could also be eliminated, except for a small amount needed for quick turn around information capture during hearings. DOE would incur the cost of processing non-DOE material and the costs of any changes to INFOSTREAMS software and procedures necessary for processing it. The Working Group believes that adequate quality checks can be instituted by both the LSS Administrator and LSS participants to assure accurate processing of non-DOE material through INFOSTREAMS.

DOE has stated that it has serious concerns about any plan that would give DOE responsibility for entering other parties' submissions. DOE's access to, and control over, other parties' materials was very contentious during the negotiated rulemaking. Furthermore, there are serious policy and operational questions related to responsibility

for intake prioritization, liability for accuracy and timeliness of entry of other parties' materials, and budgeting and procurement of incremental resources. The DOE Working Group representative's level of concern is such that he cannot concur in recommending this for any further consideration.

Implementation of this alternative would require the agreement of LSS participants and a change to the LSS rule.

RECOMMENDATION: ADOPT PROVIDING DOE AND OTHER PARTICIPANTS CONCUR

8b. Minimize non-DOE capture costs - LSS capture non-DOE material using software adapted from INFOSTREAMS

This alternative would retain the central LSS facility to process documents submitted by non-DOE participants. Software development costs could be reduced somewhat by adapting INFOSTREAMS developed software for LSS use.

The Working Group finds this to be an acceptable alternative to the current plan, but lacking the distinct advantages of 8a above. The only savings that could be realized from this alternative would be the amount of development cost avoided by adapting INFOSTREAMS developed software to the LSS (estimated at \$1 million or less).

RECOMMENDATION: ADOPT IF ALTERNATIVE 8a IS NOT ADOPTED

9. No on-line images/limited on-line images

The LSS rule requires that digital images of all pages be stored on-line in the LSS. In the SAIC design, the LSS would have duplicate image servers in both the Eastern and Western part of the U.S. to minimize telecommunications costs and to have one set of optical disks serve as backup to the other. The benefits of on-line images are three-fold; users will be able to view images of document pages and technical data on screen with little delay; capture system staff will access page images to verify that duplicate documents are not being entered into the database and image servers will be linked to high-speed printers to produce hard copy of document pages upon request.

LSS users will search the LSS text and bibliographic header databases in order to locate relevant documents; however, they will need to view images in order to see document pages in their original format, including italics, underlining, highlighting and strikeouts. More importantly, images of document pages provide access to "graphic" information elements that cannot be captured in text and bibliographic header databases. Such elements include graphics, line drawings, signatures, mathematical equations, chemical formulas and marginalia.

Many of the technical reports to be included in the LSS will contain large numbers of charts and graphs (often as much as 50 percent of the pages) that the user must see in order to adequately review and understand the reports. Since the "graphic" information is typically interspersed with text, the ability to view both text and graphical information without interrupting ongoing work to go to other sources will be very beneficial for users. By one estimate, half of the LSS material will eventually consist of pages containing graphic information. Some technical users have asserted that access to on-line digital images is an important attribute of the LSS and that eliminating this capability would impair its use in the technical review process.

Having on-line images available is especially important in the case of "technical data" because very little of this material has text that can be captured and stored in the LSS. Technical data is largely raw data compiled during scientific investigations. This data consists of items such as handwritten notes, graphs, maps, photographs, sketches, numeric tables and computer tapes. The LSS will contain bibliographic indexes for this material and images for all of it that can be scanned. The LSS will contain a large volume of this material; the Yucca Mountain Project Office already has a backlog of roughly four million pages of this material.

A number of cost and benefit issues should be examined carefully when considering limiting or eliminating access to on-line images from the LSS. There are several cost components associated with providing on-line images in the LSS -- the cost of creating digital images from source documents, the cost of storing and maintaining those images in the LSS database, the cost of workstations, and the cost of communications services to access the images. The cost of creating the images from source documents is not an issue for DOE's LSS material (80 - 86 percent of total LSS material), because DOE plans to create digital images of its LSS material for its own internal purposes using INFOSTREAMS, irrespective of LSS requirements. The cost to create these images is included in the previously discussed \$73.6 million estimate for processing DOE's LSS material through INFOSTREAMS (see Alternative 1.) Storing and maintaining images in the LSS database is relatively inexpensive, because of the high storage density of optical disks. Image storage and maintenance costs for the planning period total \$2.4 million for 20 million pages of LSS material. On-line access to images requires properly configured workstations and increased communications traffic. These are both user costs because the LSS rule requires users to pay for their own workstations and telephone connect charges (see Alternatives 3 and 4). Therefore any savings in workstation and communications costs due to limiting or eliminating on-line images from the

LSS accrue to users, not the LSS.

Eliminating or reducing access to the LSS negates or reduces many of the benefits discussed above. Because of the large size of the LSS database, it would be awkward and time consuming for users to view images of documents and technical data in an off-line environment. Manually finding particular images or groups of images in a collection of tens of millions of pages of paper, or tens of thousands of microfiche, or thousands of CD-ROM disks is not practical, particularly considering how ineffective an information collection becomes when people are continually withdrawing, returning, misfiling (or never returning) items of interest. Because of this difficulty, those who can, will likely develop their own LSS image access systems if the LSS eliminates or reduces access to on-line images. This would result in a large duplication of effort and in most cases, additional costs to the Nuclear Waste Fund.

9a. No on-line images - Digital images of all pages stored off line in LSS; paper copies of requested pages mailed to individual users

If this alternative is adopted, no on-line access to images through the LSS would be available. Instead, paper copies of the images on these disks would be generated and mailed to LSS participants upon request.

The Working Group does not recommend adoption of this alternative for two reasons. First, adopting this alternative would increase the cost of the LSS by \$1.3 million according to the SAIC benefit-cost analysis. The savings potentially achieved by eliminating equipment and software for on-line image storage are more than offset by the increased cost of providing voluminous paper copy production from optical disks to LSS participants. Perhaps more important, however, is the large negative affect it may have on LSS participants. They would have to deal with both ordering and maintaining huge quantities of paper and would experience difficulty locating information in a paper environment.

RECOMMENDATION: DO NOT ADOPT

9b. No on-line images - No digital images (off line or on line) in LSS; microform images of all pages sent to key user locations

This alternative would replace on-line digital images with off-line microform stores located at key user locations. Having located documents of interest using the text search capabilities of the LSS, users would visit user microform files at key locations to locate and view document images.

The Working Group does not recommend adopting this alternative. In their benefit-cost analysis, SAIC concluded that \$3.1 million could be saved by this option, but that there would also be a large reduction in benefit to LSS users. The LSS is currently expected to hold several million pages of images (maps, technical charts, etc.) that are either non-textual or only partly textual. The only way users could view these images would be away from their LSS workstations, perhaps in other buildings. This could be disruptive and would remove one of the most beneficial functions of the LSS design.

RECOMMENDATION: DO NOT ADOPT

9c. Limited on-line images - Digital images of "graphic" pages only stored on line in LSS; digital images of text pages sent to key user locations

Under this alternative images of pages that consist of text with no marginalia or embedded graphics would not be stored on line in the LSS, but images of all other LSS material would. Optical disks containing digital images of "text" pages (no marginalia or embedded graphics) would be sent to key user locations. Based on information from the SAIC communications design document (Ref. 9), it appears that there are about 40 such sites. Users would want to be able to view images of "text" pages because of the occurrence of errors. Information in the text and header databases will always be less than 100 percent due to errors introduced during the conversion and cataloging processes. Some users will also want to view these images in order to see text in its original format. The latter is important because affordable ASCII text conversion does not preserve features such as type face and size, italics, underlining, highlighting and strikeouts.

If images of "text" pages were loaded onto 600MB CD-ROM disks for distribution, about five new CD-ROMs could be sent to each key location each week, assuming that LSS information is made available at a rate of 4 million pages per year and 50% of it consists of text with no marginalia or embedded graphics. Thus each key user location would amass a collection of 1,250 CD-ROMs by the time DOE submits the license application in 2001. The cost to produce the CD-ROMs and distribute them to the 40 sites would be about \$1.4 million. A set of CD-ROMs and a CD-ROM reader would be required for many standalone image workstations. At sites with multiple workstations, the CD-ROMs could be stored in jukeboxes connected to networks to permit access by multiple users.

It would at first appear that this alternative would cut LSS image storage and maintenance costs in half and reduce LSS telecommunications costs. The amount of reduction in

telecommunications costs would be equal to the telephone connect charges for transmitting images of pure text pages if they were available on line. However, LSS participants must pay for their telephone connect charges, so limiting on-line images will not reduce future LSS telecommunications costs.

Storage and maintenance cost savings are smaller than expected because a full set of optical images must be kept to support LSS functions. In order to provide paper copies on demand, as described in the LSS rule, in an efficient manner and in order to assure accurate duplicate data entry checking, pages of all documents must be maintained on line on optical disks to support these functions at the Western U.S. site. Half (\$0.6 million) of image storage and maintenance costs for the Eastern U.S. image storage facility could, however, be eliminated from the LSS budget.

The Working Group does not recommend adoption of this alternative. It represents a negative savings (increase) to the LSS budget of \$0.8 million. It offers no additional communications cost savings and image storage and maintenance cost savings (\$0.6 million) would be more than offset by the \$1.4 million cost of producing and distributing CD-ROMs.

In addition, participants (and ultimately the Nuclear Waste Fund in most cases) would bear the cost of CD-ROM readers, jukeboxes and any networks necessary for accessing the CD-ROMs. A CD-ROM reader for a single workstation could be purchased and maintained over the planning period for as little as \$1,500; however, since images would be loaded onto CD-ROMs in the order that documents are added to the LSS, a workstation user would likely have to load multiple CD-ROMs in order to view the images of the several documents found in a particular search or series of searches. This could require multiple trips (across the room, down the hall or wherever) to retrieve the appropriate CD-ROMs from the collection. This procedure would be further prolonged in situations where the CD-ROMs were already in use elsewhere. To avoid this problem users could share their set of LSS CD-ROMs among a number of workstations by purchasing and maintaining appropriate jukeboxes at an estimated cost of \$0.6 million per site. Doing this at multiple sites would, of course, duplicate effort and cost.

RECOMMENDATION: DO NOT ADOPT

- 10a. Eliminate some documents from LSS database and place them in NRC/DOE public document rooms in a timely manner - Establish a cutoff date unless to be relied upon

A fundamental assumption in the LSS concept is to have in the electronic database all material that LSS participants agreed might be relevant or potentially relevant to the

licensing of the repository, irrespective of date. This alternative assumes that a cut-off date would be established, such that low-value (older) material would not be entered into the LSS but would be available to participants in paper or microform, unless a party intended to rely on one or more of these documents. The Working Group recommends that this alternative not be adopted because there is little potential for achieving additional cost savings. Most of the potential savings that could be achieved are in the area of reduced capture costs, which will not be included in the LSS if Alternatives 1 and 8a are adopted. The only additional costs that could be eliminated would be a portion of on-line document storage cost. Because that cost is only \$0.3 million per million pages, agreement would have to be reached to eliminate a large number of pages from the database in order to achieve an appreciable savings. The idea of establishing a cut-off date was discussed during negotiations on the LSS rule but an agreement was never reached.

RECOMMENDATION: DO NOT ADOPT

- 10b. Eliminate some documents from the LSS and place them in NRC/DOE public document rooms in a timely manner - include only "core" documents in the database

This alternative would limit the size of the LSS database by defining a core set of documents for inclusion in the database. Indexes of all LSS material would be made available from time to time to help parties determine what additional documents they might want to have added to the core database.

The concept of limiting the scope of the LSS database was discussed during the LSS negotiated rulemaking; however, it was concluded that the LSS needed to have a comprehensive database of searchable full text, constrained only by the Topical Guidelines and certain exclusions described in the LSS rule. The argument was made that a complete and comprehensive electronic database gives users a very high confidence level that all relevant or potentially relevant documents can be readily located and examined.

The Working Group recommends that this alternative not be adopted. Similar to Alternative 10a, at \$0.3 million per million pages, a large number of pages would have to be eliminated from the database in order to achieve appreciable additional savings. Moreover, the process of agreeing on which documents to eliminate from the database would be so subject to interpretation and debate it is questionable whether a large number of pages could actually be eliminated.

RECOMMENDATION: DO NOT ADOPT

11a. Reduce early availability of the LSS database - limit use and size of database from early 1996 until early 1998

In the LSS Administrator's \$193 million estimate, he planned to give 30 users access to a small number of critical documents (approximately two million pages) in early 1996 and then expand the number of users and the database starting six months later. Alternative 11a would provide limited access to a database of approximately two million pages for 18 months beginning in late 1996¹; full access would not begin until early 1998, three and one half years before DOE is expected to submit its license application to the NRC.

The Working Group recommends adoption of this alternative because of the operational cost savings and because all participants would be able to have full access to the database starting three and one-half years before the license application submittal date, which was the expectation at the time the LSS rule was promulgated. Although there is a small reduction in benefit, the magnitude of the cost savings (\$3.3 million) make it attractive.

RECOMMENDATION: ADOPT

11b. Reduce early availability of the LSS database - don't make database available for use until early 1998

This alternative makes further operational savings possible since no database would be available to anyone until three and one-half years before DOE is expected to submit its license application. This alternative would provide no user access until early 1998, although the system would have to be available to start loading a year to 18 months beforehand.

The Working Group does not recommend the adoption of this alternative. The increase in savings over Alternative 11a is significant (\$3.1 million), but so is the benefit lost by not having high priority material accessible during the 1996/1997 timeframe. Moreover, the experience gained from use of the system on a small scale during 1996/1997 could be invaluable to the future success of the LSS under full load conditions.

RECOMMENDATION: DO NOT ADOPT

¹ This is the earliest possible data assuming a decision is made to accept the Working Group's recommendations by the end of March 1992.

Other Considerations

Alternatives 1 - 11 present a series of measures for reallocating or reducing costs based on reuse of DOE's INFOSTREAMS technology, reduced functionality, reduced availability, and other strategies. Many of these items are interdependent or could be considered in conjunction with others as part of a package. In this section, several discrete strategies raised by DOE are presented.

1. Is it feasible that not all documents be included with searchable full text, but rather made available via bibliographic header and bit-mapped images only?

Text conversion is the single most costly element of all LSS processes. It was incorporated into the LSS design as a blanket requirement for all documents: a) before the header fields were decided, b) as a response to legal representatives who were familiar with the technology, and c) recognizing that subject cataloging had inherent deficiencies.

Conversely, the text of some documents adds little or nothing to their retrievability if they have been competently and fully cataloged. A bibliographic header does provide search and retrieval capabilities and is an appropriate level of treatment in some circumstances. By using bibliographic headers, where the associated image is available on line, participants still have access to those materials.

Some situations typical of the LSS document collection are amenable to differential treatment. For example, a case can be made that transmittal memos and letters attached to reports, studies, etc., are often not content rich. Rather, it is the item being transmitted that contains the information of value. So, if attachment relationships and cross-reference fields are properly designed, and if the item attached, itself, is full-text searchable the entire package (transmittal and report) is still eminently retrievable via text search.

Another situation consists of the flip charts and other presentation materials which are attached to textual meeting minutes.

DOE's contribution to the LSS holdings is estimated to be 80 percent of the low-volume estimate and 86 percent of the high-volume estimate. Of DOE's contribution for the low volume estimate, 4,320,000 pages (65 percent of all its documents but only 12 percent of its pages) will be correspondence (letters, memoranda, telex, etc.). A simple analysis indicates that \$2.1 million could be saved during the planning period (\$3.3 million through 2004) by not including text for such correspondence in the LSS. This savings would be offset somewhat by the labor or automated

processes needed to determine which correspondence would fall into this category on a document by document basis. Moreover, such determinations would be subjective, and it would likely be difficult to get all participants to agree on them.

This is a simplistic presentation insofar as storage would not really decrement proportionately, since text from correspondence is less character-dense than equivalent pages of reports and publications. And, it is more palatable if text is omitted only for correspondence that is attached to a text-searchable report, resulting in a smaller percentage reduction. However, it is representative of strategies focused on the peculiarities of the document collection and knowledge of users' retrieval expectations.

2. What economies could result if data accuracy requirements are reduced to 98 percent accuracy rather than 99.8 percent because "intelligent" retrieval software compensates?

DOE's LSS Prototype showed that the most accurate OCR device tested achieved an average character accuracy of 98.6 percent, which corresponds to 25 errors on an average 1800 character LSS page (see Ref. 24). In that same prototype, it was found that text accuracy must approach 99.8 percent or users would lose confidence that they were able to retrieve all critical documents, and thus lose confidence in the LSS itself. Under SAIC's design, documents for which the OCR output accuracy was not in the 95-98 percent range would require additional editing that would exceed the cost of a complete, manual rekey of the entire page. It was also found that, on average, editing represents from 65-75 percent of the total cost of text conversion, and that correcting OCR-induced errors constitutes 67 percent of that total editing cost. The multiple OCR device approach for intake, reflected in SAIC's final cost estimates, was based on analyses showing that 2/3 of OCR-induced errors could be eliminated by merging and matching streams from multiple OCR devices.

DOE is studying content/concept based retrieval software to augment classic Boolean tools. The most significant aspect of this software is that it profiles a document's content. But, one unanswered question is how much of the document must be "read" before all the relevant terms and topics have been identified?

If, after analyzing the first 20 pages of a 350 page report, the software "knows" what the document is about, isn't the rest of the document superfluous in adding to our understanding of its content? If after these 20 pages our matrix is already "saturated", we have 330 pages where the input accuracy of the text could be as low as 90 percent and have no impact whatsoever on our ability to characterize the document.

What if the entire document were 90 percent accurate? Then it may take an additional 10 pages of text to find a "clean" occurrence of terms and topics before the matrix was again saturated. But, again, 320 succeeding pages contribute nothing more to our understanding.

In a way, the "intelligence" of the software compensates for typographical errors by having access to enough bulk ASCII, with enough clean text, to be able eventually to correctly characterize the document. DOE's testing still has to validate the concept. For example, DOE does not know where the "saturation" level is, and if it is affected by the overall length of a document. How much "clean" ASCII is needed? Will it work as well on an eight page letter as it will on the longer report? Will a high percentage of uncorrected ASCII result in an unacceptable level of false characterizations, resulting in associated false drops during retrieval? How would the highlighting of occurrences of terms in text be implemented in a "dirty ASCII" environment? Can the matrix compiled during the filtering of incoming text be added somehow to a simple bibliographic header with associated image, obviating the need for text?

Academic papers about the new software packages which utilize "fuzzy logic" indicate that this approach will work for search and retrieval -- and this would be sufficient because it is the images and not ASCII that are relied on for introduction as exhibits. Will LSS users be satisfied that such intelligent software is able to compensate for typographical errors? If they could be convinced, and, if one of these new software packages is roughly comparable in cost to a current state-of-technology, Boolean-based package such as BASIS+, then the following scenario could apply: we could remove the multiple OCR devices from SAIC's final design, and accept the basic 95 percent text accuracy with no additional text editing and OCR cleanup. A simple analysis indicates that such a strategy could theoretically save \$12.2 million (\$19.5 million through 2004).

A demonstration of this strategy was made to DOE utilizing commercially available off-the-shelf technology, EXCALIBUR software, which is VAX compatible but does not work in conjunction with DOE's current BASIS+ records management software.

Both of the approaches outlined above would represent major deviations from what the parties agreed to during the Negotiated Rulemaking, and they would all be contentious to varying degrees.

Other strategies are conceivable: if bibliographic headers could be made to store the entire subject-content matrix of every textual document (derived from DOE's expert system software), the OCR and text analysis processes would not

decrease, but perhaps no text at all would have to be stored or retrieved. This would have major impacts on the amount of disk storage, the size of the search engine hardware, the organization of databases (no partitioning), database loading and maintenance, the size of the telecommunications lines, etc. It would, of course, also have a significant effect on the LSS functionality. Assuming one could actually determine and store all document subject-content information that would be of interest to all users for the life of the system, users would be able to retrieve information of interest without searching text, but they would be unable to search through, or download text once documents were located. Their only access to textual information would be through browsing images. The cost and benefit ramifications of such strategies would require robust, detailed, and professional feasibility and benefit-cost studies outside the scope of this paper.

The Working Group notes that while these ideas may have merit, they must be researched, proven and accepted by potential LSS users before they can be incorporated into the LSS design. There may also be other innovations or technical enhancements as time goes on. The LSS development plan should continuously monitor such developments and when it can be demonstrated to users that they can be relied on, be adopted wherever possible. However, there will be points in the design and development process where one must lock in a design and proceed or the final system will suffer delays trying to take advantage of each new improvement that is on the horizon.

Observations vis-a-vis Future Actions on the LSS

The LSS Administrator identified two major issues confronting the LSS program. These are the budget responsibility (DOE or NRC) and the schedule for the development of the LSS. The issue of which organization (DOE or NRC) builds the LSS raises a number of policy questions. The Working Group notes that if a decision is made to assign this responsibility to NRC, there may be opportunities for cost optimization by joining the development of the LSS and NRC's internal document management systems.

The NRC's Nuclear Document Control System (NUDOCS) serves as NRC's document storage and retrieval system and provides bibliographic reference material to the PDR. Many of the functions required by the LSS and planned for inclusion in INFOSTREAMS are also useful to the NUDOCS system. A combined INFOSTREAMS/LSS/NUDOCS information and technology exchange (if the time schedules are complimentary) could provide even further cost reductions. The amount of these cost savings cannot be estimated at this time and would be achieved in other DOE or NRC budget categories (not LSS). However, such an exchange would undoubtedly offer cost savings since many of the requirements of all three systems are quite similar. The Working Group supports further efforts to explore the development of a combined DOE/NRC working relationship that fosters the exchange of technology related to automated document processing.

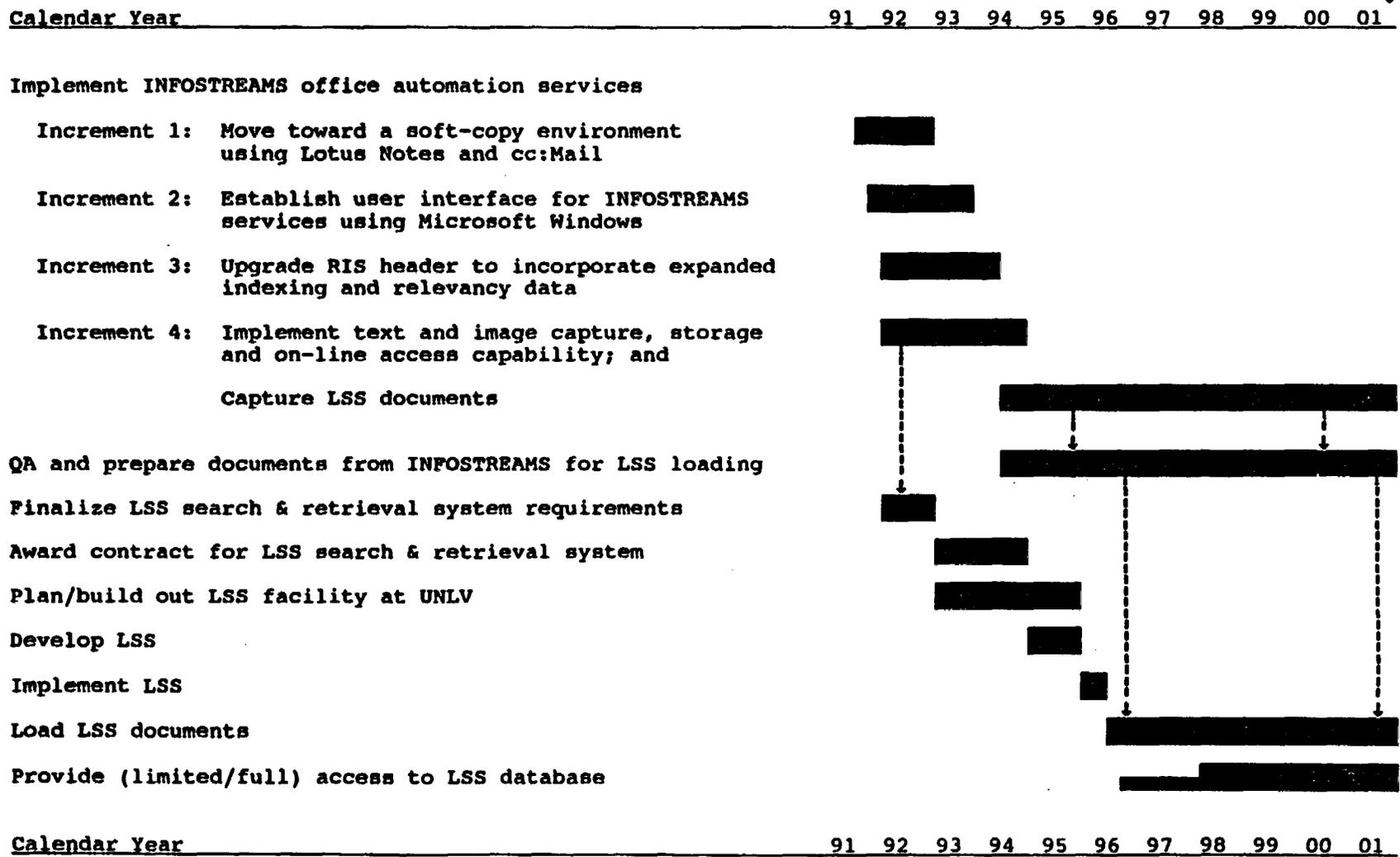
The Working Group also notes that if repository development progresses on the schedule provided by DOE (Refs. 25-26) and if an LSS of the SAIC design is to be used, LSS development activities should resume now if the system is to be available to support the NRC staff's technical review and pre-hearing discovery, albeit on a small scale starting in 1996/1997.

It normally requires about five years to procure, develop, implement and test a major automated system like the LSS. If the LSS is limited to essentially a search and retrieval capability (the data being captured using INFOSTREAMS), the procurement will be simpler and perhaps the five-year timeframe can be reduced to four years. Following system testing, an initial quantity of high priority documents must be loaded prior to providing access to the system. Database loading would continue for about four years following the initial "high priority" loading and users would gain access to increasing amounts of material, with the database expanding to about 20 million pages by six months prior to the submission of DOE's license application in 2001. If the system is not developed on a schedule that makes it available for database loading four to five years before the submission of the license application, it is unlikely that the estimated 20 million pages of relevant material would be in the LSS system by 2001.

Attachment 1 provides a schedule for development of the LSS assuming the use of INFOSTREAMS as the data capture mechanism and the LSS as a search and retrieval system. This schedule assumes a decision is made to proceed with the LSS by the end of March 1992.

INFOSTREAMS/LSS Development & Implementation Schedule*

License
Application
↓



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*Assumes a decision is made by the end of March 1992 to accept the Working Group's recommendations

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