LICENSING SUPPORT SYSTEM
CONCEPT FEASIBILITY ANALYSIS

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

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LSS SYSTEM CONCEPT FEASIBILITY ANALYSIS

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Preface

This report fulfills the contract milestone for a Systems Concept Feasibility Analysis as required by the contract between the Department of Energy Office of Civilian Radioactive Waste Management (OCRWM) and Science Applications International Corporation (SAIC) for the Licensing Support System (LSS). The analysis effort has been an ongoing process as a part of the preparation of the series of four reports which have been prepared for OCRWM submittal to the Office of Management and Budget over the past eight months. Therefore these reports, which constitute the body of work performed on the Systems Concept Feasibility Analysis, are incorporated as attachments to this report.

1.0 INTRODUCTION

As a part of the initial Licensing Support System (LSS) development effort, Science Applications International Corporation (SAIC) has prepared a series of four reports for the DOE Office of Civilian Radioactive Waste Management (OCRWM). These reports have in turn been submitted to the Office of Management and Budget by OCRWM to document the basis for the LSS design. The reports have covered the entire conceptual design process, from identification of needs and requirements to analysis of benefits and cost. The reports constitute the basis of the System Concept Feasibility Analysis and have been assembled here.

1.1 Purpose and Scope

The LSS System Concept Feasibility Analysis was originally intended to provide DOE with the assurances from the LSS contractor that the conceptual design as contemplated in the Functional Requirements Document is both technically achievable and can be attained within reasonable costs. In light of the fact that the High Level Waste LSS Advisory Committee was determining LSS requirements as part of the negotiated rulemaking process, it became necessary to revise the process somewhat. SAIC therefore performed a complete conceptual design: integrating the requirements from the negotiated rulemaking process with needs identified from user interviews, determining the scope of the information to be stored, developing a conceptual design with reasonable variations, and analyzing the costs and benefits of the designs. During the course of developing the conceptual design and the benefit-cost analysis, the feasibility of the design was constantly being evaluated. This report will focus on this feasibility aspect of the design process.

This report has been organized into three major sections. Section 1 provides an introduction to the report. Section 2 is a summary of the information contained in the four previous reports with specific information on the aspects of concept feasibility that are explicitly or implicitly contained in those reports. Section 3 provides the conclusions, and the four reports comprising the basis of the analysis are included as attachments.

1.2 Background

The development phase of a system integration contract, either explicitly or implicitly, includes an analysis of the feasibility of the total system. Feasibility in this context generally means a reasonable assurance that the system conceptual design is capable of being produced without unreasonable technical risk or cost, and that the system will perform according to the requirements and specifications.

2.0 CONCEPT FEASIBILITY

The conceptual design analysis which has been performed for the LSS consisted of four steps, each of which culminated in a report documenting the results. In this section the reports will be summarized, paying particular attention to the feasibility aspects which are inherent in the process. Additional detail in any of the four steps can be found in the reports themselves which are included as attachments.

2.1 Preliminary Needs Analysis

Several background studies were performed prior to this contract which indicated the need for a sophisticated computer system to support the High Level Waste repository licensing process. General estimates of the size and variety of the document data base and the number and geographic distribution of users suggested an advanced computer system that will make use of state-of-the-art search techniques. However these studies lacked the necessary detail to develop reliable system specifications. Thus a focused study of user needs was determined necessary to ascertain specific requirements.

The process of determining the user needs consisted of identifying user categories and interviewing representative members of each. This was particularly challenging since many of the job functions which will use the LSS have not yet been defined. In many cases persons able to anticipate the representative LSS usage were relied upon. The results of the interview process, combined with the system requirements defined in the draft 10CFR Part 2 Subpart J, form the basis for the LSS system user requirements.

The needs analysis focused on a determination of system performance requirements and information access features which the users determined would be necessary to aid them in performing their assignments. Specific aspects included user session characteristics, geographic distribution and number of users, required response time, output requirements, access techniques, features of full-text and structured index searching, and system-user interface.

The conclusions from this analysis are detailed in the Preliminary Needs Analysis (Attachment A), and summarized below:

1) Some information should be stored in the form of headers for every document and full-text for many, if not all documents.

2) Capability should be provided for efficient and accurate data retrieval using a variety of methods including structured index searching on detailed headers and full text search on both headers and document text.

that there is (and will continue to be) appreciable unavoidable uncertainty in making estimates of the LSS data base size under any given set of conditions, overlain by additional uncertainty about the stability of these conditions. Since this process involves a significant level of uncertainty, a range of values were calculated providing both a low and a high estimate of the number of pages which would be candidates for inclusion in the LSS. The results of this analysis projected the candidate data base size to be:

	Cumulative Pages at Year End	
Date	Low Estimate	High Estimate
1990	9,304,000	11,885,000
1998	21,404,000	27,921,000
2009	32,191,000	42,216,000

While the negotiated rulemaking process resulted in a topical definition of documents to be included in the LSS after this estimate was complete, an analysis of the topical definitions did not indicate any significant difference from the methodology used to create this estimate. Thus this remains to date the best projection of the data scope for the LSS.

The concept of feasibility did not enter into this phase of the work in order that the estimates not be biased with concerns over size of the system.

2.3 Conceptual Design Analysis

The Preliminary Needs Analysis, Preliminary Data Scope Analysis, and the results of the Negotiated Rulemaking process defined the requirements of an automated information storage and retrieval system. A conceptual design was formulated which meets the requirements and contains the following primary features:

1) Headers and searchable full text of all documents,
2) Bit-mapped images of all documents for hardcopy reproduction and distribution as well as on-line display and local printing,
3) Centralized text and image storage,
4) Multiple geographically distributed capture systems,
5) Workstations capable of displaying text and images, and support for user-owned workstations for text display,
6) Retrieval through structured index searching of cataloged information and software full-text searching of document text, and
7) Electronic mail.

The primary application of the concept of feasibility entered into this phase of the design. As the design concept evolved, it was reviewed from the standpoint of the ability of current or near-term technology to accomplish the required need, and the overall system capability to perform the total mission. This concern resulted in a division of the total LSS functionality into systems which can, for the most part, be evaluated

2.3.2 Search System

The Search System represents the most difficult functional requirements to evaluate. This system must index and store all of the text as well as the structured data base containing the bibliographic and subject data (headers). The concept itself is not difficult to accomplish as commercially available software is available to perform this function. The problem lies in the size of the data base to be captured, the number of simultaneous users to be serviced, and achieving acceptable response times. In order to determine if the requirements on the computer system were within the realm of possibility, and in order to size the computer for cost estimates, a detailed computer model was developed. Inputs to the model included the expected transactions to be performed by the users in terms of text searches, structured data base searches, requests for reports, etc.; results included the required processing power to service the users and the expected response time. Comparing the results to currently available computer offerings, both in terms of mainframes and clustered mini-computers, revealed that the Search System would be within the capabilities of current computer systems. Additionally, the analysis revealed that a "single" data base of the size expected for LSS was not feasible, and that the data base must be partitioned. All of the commercial and government full text data bases of a size comparable to LSS utilize this concept. Feasibility of the Search System can therefore be determined provided the assumptions used in the analysis, particularly user query profiles, are correct. One of the major aspects of the LSS prototype testing phase will be to more closely define user query profiles and complexity.

2.3.3 Image System

By separating the image retrieval function from the Search System, the primary function of the Image System becomes one of a "file server" to retrieve and transmit images (via the Communications System) to the user workstation or a high-speed printer for hard copy production. As such, the functionality of this system is within the capabilities of commercially available hardware and software for image file control in terms of the expected usage of images in the LSS. That is to say, the Image System is designed to support limited on-line access to images by some users and access for background and overnight printing. Continuous "browsing" of images by most users would result in long image access times. Again the question of data base size is a problem area, for while vendors advertise the capability to tie multiple optical disk jukeboxes to a file server, the size of the anticipated LSS image data base (1,400 gigabytes by 1998) is larger than any system currently on-line.

2.3.4 Communications System

The conceptual design envisions that the Capture System will provide data to the Search and Image Systems by manually transmitting magnetic media and/or optical disks via mail or delivery service. Therefore the primary function of the Communication System is to link the user workstations to the

Washington D.C. and one in Las Vegas

II. Hardware full text search, rather than software

III. No workstations capable of displaying images

IV. Microform digitization rather than optical disk storage of images

V. Off-line microform printing rather than on-line bit-mapped image system

VI. Re-keying text rather than text conversion from scanned bit-map

VII. Combination of Variants III, V, and VI above.

The major results of the study were that the overall 10 year life cycle costs of the various alternatives were between $192 million and $236 million in 1988 dollars. The predominant factor in the cost is associated with the data capture, accounting for approximately 62 percent of the total. In other terms, labor was by far the largest cost category, accounting for approximately two-thirds of the cost, with hardware purchase and maintenance being second at nearly 20 percent.

From the standpoint of feasibility, the Benefit-Cost analysis provided the information from which one can judge the relative merits of the alternatives. The conclusion reached in the analysis was that the Base Conceptual Design provided the best combination of cost and benefit and is therefore the preferred design approach. Since the Base Conceptual Design was also chosen as the alternative which presented the least risk in development, this conclusion did not affect the feasibility of the overall project.

In addition to the relative merits and cost of the alternatives this analysis also provided the results of a 10 year life-cycle costing of the design and operation of the LSS from which one could judge the overall financial feasibility of the project.

3.0 CONCLUSIONS

The concept of feasibility has been incorporated into the conceptual design process of the LSS as documented in the attached series of reports. The overall functional requirements of the LSS are complicated and varied. By subdividing the LSS into systems, assigning functions to those systems, and then evaluating the feasibility of those systems operating individually and in concert, the feasibility of the total LSS can be demonstrated.

In each case, feasibility is demonstrated by comparison of the LSS with similar systems which have been produced, demonstrated, or are being marketed by vendors, thus demonstrating that the LSS Conceptual Design is not dependent upon research or unproven technology. Further, the LSS is not contemplated to utilize hardware or software components beyond their limits of design capability. By providing maximum independence of subsystems, there is reasonable assurance that the subsystems as a whole will function as a complete LSS.

While the LSS is not dependent upon technological advances which are expected in this field, those advances can only provide further conservatism in the feasibility of operation.

The largest unknowns in the assessment of feasibility relate not to the technology, but rather to the assumptions in user performance. For example, relatively small changes in query complexity can result in large changes in computational requirements. Thus while feasibility can be determined for the assumed user profiles used in this analysis, if the prototype results differ significantly from these assumptions, the question of feasibility needs to be re-examined.

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U. S. NUCLEAR REGULATORY COMMISSION

LICENSING SUPPORT SYSTEM ADVISORY REVIEW PANEL

MEETING NOTICE

Notice is hereby given pursuant to the Federal Advisory Committee Act of October 6, 1972 (Pub. L. 94-463, 86 Stat. 770-776), that the Licensing Support System Advisory Review Panel (LSSARP) will hold a meeting on June 7, 1990. The meeting will convene at 9:00 a.m. in the Fifth Floor Hearing Room, East West Towers Building (West Tower), 4350 East West Highway, Bethesda, Maryland. The Nuclear Regulatory Commission established the LSSARP to provide advice and recommendations to the Nuclear Regulatory Commission and to the Department of Energy on topics, issues, and activities related to the design, development, and operation of an electronic information management system known as the Licensing Support System (LSS). This system is being designed to contain information relevant to the Commission's high-level waste licensing proceeding. In addition to routine administrative matters, this meeting will include a discussion of a Panel working group's recommendations on elements of information to be required in headers for LSS documents.

The meeting will be open to the public. Interested persons may make oral presentations to the Panel or file written statements. Requests for oral presentations should be made to the contact person listed below as far in advance as practicable

so that appropriate arrangements can be made to allow the necessary time during the meeting for oral statements.

For further information regarding this meeting, contact Marilee Rood, Office of the LSS Administrator, U.S. Nuclear Regulatory Commission, Washington, D. C. 20555; telephone 301-492-4003.

Dated at Rockville, Maryland, this 14th day of May 1990.

FOR THE NUCLEAR REGULATORY COMMISSION

John C. Hoyle, Chairman
LSS Advisory Review Panel

AGENDA

LSS ADVISORY REVIEW PANEL MEETING

JUNE 7, 1990

9:00	Administrative Issues (including approval of Minutes from 3/20-21/90 LSSARP meeting)
9:15	Discussion and Vote on Recommendations Made By Header Working Group
10:45	Future Schedule
11:00	Adjourn