NUREG/CR-0326

DOCUMENT CONTROL AND INFORMATION PROCESSING RESEARCH AT THE NUCLEAR REGULATORY COMMISSION

The Plato Project

H. McNeill

Prepared for
U. S. Nuclear Regulatory Commission

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H. McNeill
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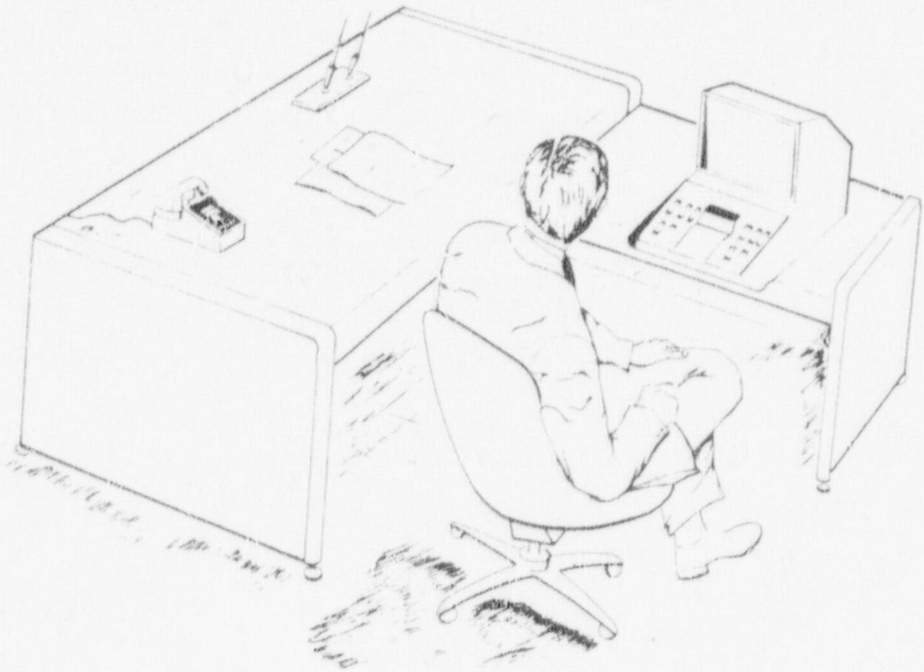
PREFACE

In early 1975 a study was initiated to investigate the use of a computer interfaced Information Storage and Retrieval System in the information processing requirements of the Nuclear Regulatory Commission.

The study was sponsored by the Technical Advisor, Dr. Stephen Hanauer, through the Office of the Executive Director for Operations (EDO). In addition to the author, personnel in the Applied Statistics Branch assisted in the investigation. Mr. Long D. Y. Ong furnished much of the information used in the study involving transportation of nuclear materials, and Mr. Jay Miller provided programming support. Many other members of the NRC staff were encouraging and helpful.

Since this report was written, the NRC has contracted for the development and implementation of a Document Control System (DCS), which uses some of the concepts of this report. The systems described in this report, however, are not necessarily the DCS as it will be implemented.



CONCEPTUAL DESIGN OF ENGINEER WORK STATION
WITH ACCESS TO DOCUMENT RETRIEVAL SYSTEM

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FIGURES

FIGURES (cont'd)

I. INTRODUCTION

NRC Regulatory activities are the responsibility of various Program Offices and other units that comprise the NRC organizational structure. Each of these is now facing an information explosion in which vital information concerning their activities is accumulating at an alarming rate. Decisions related to the issuance of licenses, development of criteria, standards and codes, and compliance activities require that all pertinent information be readily available. This includes not only new data but information previously used to establish policy and criteria.

To meet the statutory and operational responsibilities of the U.S. Nuclear Regulatory Commission (NRC), a large number of regulatory/technical documents must be processed daily.[1] The principal document volume comes from bulk shipments such as license applications. The applications include items such as safety analysis reports and environmental reports, amendments to licenses, hearings, transcripts, etc. Shipments average five per day and consist of as many as 22 volumes with 450 to 500 pages per volume. In terms of processing, the work load may approach 125,000 pages daily.

The remaining volume to be processed is attributable to those smaller documents that arrive through regular Postal Service deliveries. This amounts to about 1,000 smaller-size documents daily. In terms of processing, this adds about 10,000 pages per day to the bulk volume estimate. From a dissemination standpoint, these documents require more handling to ensure that correspondence earmarked for action reaches the appropriate office in a timely manner.

Administrative procedures at NRC call for no more than a 48-hour delay from the time most documents are received until the time they have been processed and are in the hands of the staff. Moreover, much of the incoming material and some of the internally generated material are official records that are required to support legal proceedings that have specified response times; these documents must be processed within a 24-hour period. (A description of the licensing process for a Nuclear Power Station is provided in Appendix II and a summary description of supporting documentation and current file storage is included in Appendix III.)

Current information processing requirements and the possibility of ever-increasing future demands indicate that present methods may prove to be inadequate. The problem was recognized and an investigation into Document Control and Information Processing was initiated to study the feasibility of developing a more responsive system and to demonstrate how this system could be used effectively at NRC. The project was named PLATO after the simulator used in the investigation.

The first step taken to achieve the objectives of the PLATO project was to conceptualize a reference system which could meet all present and foreseen future needs of the Commission. It was decided that the system to be implemented in the near future should utilize hardware either currently available (off the shelf) or soon to be available. It should permit automated remote access to all information in the Commission files and enable multiple users to simultaneously search, locate and examine documents in the centralized data base. The system should also provide hard copy when desired and meet all legal requirements and staff needs.* A search was undertaken to determine if such a system was available in the market place.

II. TECHNOLOGY

An examination of the current technology available in systems applications to information storage and retrieval revealed that the reference system was technologically feasible although not yet available on the marketplace. (In Appendix III a source guide of government agencies, vendors, manufacturers, etc., involved in microfiche information systems is provided.)[3] A large system that synthesizes current technology and meets the requirements of the reference system has been described by the TERA Corporation[4] and is illustrated in Figure 1. In addition, this system is capable of providing archival storage of documents both as fiche and hard copy and permit the publication of computer

*An interesting description of an idealized information system is provided by Vahoda.[2] An excerpt is found in Appendix I.

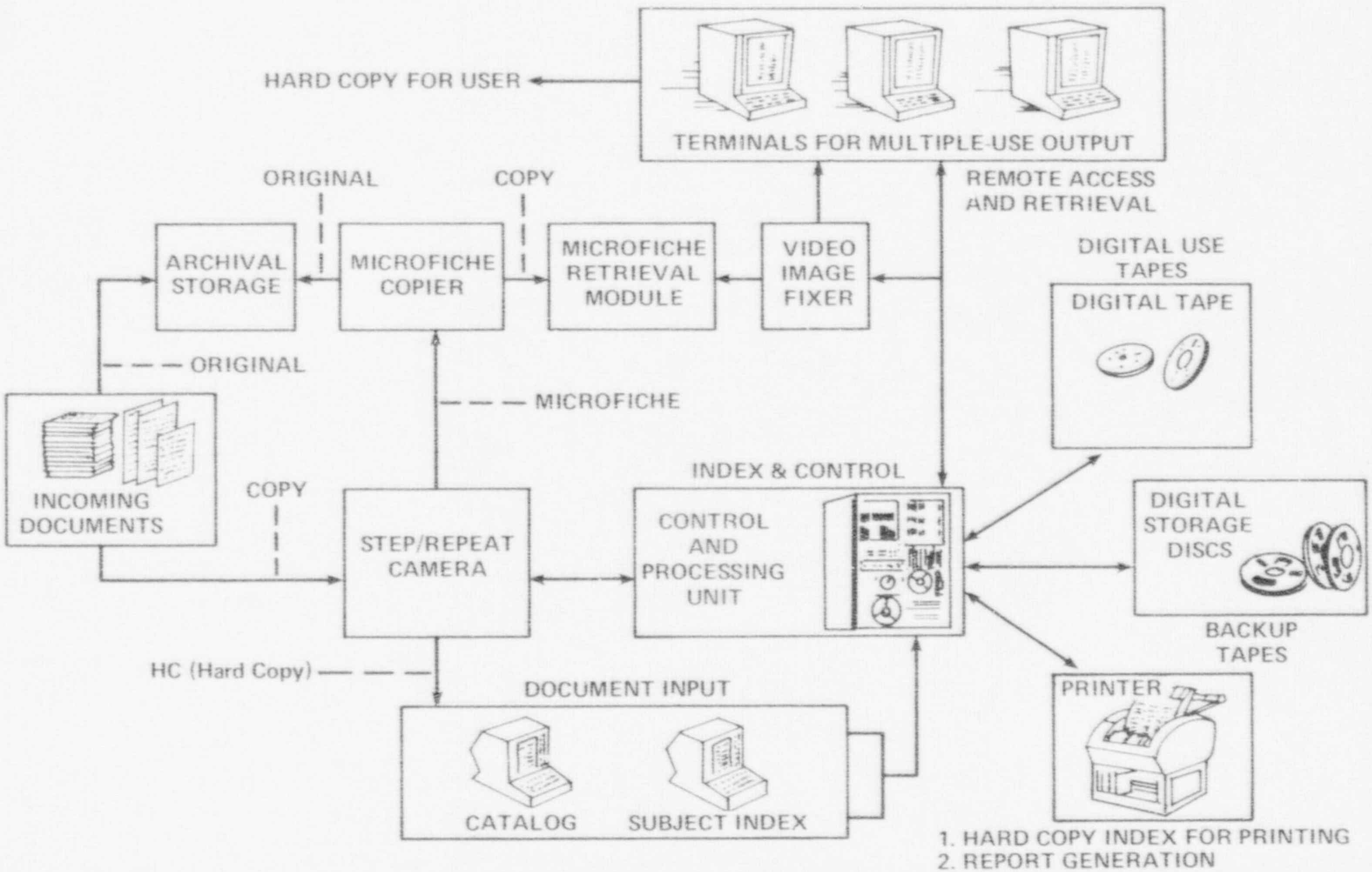

Figure 1. Document Retrieval System

generated information via the printer. This system was chosen as the reference system for the PLATO project and subsequently will be referred to as the Document Retrieval System (DRS).

Documents coming into or leaving the NRC would be sent to the microfiche cameras where they would be photographed with identifying serial address numbers. These numbers would be simultaneously recorded in the Index Control Unit which functions as the "brains" of the system. The hard copy documents, after the camera stage, would be permanently stored in a chronological hard copy file; the microfiched document images produced by the camera would become the working medium. Diazo copies of all microfiche (fiche) would be made and originals would be stored in a security file. Each working fiche would then be mounted on a card with a retrieving tab (specifying the fiche address title).

The document images would then be indexed at the Document Input Unit and the index stored in the Index Control Unit. The Index Control Unit correlates the indexing with microfiche so that the microfiche image of each page can be retrieved through interactive terminals. The index would lead the user through the information store so that the specific document and all related documents or any group of related documents could be located.

The microfiche would be stored in the Microfiche Retrieval Unit. This unit incorporates an electrically-driven fiche carousel and a high-resolution video camera. At the command of the Index Control Unit, the desired fiche would be positioned for viewing by the video camera. The document image would be transmitted to user cathode-ray tube (CRT) terminals at remote locations via coaxial cable or a microwave transmission system. Each microfiche storage module (Retrieval Unit) has the capacity to store about 150,000 pages.

In order to prevent a given information user at a remote CRT terminal from monopolizing the use of a system carousel, the video image requested by the user would be temporarily stored in a video-image fixer. This would allow the image to be retained or "fixed" on the screen and the fiche and the carousel may then be used by others. By the use of the video-image fixer, or "buffer," the user can also switch from index to page image and back to index image.

All modules (i.e., input consoles, output terminals, microfiche retrieval, etc.) would be controlled by the Index Control Unit. For the NRC the principal criteria which govern the size of the computer in this module are: the number of transactions (i.e., number of inquiries, searchers, commands, etc.), the number of index points for the estimated 30-million document store, the amount of data that is required to be removed or manipulated, the overall complexity of the search, and finally, the number of remote terminals through which access to the index unit and the image-retrieval unit will be gained. Index structures, cross-reference structures, and system logic would be stored in either disc or tape form. Hard copy of indexes and other information to be used for generation of reports would be produced in a camera-ready form from the printer. Fiche-to-fiche and fiche-to-paper copies could be used to fulfill non-NRC requests. Hard copy would be available at remote locations for the convenience of the user. If the user desired a hard copy report, administrative procedures would require that the copy be ordered from Central File. If the user needed only a few pages in hard copy, then it would be expedient for him to obtain them from his terminal.

III. <u>THE PLATO PROJECT</u>

The "PLATO" project is a feasibility study simulating the use of computers and a centralized information storage and retrieval system in the information processing requirements of the Nuclear Regulatory Commission.

Since the "PLATO" project is a study involving simulation, it was necessary to search the technology for a simple inexpensive system which could be used to address problems which might be encountered using the Document Retrieval System (DRS).

The digital computer memory, branching capabilities, and computational power were well known, but the application to tutorial presentation, information retrieval, logical problem solving, inquiring and testing required in Regulatory activities remained to be demonstrated.

Investigation revealed that the inherent problems found in the NRC Regulatory process are in many ways similar to those addressed in the past ten to fifteen years by the researchers in "Computer Aided Instruction" (CAI). Specialized hardware featuring graphics, microfiche presentation, touch control and audio has been developed. A higher order programming language which eliminates the need for specialized computer programmers has been employed in writing complex scientific and engineering courses. Two recent CAI systems--the University of Illinois' PLATO (Programmed Logics for Automatic Teaching Operation) and the Mitro Corporation's TICCIT (Time Shared Interaction Computer Controlled Information Television)--have been designed to address shortcomings in previous systems.[5]

The technology of PLATO was selected as being most useful at this time to not only simulate the use and capability of the DRS system in the search and retrieval of information, but also to investigate the use of DRS as a component in the regulatory process of review and evaluation.

PLATO System

System Description

A block diagram of the PLATO System is shown in Figure 2. Operation of the entire system is under control of a CDC 6400 computer system directed by a Network Interface Unit (NIU). Computer output is relayed to a site controller by a Cable TV system. Here the data is distributed by phone lines to active terminals. Interaction with the computer is achieved by a keyset located at the terminal and relayed to the computer via the site controller and NIU as shown in Figure 2.

The terminal consists of:

1. An 8-1/2 inch square plasma display panel that is readable in a brightly lighted room without eyestrain.
2. Permanent storage of information on the display screen without flicker. No refreshing of the display panel by the computer is required. Selective WRITE and ERASE capability exits for all dots, lines and characters.
3. Self-contained character and line generators.
4. A character writing speed of 180 characters per second and the capability of displaying 2,048 characters on the screen.
5. A line drawing speed in excess of 600 inches per second.
6. A character repertoire of 252 characters, 126 of which are alterable via the computer program.
7. The ability to transmit and receive data on voice grade telephone circuits.
8. A random access slide projector under computer control for projection of microfiche images on the display panel.

A user seated at the terminal is shown in Figure 3.

Project Goals and Organization

The "PLATO" project was formally organized into four categories as follows:

I Objectives

1. To describe, illustrate and document the use of a computer controlled centralized data base consisting of microfiche accessible for remote viewing DRS in the Licensing and Regulatory procedures at NRC.

2. To investigate the use of DRS in both the library sense (location and retrieval of information) and also as a system capable of quick response for real time information processing needs.

II Strategies

1. Simulate the use of the NRC/DRS by using the PLATO system.

2. Sample NRC/DRS requirements from 2 representative program offices.

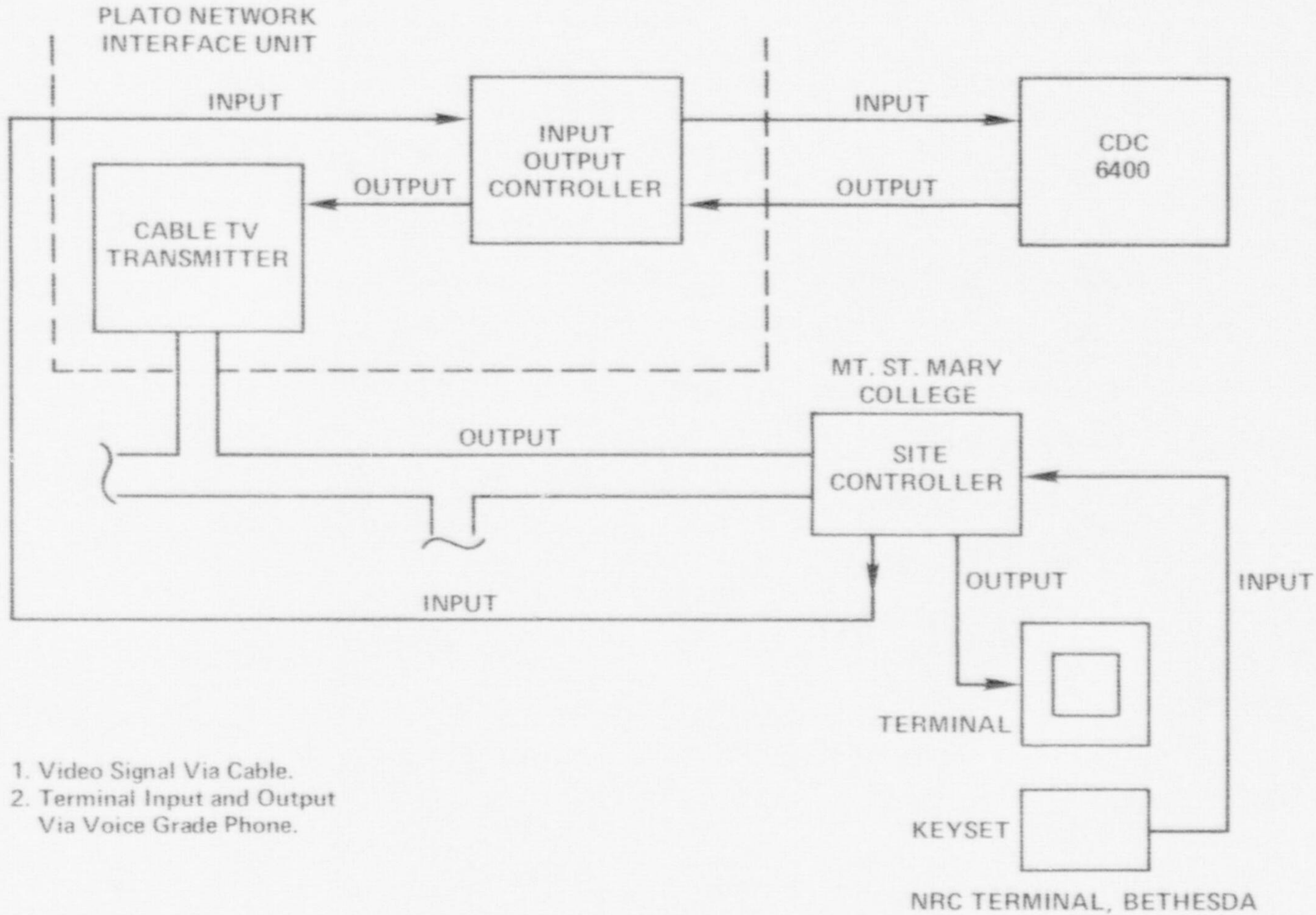

Figure 2. PLATO System

FIGURE 3

PLATO TERMINAL

a. Office of Nuclear Reactor Regulation, and

b. Office of Nuclear Material Safety and Safeguards.

3. Since the indexing and classification procedures to be used for NRC/DRS have not been decided upon, the NRC/RECON[6] system was modeled for the PLATO simulation.

III Criteria

1. The PLATO System simulation mus. illustrate a possible DRS search and retrieval strategy.

2. The system must provide real time analysis (defined as information retrieval strategy in sufficient time to permit decisions to be made) when a quick response is necessary.

3. Documentation of the project must include actual photographs of the terminal display and an evaluation of DRS based on the simulation.

IV Procedures

The objectives of this study were addressed by dividing the study into three tasks.

TASKS DESCRIPTION

1 SIMULATION OF DRS BY PLATO

1.1 Data Base Preparation

Documents needed for simulation will be indexed and placed on microfiche to simulate the DRS data base.

1.2 Search and Retrieval System

NRC/RECON system will be modeled to provide a simulated Boolean logic in the search and retrieval of information in the data base. A sample search will be provided.

TASKS		DESCRIPTION
2		
	2.1	Some of the steps taken in the technical review by NRR of a licensee SAR will be simulated. The use of DRS in the licensing process will be illustrated by a study involving a technical review procedure.
	2.2	The real time information processing requirement of NMSS will be addressed by simulating the information available regarding response to an incident involving the transportation of nuclear material.
3		
	3.1	System Evaluation The system will be evaluated from the viewpoint of the simulation since no actual DRS hardware will be available.
	3.2	Report Preparation and Publication

IV. SIMULATION OF DRS BY PLATO

One of the principal objectives of the PLATO project was to stimulate the use of the DRS in the search and retrieval of information needed by the NRC. PLATO, which operates in an interactive mode with a computer accessible microfiche data base, has some operating characteristics similar to DRS.

The search procedure which is the sieve through which an information request must be passed is directly related to the way the information in the data base is indexed and filed. The file structure and search and retrieval storage of NRC/RECON[6] was chosen as a model for the DRS.* The important difference is that while the RECON System retrieves bibliographic information that is stored in the computer memory, the DRS retrieves actual documents stored on microfiche. The selection of RECON does not imply that other systems would not be compatible with DRS. It was selected for convenience since it is a system which is in use at NRC and therefore familiar to many staff members.

SEARCH AND RETRIEVAL LOGIC

The documents are sorted into files, each file dealing with a different type of information. For example, the NRC documents may be separated into the following files:

Docket File
Subject File
Authority File
Author File
General File

In the computer, files of key words and other suitable parameters are created to allow access to the documents in a data base. The structure of the file is shown in Figure 4.

In the general file, there will be indexes to such terms as subject, keywords, docket numbers, and plant names. Separate files will contain author names and dates of receipts. The related terms file contains a list of logically and topically related terms to terms in the general file. This helps the user specify more exactly his research.

All files point to an inverted file. This file stores records of document identifiers. The inverted file, in turn, contains pointers to the Linear Index. This index contains the location of the desired information with respect to the fiche bank. The fiche bank contains the actual documents, placed on computer addressible carousels.

These files are accessed and searched by the user through a series of commands which are interpreted by the computer in the Index Control Unit. His objective is (1) to identify the document and sections or even the individual pages thereof that are likely usable to him, and (2) to consult the references identified. He first identifies himself, chooses the data base he wishes to search, then searches by specifying different commands and arguments.

*This file structure is not necessarily the one being developed for the actual NRC purchased system; see Preface.

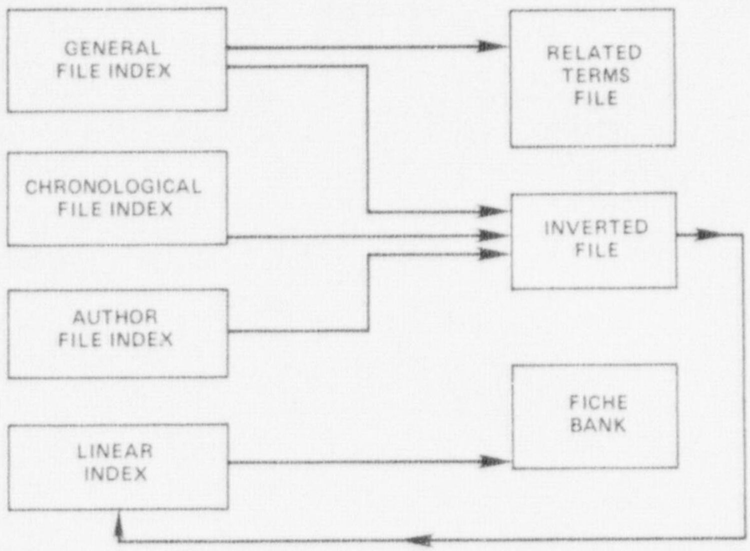

FIGURE 4

DRS FILE STRUCTURE

For example, the expand command displays a portion of the General (or Author or Date) index that contains the item specified in the argument of the command. The form of this command is: "expand argument type = argument name." For example, expand "it = power." In this case, "it" refers to argument type which is interpreted by the computer as an index term or keyboard. The files are alphabetically (or chronologically) ordered, so execution of the command will be displayed as shown in Figure 5. This may help the user find the proper term on which to collect information.

Ref. #	Description	Doc.
E01	Postestative Condition	590
E02	Pot hand	24
E03	Pot value	11
E04	Power coupling	4
E05	Power metallurgy	23
E06	Power	4,090
E07	Power density	2,019
E08	Power distribution	1,057
E09	Power grid	120
E10	Power limit	374
E11	Power load	293

FIGURE 5

SIMULATED TERMINAL DISPLAY OF RESULTS FROM EXPAND COMMAND

In the expand command, the "argument type" is a two letter abbreviation of each separate index contained in the files. The "argument name" will be the term (or name or date) you wish to search on. A list of some representative argument types and the file each identifies follows:

au -- author
it -- index term (narrow search)
su -- subject (broad search)
da -- date
co -- company responsible

The select command forms a set of the document identifiers contained in the record corresponding to the term identified in the argument of the command, as for example "power." This set is called a work set, and is assigned a number for later identification by the system. The form of the select command is the same as that of the expand command. For example, if the user wished to see all documents written by John Z. Smith, he would type, Select au = Smith, John Z. The terminal display would show as:

Set	Des.	Doc.
1	au = Smith, John Z.	2

This means that the user has created his first work set consisting of all documents produced by John Z. Smith. In this example, there are two such documents.

This work set can be viewed directly or combined with other work sets using the combine command. The viewing of the fiches themselves using the display command or a listing of the titles or other references of the document contained in the work set, can be displayed using the display command. The combine command allows the user to use Boolean logic to combine work sets, thus expanding or condensing his search. The form of this command is:

combine <work set #> logical connector <work set #>

There are three logical connectors: "and" (coded with a "*"), "or" (coded with a "+"), and "difference" (coded with a "-"). In other words, if you have work sets a and b, then "combine a * b" creates a work set consisting of all document identifiers common to both a and b, while "combine a + b" gives you all documents either in a or b, and "combine a - b" produces a work set of all documents that are in a and not in b. The following table indicates the relationship between the logical connection used in RECON to Symbolic Boolean operators.

Operation	RECON	Boolean	Verbal
Intersection	a * b	$a \cap b$	a and b
Union	a + b	$a \cup b$	a or b
Complement	a - b	$a \wedge \bar{b}$	a not b

As an example, suppose the user has created two work sets:

Set	Des.	Doc.
1	it = computer codes	1,257
2	it = core design	13,294

If he wished information on the computer codes that deal with core design, he would type:

combine 1 * 2

The system would perform the logical combination, creating a new work set 3, and print:

3	1 * 2	982

The display command calls up any work set for viewing at the users terminal. The form of the display command is:

display <work set #>

For example, if the user wished to view the work set created in the example above, he would type "display 3." The system would find the corresponding fiche locations in the Linear Index, then access the proper fiche from the fiche bank. Alternatively, the user could view a listing of the titles or other identifying features of the documents in the work set.

While viewing a work set, the user may page through it using the page command. The command has two arguments: "+" to page forward and "-" to page backward. When viewing the fiche, he can obtain printed copies with the print command.

At any time the user may see a list of all work sets created that session hy typing history. When finished searching, he simply types logoff to end his session.

Sample Search

An example of a typical session may further illustrate the use of several of these commands. The user is searching for documents pertaining to the core design of the Bellefonte Power Plant.

The user first signs on the system. His name and organization will be requested for accounting purposes, optionally, keywords may be requested for restricted files. Once in the system, he chooses the data base he will search in. As seen in Figure 6, the user decides to search in the general file.

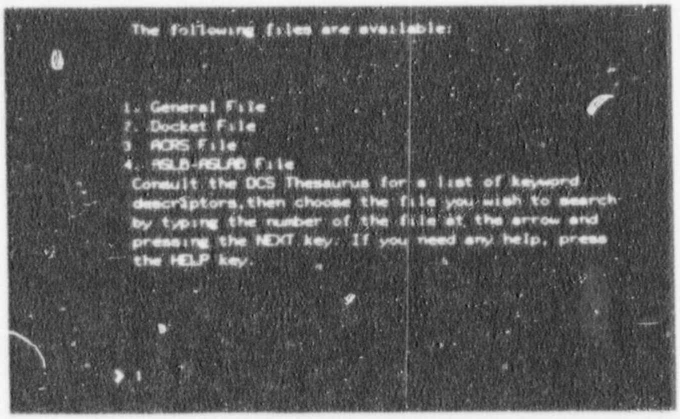

FIGURE 6

TERMINAL DISPLAY OF FILES AVAILABLE
USER SELECTS FILE 1

He begins the actual search by selecting all documents pertairing to the Bellefonte Plant (Figure 7). The system responds by printing the set number, the number of documents of the work set just created, and the description (Figure 8)

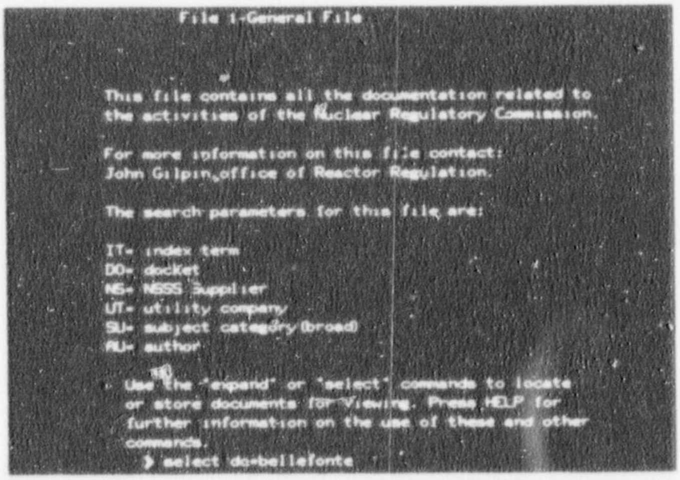

FIGURE 7

TERMINAL DISPLAY INDICATING SELECT COMMAND

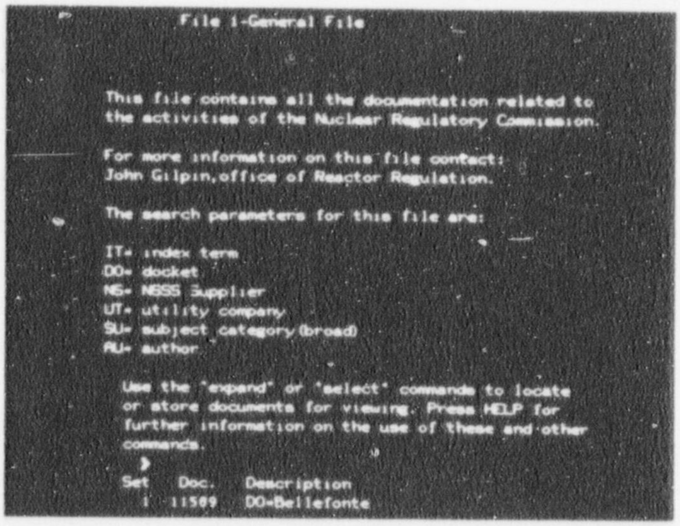

FIGURE 8

TERMINAL DISPLAY INDICATING RESULT OF SELECT COMMAND

Now the user would like to examine the Thesaurus* about the term "power density." This enables him to see if the system stores information under the term specified, and possibly gives him alternative terms to search. He requests an expansion on the term "power density" (Figure 9). The resulting page is shown in Figure 10. The top line is a title for this display. Following is a list of terms, including "power density." For each term is a reference number, and the number of documents pertaining to that term.

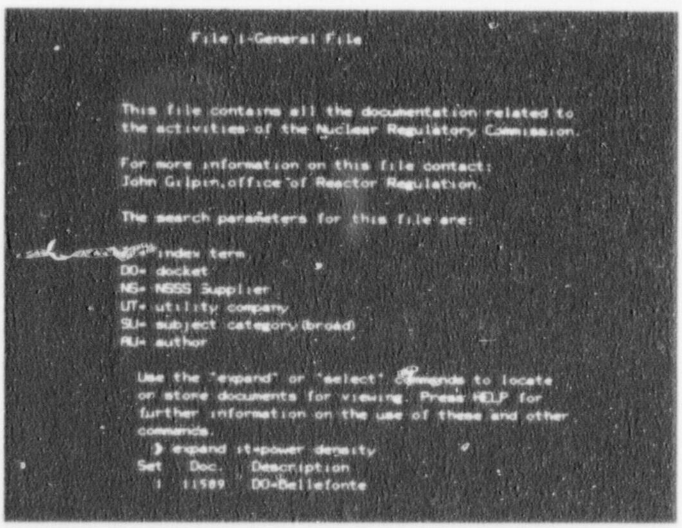

FIGURE 9

TERMINAL DISPLAY INDICATING EXPAND COMMAND

*Thesaurus is a dictionary of computer recognizable terms.

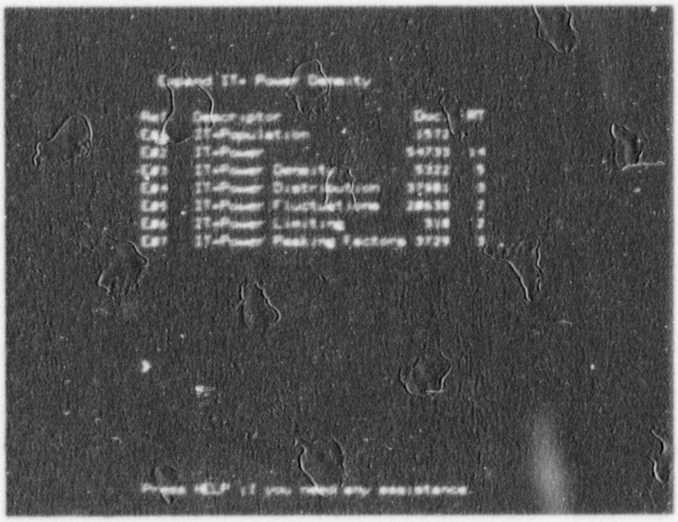

FIGURE 10

TERMINAL DISPLAY INDICATING RESULT OF EXPAND COMMAND

Up to this point the user was not certain that power density was in the Thesaurus. The display shown in Figure 10 shows that it is an allowable search term.

After examining the page, the user decides to select information on power distribution (Figure 11). We do not offer an elaborate justification for the reason that power distribution was selected instead of power density. Browsing permits the use of intuition and trial and error. The need to justify each decision would disrupt the interactive process.

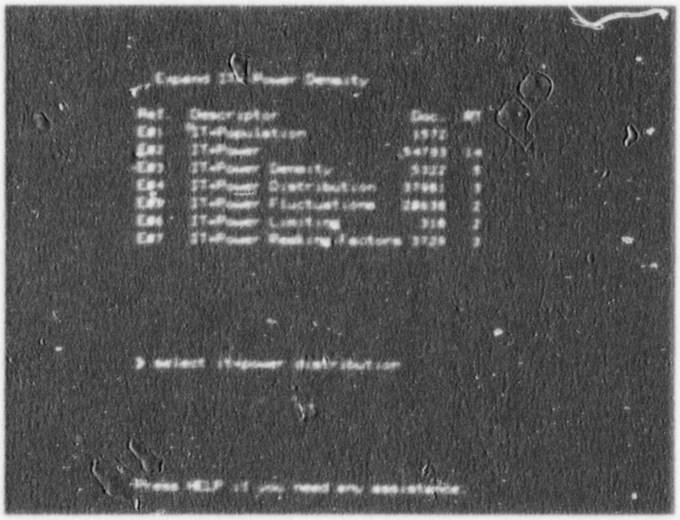

FIGURE 11

TERMINAL DISPLAY INDICATING SELECT COMMAND FOLLOWING EXPAND

At this point, he combines the two work sets created, using the "and" operator. This command is shown in Figure 12 with the result shown in Figure 13. Set 3 has been created.

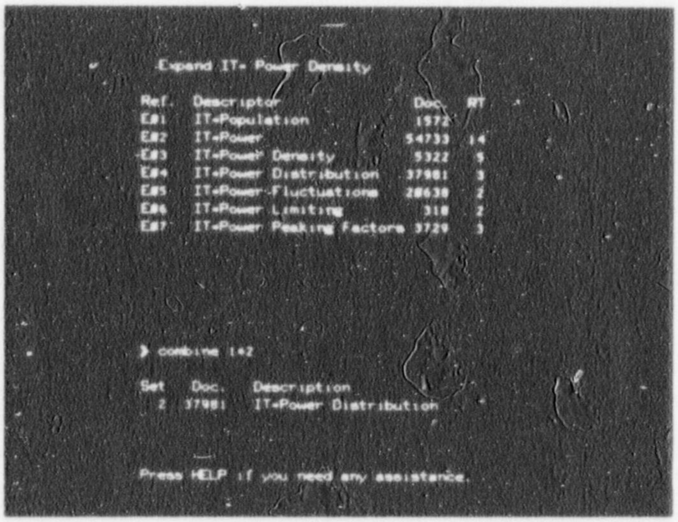

FIGURE 12

TERMINAL DISPLAY INDICATING EXPAND FOLLOWED BY COMBINE COMMAND

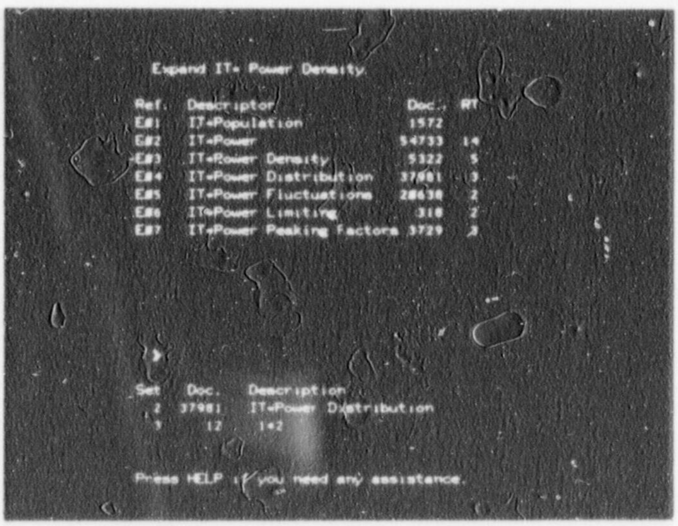

FIGURE 13

STATUS DISPLAY AFTER TWO SETS HAVE BEEN COMBINED INTO SET 3

He now displays set 3 to obtain information he desires, using the page command to flip through the documents. The command is shown in Figure 14. When he is satisfied, he types logoff and the session is ended.

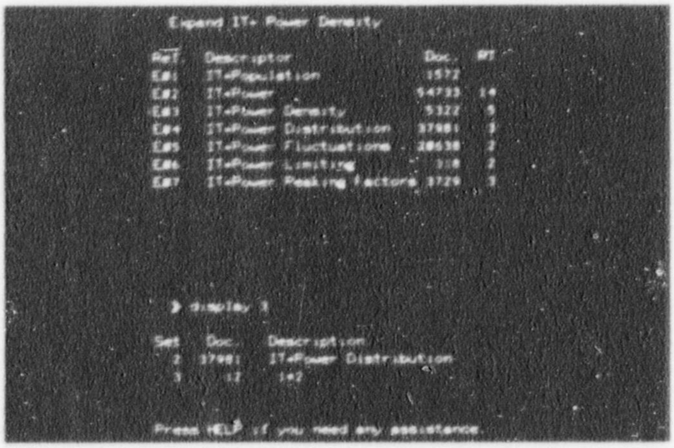

FIGURE 14

STATUS DISPLAY INDICATING DISPLAY COMMAND

This example of the use of Boolean logic in a search strategy shows how a search which might have required the examination of thousands of pages was reduced to only 12 which were then immediately retrievable for review.

V. DRS IN THE REGULATORY PROCESS

Up to now we have shown how the DRS will operate as a unit in the storage and retrieval of information. We saw how archival requirements could be met by the system. Obviously there are many other applications at NRC involving the regulatory process in which the rapid and efficient retrieval of information is a necessity. A sample search was illustrated in the previous section. It is clear all information contained in the file is available for review and available as hard copy if necessary. Although the detailed information retrieval requirements of the staff are as diverse as the many functions and disciplines represented at NRC, we believe that at most a few retrieval strategies available through DRS will be needed. Instead of developing scenarios to show how one branch or another would use DRS, we leave the generic issue of information search and retrieval to address another concept.

The next step upward in the hierarchy of usefulness for DRS is to investigate whether the system could do more than simply retrieve information but could it also aid the staff to implement decisions by providing steps in the process such as retrospective analysis, guidelines in selecting alternatives when in a decision process and to formalize logic to ensure staff compliance with established procedures.

In the investigation of this concept two situations involving different time constants were selected.

1. A standard review procedure for licensing a plant which has submitted a PSAR. The acceptance procedure for a PSAR has a 30-day time limit but the entire review process takes months and years.

2. A situation involving a real time information processing requirement in which an immediate response to an incident involving the transportation of nuclear material is required.

DRS In Technical Review

One of the most interesting yet difficult areas to investigate was the concept of using the DRS concept in the technical review and licensing process.

Some progress has been made in the formalization of review procedures with the issuance of the Standard Review Plan (SRP). The (SRP) was prepared for the guidance of the staff reviewers and to provide the industry and the public with information covering staff policy regarding acceptance criteria and review procedure. The SRPs are written to cover a spectrum of site conditions and plant designs and, therefore, are broad in scope and short on details.

The organization of the SRP is uniform for all systems and has the following format:

1. Area of Review - Describes the scope of the review.

2. Acceptance Criteria - Statement of the purpose and technical basis.

3. Review Procedure - How the review is conducted.

4. Evaluation - Specifies the findings and conclusions that must be made.

The SRP is keyed to the "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants." The work done by the Commission in formalizing the review procedure with the publication of SRP and the Standard Format suggests the concept of an automated review procedure using the capability of the DRS with enhanced computer capabilities. This enhancement capability is achieved with system processors which for convenience will be addressed as a "module."

The purpose of a module is simple. It is a computerized procedure which processes a review through the steps needed for the review. It is an SRP on a microstructure level--the level a computer understands. The module steps the reviewer through an approved procedure. It pauses at decision points and suggests alternatives. It inquires of the reviewer the need for additional information, suggests the information needed for that stage of review and then automatically brings up the requested documentation. At no time does the module compromise the reviewers prerogatives to make decisions; it merely aids him in decision by bringing up the required information quickly and easily. From the management point of view the module can be designed to monitor adherence to prescribed procedures and therefore, provide quality assurance for the review process.

The characteristics of a module can be summarized as follows:

1. Step by step review process keyed to the SRP.

2. Identification of decision points and approved alternate paths.

3. Prompt availability of principal reference documents.

4. Approved logic train to provide Q/A for the review process.

<u>The Technical Review of a PSAR</u>

The technical review of a licensee application for a construction permit follows four steps:

1. Acceptance review of PSAR and docketing.

2. Technical review and rounds of questioning.

3. Preparation of the Safety Evaluation Report by the staff (SER).

4. Preparation of supplements to the SER when significant additional information becomes available following ACRS review.

The emphasis in this study will be on only one of the above steps, namely, the Acceptance Review. A module has been written to illustrate how the Acceptance Review could be conducted using the DRS and logic programmed into the computer. The standardization of the SAR format has made the acceptance review a relatively simple review procedure. The module reflects the simplicity of the process while emphasizing the structure and application of the module concept. It should be noted, that at no time does the module attempt to influence the decision of the reviewer.

Since the Acceptance Review is essentially a completion review of a PSAR prior to docketing, we will assume that an administrative decision has been made not to index the document until it has been accepted for docketing. In this case the PSAR will be available in hard copy only. This is a practical measure since the PSAR may not be acceptable and require considerable changes before it is acceptable for docketing.

After accessing the appropriate module, the display shown in Figure 15 will appear on the screen.

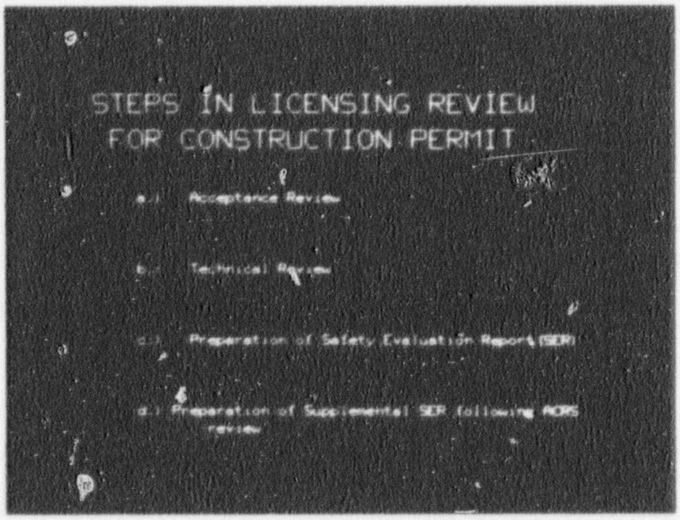

FIGURE 15

TERMINAL DISPLAY IDENTIFYING MODULES IN TECHNICAL REVIEW

The reviewer selects the appropriate module which in our case is the Acceptance Review and then is taken through the review in sequence. Figure 16 is the next display in which the module advises the reviewer of the code requirements regarding the Acceptance Review.

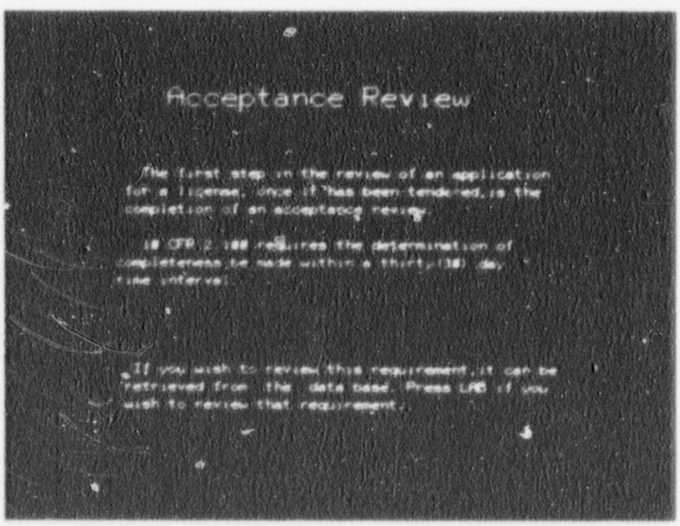

FIGURE 16

TERMINAL DISPLAY INDICATING A DECISION POINT AND MODULE MAKING INQUIRY OF REVIEWER

After study of the code requirements shown in Figure 17, the reviewer then proceeds to the next sequence by computer command--next. Figure 18 is brought up by the computer for the reviewer's consideration.

Chapter I—Nuclear Regulatory Commission § 2.101

Stat. 1244: " any State or any political subdivision of, or any political entity within a State, any foreign government or nation or any political subdivision of any such government or nation, or other entity; and (2) any legal successor, representative, agent, or agency of the foregoing.

(p) "NRC personnel" means (1) NRC employees; (2) for the purpose of §§ 2.720 and 2.740 only, persons acting in the capacity of consultants to the Commission, regardless of the form of the contractual arrangements under which such persons act as consultants to the Commission; and (3) members of advisory boards, committees, and panels of the NRC; members of boards designated by the Commission to preside at adjudicatory proceedings; and officers or employees of Government agencies, including military personnel, assigned to duty at the NRC.

(q) "NRC records and documents" means any book, paper, map, photograph, brochure, punch card, magnetic tape, paper tape, sound recording, pamphlet, slide, motion picture, or other documentary material regardless of form or characteristics, made by, in the possession of, or under the control of the NRC pursuant to Federal law or in connection with the transaction of public business as evidence of NRC organization, functions, policies, decisions, procedures, operations, programs or other activities. NRC records and documents" do not include objects or articles such as structures, furniture, tangible exhibits or models, or vehicles and equipment.

(r) Except as redefined in this section, words and phrases which are defined in the Act and in this chapter have the same meaning when used in this part.

[27 F.R. 377, Jan. 13, 1962, as amended at 28 F.R. 10152, Sept. 17, 1963; 29 F.R. 12890, Sept. 11, 1964; 31 F.R. 12776, Sept. 30, 1966; 35 FR 19501, Dec. 23, 1970; 36 FR 1500, Jan. 15, 1971; 40 FR 8776, Mar. 3, 1975]

Subpart A—Procedure for Issuance, Amendment, Transfer, or Renewal of a License

§ 2.100 Scope of subpart.

This subpart prescribes the procedures for issuance of a license; amendment of a license at the request of the licensee; and transfer and renewal of a license.

§ 2.101 Filing of application.

(a) An application for a license or an amendment to a license shall be filed with the Director of Nuclear Reactor Regulation or Director of Nuclear Material Safety and Safeguards, as appropriate, as prescribed by the applicable provisions of this chapter. A prospective applicant may confer informally with the staff prior to the filing of an application. Each application for a license for a facility, or for receipt of waste radioactive material from other persons for the purpose of commercial disposal by the waste disposal licensee will be assigned a docket number. However, an application for a construction permit or operating license for a production or utilization facility will be initially treated as a tendered application after it is received to allow determination as to whether it is complete and conforms to the requirements of this chapter. Generally, that determination will be made within a period of thirty (30) days. If it is not returned to the applicant at the end of that period, it will be assigned a docket number or docketed, as the case may be. If an application is returned, the applicant will be informed in what respects the application is considered incomplete. An applicant for a construction permit for

[1] The Administration facilities specified in section 202 are:

(1) Demonstration Liquid Metal Fast Breeder reactors when operated as part of the power generation facilities of an electric utility system, or when operated in any other manner for the purpose of demonstrating the suitability for commercial application of such a reactor.

(2) Other demonstration nuclear reactors, except those in existence on January 19, 1975, when operated as part of the power generation facilities of an electric utility system, or when operated in any other manner for the purpose of demonstrating the suitability for commercial application of such a reactor.

(3) Facilities used primarily for the receipt and storage of high-level radioactive wastes resulting from licensed activities.

(4) Retrievable Surface Storage Facilities and other facilities authorized for the express purpose of subsequent long-term storage of high-level radioactive waste generated by the Administration, which are not used for, or are part of, research and development activities.

19-052 O—76——3 25

FIGURE 17

TERMINAL DISPLAY OF REQUESTED DOCUMENT 10 CFR 20

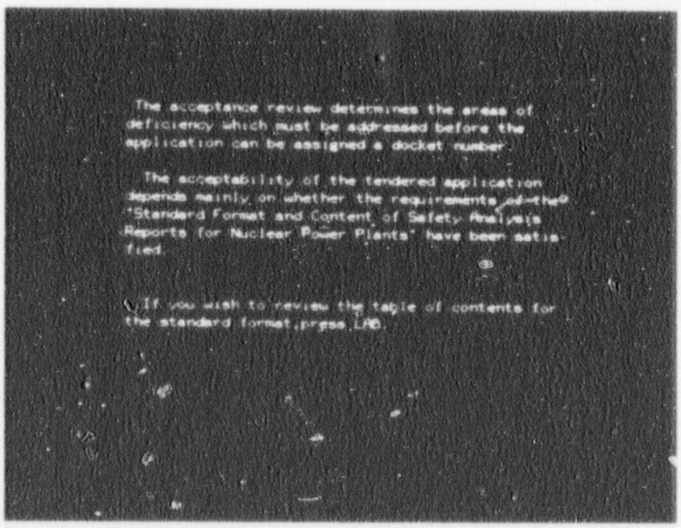

FIGURE 18

TERMINAL DISPLAY IDENTIFYING ANOTHER DECISION POINT FOR THE REVIEWER

The reviewer decided it is necessary to review the Standard Format Table of Contents and request that it be made available. Display is shown in Figure 19.

U.S. NUCLEAR REGULATORY COMMISSION

REGULATORY GUIDE

OFFICE OF STANDARDS DEVELOPMENT

Revision 2
September 1975

REGULATORY GUIDE 1.70

STANDARD FORMAT AND CONTENT

OF

SAFETY ANALYSIS REPORTS

FOR NUCLEAR POWER PLANTS

LWR EDITION

FOR COMMENT

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

FIGURE 19

TERMINAL DISPLAY OF STANDARD FORMAT
TABLE OF CONTENTS

After reviewing the Table of Contents presented by the Module, the reviewer who is usually a specialist working in a particular discipline makes a selection. In this case we will assume the reviewer is a Nuclear Engineer or Physicist in the Core Performance Branch. He is concerned with Section 4.3 Nuclear Design. Selection results in the display shown in Figure 20.

FIGURE 20

TERMINAL DISPLAY OF SECTION 4.3
STANDARD FORMAT

4.3.3 Analytical Methods

A detailed description of the analytical methods used in the nuclear design, including those for predicting criticality, reactivity coefficients, and burnup effects should be provided. Computer codes used should be described in detail as to the name and the type of code, how it is used, and its validity based on critical experiments or confirmed predictions of operating plants. Code descriptions should include methods of obtaining parameters such as cross sections. Estimates of the accuracy of the analytical methods should be included.

4.3.4 Changes

Any changes in reactor core design features, calculational methods, data, or information relevant to determining important nuclear design parameters that depart from prior practice of the reactor designs should be listed along with affected parameters. Details of the nature and effects of the changes should be treated in appropriate subsections.

4.4 Thermal and Hydraulic Design

4.4.1 Design Bases

The design bases for the thermal and hydraulic design of the reactor should be provided, including such items as maximum fuel and clad temperatures and cladding-to-fuel gap characteristics as a function of burnup (at rated power, at design overpower, and during transients), critical heat flux ratio (at rated power, at design overpower, and during transients), flow velocities and distribution control, coolant and moderator voids, hydraulic stability, transient limits, fuel cladding integrity criteria, and fuel assembly integrity criteria.

4.4.2 Description of Thermal and Hydraulic Design of the Reactor Core

A description of the thermal and hydraulic characteristics of the reactor design should be provided and should include information indicated in the following sections.

4.4.2.1 Summary Comparison. A summary comparison of the thermal and hydraulic design parameters of the reactor with previously approved reactors of similar design should be provided. This should include, for example, primary coolant temperatures, fuel temperatures, maximum and average linear heat generation rates, critical heat flux ratios, critical heat flux correlations used, coolant velocities, surface heat fluxes, power densities, specific powers, surface areas, and flow areas.

4.4.2.2 Critical Heat Flux Ratios. The critical heat flux ratios for the core hot spot at normal full power and at design overpower conditions should be provided. State the critical heat flux correlation used, analysis techniques, method of use, method of employing peaking factors, and comparison with other correlations.

4-10

FIGURE 20 (Continued)

The reviewer will then compare the information in his hard copy of the licensee's PSAR with the requirements of the Standard Format--step by step, requirement by requirement--until the review is completed.

If the documentation is considered to be deficient (i.e., not sufficiently complete) the staff reviewer(s) will make specific requests for additional information. At this point professional judgment is needed to evaluate deficiencies and to determine the necessary additional data or information to be requested of the applicant. The reviewer may find it necessary to use the full capability of DRS to access information needed to complete the review.

The Acceptance Review was selected to illustrate the concept and use of a module because of its simplicity, but the employment of the module concept in the licensing process would find its most useful application in the steps following the Acceptance Review. For example, the second step, "Technical Review and Rounds of Questions," would use the capability of DRS to access information needed in the review procedure. A sampling of information sources might include the applicable portions of:

- Code of Federal Regulations (10 CFR)
- Standard Review Plans
- Regulatory Guides
- Staff Technical Reports
- Branch Technical Positions
- Letters from Advisory Committee on Reactor Safeguards
- Topical Reports
- Code and Standards - Industry and Technical Societies (ASME, ANSI, ACI, ASCE, WRC, ASTM, IEE, etc.)
- Texts
- Technical Journals
- Technical Papers

In this case, our reviewer faces the complexity of information retrieval, logic, analysis and the execution of professional judgement. A module keyed to the SRP would be a principle aid in the review process.

A preliminary investigation was conducted to determine the feasibility of programming a module keyed to Section 4.3 of the SRP. The investigation revealed that significant effort would be needed to program the SRP to the microstructure level required by a module. The additional effort required placed this phase of the investigation outside the scope of the time and budget constraints of the PLATO Project. Across the board feasibility of the module concept in technical review would require further investigation.

DRS Use In Real Time Information Processing

Our second example shows how DRS could be used in the real time Safeguard Information processing requirements of the NRC. This is done by simulating the response to an incident involving the transportation of nuclear materials.

The Safeguard Division of the Office of Nuclear Material Safety and Safeguards has two related projects underway.

The first is to develop an Integrated Safeguard Information System, sometimes called EYE-SIS, and the second is to develop contingency plans to assure proper response to safeguards incidents.

An Incident Management Center is planned with secure telecommunications with other Federal agencies. Here an Information Management team will evaluate the validity of any threat. The question here is: how can DRS, with its rapid information retrieval capability and the concept of a module be utilized in the support of a response to a threat or an incident? The scenario chosen is concerned with the transport of strategic nuclear material. Of special interest was a study of how the concept of formalized logic or procedures could be used by prompt response forces at NRC.

The NRC is responsible for establishing rules and security regulations for the protection of nuclear material being shipped by the licensed sector of the domestic fuel cycle. The jurisdiction is over a large area of the U.S. as shown in Figure 21 and frequently many shipments are made each day.

Nuclear facilities — fuel processing.

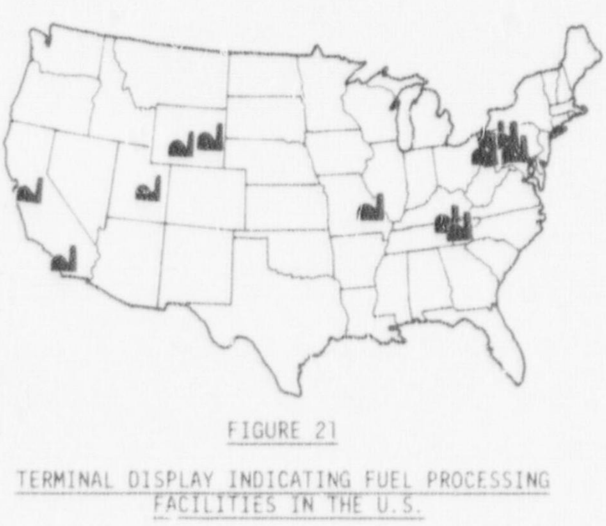

FIGURE 21

TERMINAL DISPLAY INDICATING FUEL PROCESSING FACILITIES IN THE U.S.

All routes must be preplanned and authorized. An example of a frequently used route for shipping highly enriched uranium from a conversion plant in Pennsylvania to a fabrication plant in Connecticut is shown in Figure 22.

FIGURE 22

TERMINAL DISPLAY INDICATING TRUCK ROUTE

Carrier trucks could be subject to assault and theft at all points along the 400-mile route.

Imagine a situation where NRC wishes to monitor an SSNM shipment in a real time basis. Available in the DRS data base is information normally required of all licensees and their agents.*

Installed at the Incident Management Center is a DRS terminal display. Figure 23 shows the mocked movement of a truck and its escort vehicles. The convoy is required to report its status every two hours.

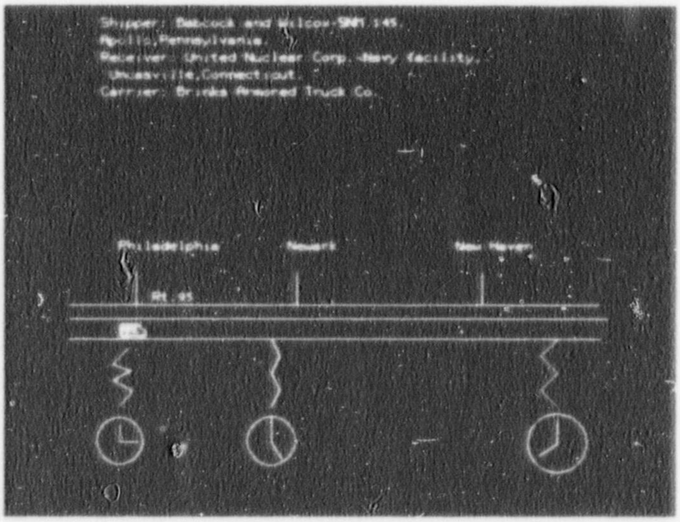

FIGURE 23

TERMINAL DISPLAY SIMULATING TRUCK MOVEMENT
STARTING NEAR PHILADELPHIA

*Shipping data deleted for security reasons.

In this scenario, the convoy did not report at five o'clock as shown on the terminal display in Figure 24. In this case, a two-hour warning is flashed which will continue until reset by the operating personnel.

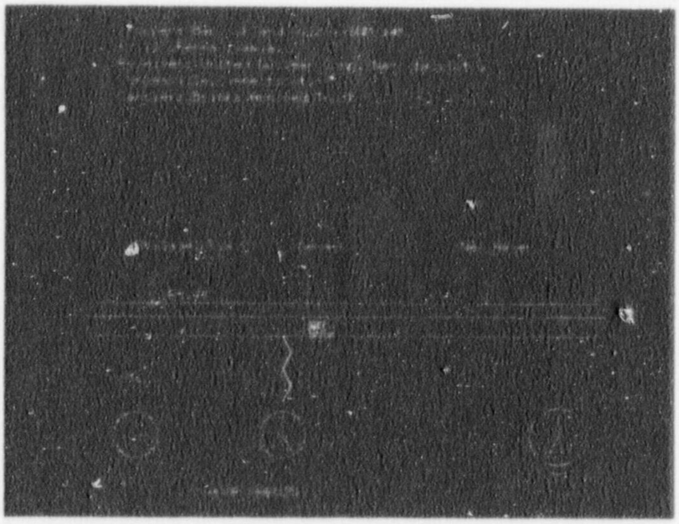

FIGURE 24

TERMINAL DISPLAY SHOWING THE TWO-HOUR WARNING SIGNAL

An alarm will result if no call is received in five hours. The terminal display shows that the last call was made on the New Jersey Turnpike near Philadelphia. The call anticipated from Newark was not received within the five-hour limit.

Figure 25 shows the terminal display. The module is programmed to sound an alarm. This is the initiating event for contingency control.

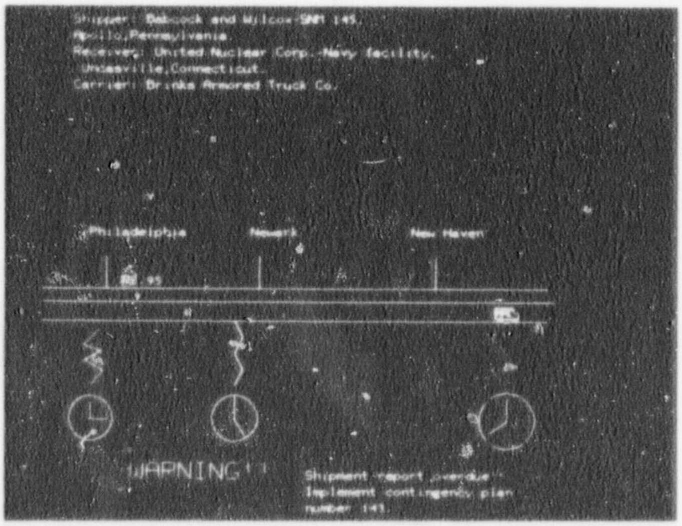

FIGURE 25

TERMINAL DISPLAY SHOWING ALARM SIGNAL

An assigned cadre at IMC then follows predetermined procedures which assess the seriousness of the situation and act to deploy strategic forces if necessary. Upon request, the location of law enforcement and other vital information is displayed at the terminal. This is shown in Figure 26 and Figure 27.

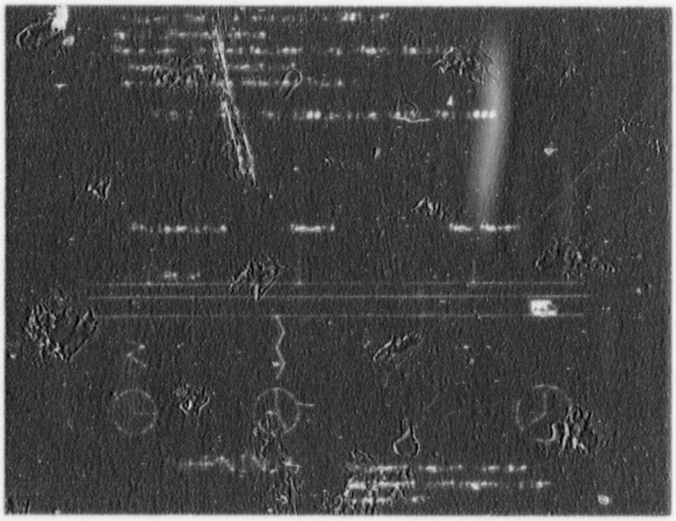

FIGURE 26

TERMINAL DISPLAY INDICATING FBI CONTACTS

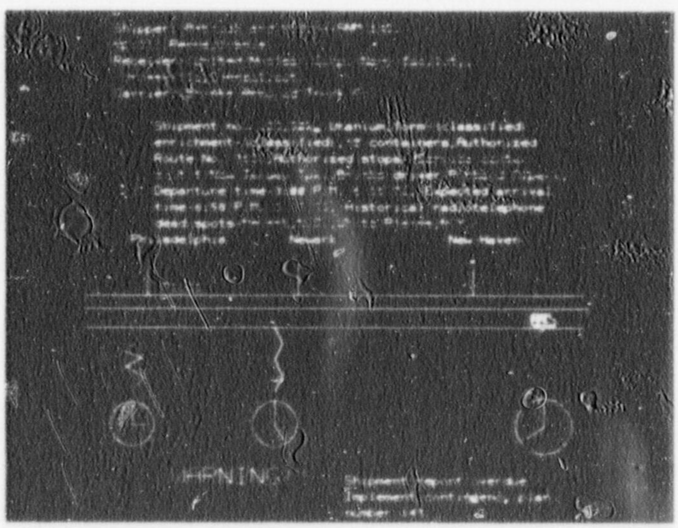

FIGURE 27

TERMINAL DISPLAY INDICATING SHIPPING DATA

Other examples of useful information are shown in Figure 28.

FIGURE 28

TERMINAL DISPLAY SHOWING PHOTOS OF TRUCK

VI EVALUATION

It should be pointed out that the ideal system which was studied and referred to as DRS is clearly not an optimal system for an arbitrary application. The unique documentation and information retrieval requirements of an organization will usually mandate that a detailed systems analysis be conducted in which Cost/Benefit/Risk analysis be performed with due consideration to alternatives before the final selection of a system can be made.

Some of the factors which must be considered will include:

1. Detailed comparative cost data between the proposed system and the present system.

2. Analysis of personnel requirements in terms of staffing needs.

3. Indication of the availability and expected costs of site preparation.

4. Organization and management of the new facility.

In defining the objectives of the PLATO project, these important considerations and others were noted; however, a decision was made to restrict the study of the usage of the DRS system in the information processing requirement of the NRC. This was done not only because of the limited time and resources available for the PLATO project (which could not be extended to include system analysis) but because it was considered more important to adopt a plan in which diverse uses and feasibility of the system could be investigated.

The evaluation of the system was undertaken from two points of view.

1. An evaluation by the investigator.

2. An evaluation of the system as seen through the eyes of NRC users.

Evaluation By Investigator

In this evaluation it is convenient to separate the DCS into three subsystems as follows:

1. Information Storage and Retrieval,

2. Terminal Equipment, and

3. Transmission System.

Information Storage and Retrieval

In reviewing systems available for storing information, choices range from microform storage in either fiche or film to magnetic tape or disk in extended computer memory storage. For microfiche storage the most widely used system is a carousel arrangement in which 750-800 fiche can be individually positioned in front of a reviewing head with a maximum time lag of about six seconds. Each fiche has 60 frames and therefore a single carousel has a storage capacity of about 450,000 - 480,000 frames (pages). It is clear that ten carousels will provide storage capacity for about 4.5 - 4.8 million frames (pages). A single carousel occupies a volume of less than one cubic foot.

The DRS described in this study uses carousel storage, is fully automatic with multiple fiche banks or carousels, each serviced by a TV transmitter. At the present time no large systems of this type are in use and, therefore, although evaluation of the component subsystem is possible, the feasibility of solving subsystem interface problems is subject to engineering judgment.

There are, however, other systems which are semiautomatic and in use in varied applications. Some are being used by utilities for records management.

In one such system,[7] computer assisted search capability is used to identify a microfilm cassette which holds the information desired. The cassette is manually retrieved from the data base by the user and viewed in a conventional microfilm reader. This system has obvious disadvantages when users are distant from the data base location. In that case satellite files may be strategically located for user accessibility.

A possible application of this technology at NRC might be used to link the regional offices to the HQ computer to provide search and browsing capability with satellite files and readers located at each regional office for the regional user.

Terminal Equipment*

In a remote access system such as DRS the user at a distant terminal requires that the system display an image at the terminal within an acceptable time, that the image be available for viewing for as long as is necessary, and that the image is displayed with sufficient resolution for easy readability.

The DRS system will comply with the first two requirements through the utilization of the banks of carousels and the terminal buffer. The problem of sufficient resolution for good readability is difficult to solve.

Early systems using the standard 525 scan lines closed circuit TV could not deal with normal type without zooming in for detail. The results were not acceptable since it was necessary to pan back and forth across a line when reading.

The newer remote display systems use a 1,200 line-scan vidicon camera in a closed circuit TV system. The Bureau of Standards has stated that the 1,200 line-scan system is not good enough and suggests double this resolution (2,400 line-scan). The reference system does not have this resolution and therefore readability may present a problem for some documents.

Also important are the information requirements of the terminal user. It is quite likely that the NRC staff will not be interested in reading a report or document completely at the terminal. They will be interested in the lists of documents or other references contained in the work sets generated in the search routines and in browsing capability in which bits and pieces of information are synthesized to satisfy an information need. These users will be willing to encounter some delay and receive a hard copy if extensive reading is required.

Transmission System

In a microfiche remote access system such as DRS the image transmission requirements between the centralized fiche data bank (base) and the remote viewer are linked to the problems of image resolution and display. Important parameters are the band width requirement of the communication link and the time it takes to produce a satisfactory image.

*This section was written before the terminals for actual use at NRC were selected; see Preface.

A system such as DRS, using closed circuit TV, requires a band width of 30 MHZ with 1,200 scan-line resolution. With buffer storage, the retrieval system could be multiplexed to service multiple users of a single carousel. The system would require co-axial cable links between the data base and the remote terminals.

Communication between the HQ located data base and user at regional offices would necessitate the use of microwave transmission with its resultant cost and technical problems. A possible alternative would be the system previously mentioned which uses satellite files.[6]

NRC User Evaluation

No attempt was made to formalize the acquisition of data related to NRC user preferences and attitudes toward DRS by a user survey or questionnaire. This was not considered feasible since we were dealing with a simulation only and the equipment was not available for user testing. Instead, numerous informal presentations were given to various groups in NRC who would be the users of the system within the guidelines of the PLATO Project. Sampling was obtained mainly from management and technical personnel with the following results:

1. Management and Technical Personnel are for the most part inexperienced and unfamiliar with up to date information retrieval methods. In some cases past experience with microfiche has developed a negative bias for this medium. If, however, the system enables the user to do his job more easily and effectively, then acceptance and use will be prompt and extensive. It is clear that administrative procedures must be implemented to ensure that information in the data base is up to date. Continuous purging and updating will be required. Another important problem arises from the necessity to safeguard proprietary or classified information. Some solutions that have been proposed include limited access terminals. Obviously the indexing, scheme, location of terminals, prompt access, etc., are important factors to be considered when specifying design criteria for the DRS.

2. In evaluating the module concept there was a good deal of skepticism by technical review personnel regarding the feasibility of the concept. Some technical personnel seem to be of the opinion that the review of a high technology system such as a nuclear power plant cannot be systemized to the point where the review procedures can be computerized and suggest that the best way to do it is just the way it is done now. Information retrieval is considered to be both feasible and acceptable but not when placed in the structure of a module. The module concept has promise but needs additional work to demonstrate across the board feasibility.

3. The concept of the use of a module in real time information processing met with almost complete approval by the technical and management personnel. The interface between ISIS was considered feasible. DRS could supply qualitative information which would be folded in with the quantitative information being accumulated by ISIS. It is probably too early to evaluate the effectiveness of the possible union of the two systems since neither is available except in concept. The availability of qualitative information provided by DRS at the Incident Management Center was considered to be an important application for the systems.

VII REFERENCES

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4. TERA Corporation, Technekron Energy Resource Analysts, Berkley, California 94704.

5. Lyman, Elisabeth R., "PLATO Highlights," Computer-Based Education Research Laboratory, University of Illinois, Urbana, Illinois, Third Revision, 1975.

6. Haeuslein and Culkowski, "The Oak Ridge Modular Recon Program," UCCND-CSD-9, 1975.

7. Northeast Utilities, "Nuclear Plant Records and Retrieval Task Force," LWM-33, June 1, 1976.

APPENDIX I

EXCERPT FROM VAHODA

"The user of our idealized system will be sitting at his own terminal which is conveniently located in his own office. The terminal will be both an input (querying) station to a computer and an output (answering) station. The output station receives messages from the computer as well as enlarged microforms of documents sent from a data base some distance removed. The computer will have in its memory surrogates of all of the documents that are of interest to the individual user of the system. The surrogates are the bibliographic citations, abstracts, and index headings of the corresponding documents. The index headings will include subjects, authors, citations, dates form of publication, and any other types of access points that might be useful. This will be an index of great depth subject headings per document consistent with user requirements. For searching the index, the user queries the system in a language that resembles everyday, natural language. He can readjust his query if the results of the first step of the search are not satisfactory, which is likely to be the case. Rapid feedback from the computer is available to facilitate the negotiation of questions. The initial output from the computer might be an indication of the number of documents on file for a particular request. After the question has been negotiated, the bibliographic citations of potentially relevant documents with or without index headings or abstracts will be displayed at the terminal. All, or a portion, of the potentially relevant documents can then be ordered for display at the terminal. The user will have an option of making hard copies from the images on the screen, although this option will probably not be used extensively. Why bother to keep a file of documents when it is so easy to call for them by means of the index and screening mechanism? The system will also include indexes to documents that are only in the researcher's office, documents such as letters, minutes of meetings, or lecture notes. The index to these documents will be stored in a section of the computer's memory that is designated for this purpose and can only be approached by the researcher.

"So far we have only mentioned the use of the system for making searches of documents that may contain answers to questions. There are other features. The computer will have in its memory tables of numeric data that are now consulted through printed data compilations. For this use, the system is not queried for documents that may be of potential interest (document retrieval) but for questions that can be answered with a number or a series of numbers (data or fact retrieval). A current awareness service would also be included to assist the individual researcher in keeping up to date on new publications in his area of interest. The individual user of the system will characterize his interests in the language of the index; that is, his interest will be indexed just like another document in the system. The index headings for new documents entering the system will be matched against the index headings that represent individual researcher's professional interests. When matches occur, potentially useful documents will be directed to the researcher's attention via his terminal.

"The idealized system consists, as do all systems for that matter, of a combination of components--people, equipment, instructions for using equipment, documents, and surrogates of documents--all put together to perform a specified task."

APPENDIX II

THE REACTOR LICENSING PROCESS

The Nuclear Regulatory Commission (NRC) is responsible for the licensing and regulation of nuclear power plants. Before a company can build a power plant at a particular site, it must obtain a construction permit from the NRC. As a major part of the application for a construction permit, the company files a Preliminary Safety Analysis Report (PSAR). This document presents the design criteria and preliminary design information for the proposed reactor and comprehensive data on the proposed site. The report also discusses various hypothetical accident situations and the safety features which will be provided to prevent accidents or, if they should occur, to mitigate their effects on both the public and the facility's employees. In addition, the company must submit a comprehensive Environmental Report providing a basis for the evaluation of the environmental impact of the proposed plant. Further, information must be submitted for use by the Attorney General and the NRC staff in their reviews of the antitrust aspects of the proposed facility.

An applicant for a construction permit for a nuclear power plant may tender the information required by 10 CFR Part 50 in three parts. One part is accompanied by the Environmental Report and site suitability information and another part by the PSAR. Tendering of the first part may precede the tendering of the other by no longer than six (6) months. Whichever of the above parts is tendered first must also include the fee and other general and financial information. The third part, consisting of antitrust information, is tendered 9-36 months prior to the other information in order for the Attorney General to begin the antitrust review.

When an application is submitted, it is first subjected to an acceptance review to determine whether it contains sufficient information to satisfy the Commission requirements for a detailed review. If the application is not sufficiently complete, the staff makes specific requests for additional information. The application is formally docketed only if it meets certain minimum acceptance criteria. In addition, when the PSAR is submitted, a substantive review and inspection of the applicant's quality assurance program, covering design and procurement, is conducted. Guides for the preparation of the documents, detailing the kind of information needed, have been developed by the staff to aid companies in preparing acceptable applications.

As soon as an application for a construction permit is received, copies are placed in the NRC Public Document Room. As soon as the ER or PSAR or early site information is received, copies are also placed in Public Document Rooms local to the proposed site. Copies of all future correspondence and filings relating to the application are placed in these locations and are available to the public. Also, a press release announcing receipt of the application is issued by the NRC. Upon docketing (acceptance) of the applicant's application for a construction permit, copies are sent to Federal, State and local officials and a notice of its receipt is published in the Federal Register.

The staff reviews a construction permit application to determine if the public health and safety will be fully protected. If any portion of the application is considered to be inadequate, the staff requires the applicant to supply the needed additional information or to modify the plant so that it will be acceptable.

The application is reviewed to determine that the plant design is consistent with NRC Rules and Regulations, regulatory guides and other regulatory requirements. Design methods and procedures of calculations are examined to establish their validity. Checks of actual calculations and other procedures of design and analysis are made by the staff to establish the validity of the applicant's design and to determine that the applicant has conducted his analysis and evaluation in sufficient depth and breadth to support required findings with respect to safety.

During the staff's review, the applicant is required to provide such additional information as is needed to complete the evaluation. The principal features of the staff's review can be summarized as follows:

1. A review is made of the population density and use characteristics of the site environs, and the physical characteristics of the site, including seismology, meteorology, geology and hydrology, to determine that these characteristics have been evaluated adequately and have been given appropriate consideration in the plant design, and that the site characteristics are in accordance with the siting criteria (10 CFR Part 100), taking into consideration the design of the facility including the engineered safety features provided.

2. A review is performed of the facility design, and of programs for fabrication, construction and testing of the plant structures, systems, and components important to safety to determine that they are in accord with the regulations, regulatory guides, and other requirements, and that any departures from these requirements have been identified and justified.

3. Evaluations are made of the response of the facility to various anticipated operating transients and to a broad spectrum of hypothetical accidents. The potential consequences of these hypothetical accidents are then evaluated conservatively to determine that the calculated potential offiste doses that might result, in the very unlikely event of their occurrence, would not exceed the guidelines for site acceptability given in 10 CFR Part 100.

4. A review is made of the applicant's plans for the conduct of plant operations including the organizational structure, the technical qualifications of operating and technical support personnel, the measures taken for industrial security, and the planning for emergency actions to be taken in the unlikely event of an accident that might affect the general public. An important aspect of this review includes an assessment of the applicant's programs for quality assurance and quality control to assure compliance with the Commission's requirements. These reviews form the basis for determining whether the applicant is technically qualified to operate the plant and whether he has established effective organizations and plans for continuing safe operation of the facility.

5. Evaluations are made of the design of the systems provided for control of the radiological effluents from the plant to determine that these systems can control the release of radioactive wastes from the station within the limits specified by the regulations and that the applicant will operate the facility in such a manner as to reduce radioactive releases to levels that are as low as is reasonably achievable.

This review is conducted by members of the NRC staff and its consultants over a period of about a year. To the extent feasible and appropriate, the staff makes use of previous evaluations of other reactors approved for construction or operation, and previous evaluations of various aspects of reactor design described in topical reports, to expedite its review.

The licensing process includes the consideration of programs proposed by an applicant for a construction permit to verify plant design features and to confirm design margins. The licensing process includes consideration of basic research and development programs necessary to assure the resolution of safety questions associated with safety features or components. The applicant must identify any research and development work that will be conducted to confirm the adequacy or to resolve any safety questions associated with the design of a particular facility, along with a schedule for completion of that research and development work. All such safety questions must be resolved prior to operation of the facility. After completion of construction, nuclear power plants are subject to operating license procedures and requirements. Data obtained from research and development programs on particular facilities and from the Commission's safety research program are factored into these licensing reviews.

When the review and evaluation of the application progresses to the point that the staff concludes that acceptable criteria, preliminary design information and financial information are documented adequately in the application, a Safety Evaluation Report is prepared. This report represents a summary of the review and evaluation of the application by the staff relative to the anticipated effect of the proposed facility on the public health and safety.

The Advisory Committee on Reactor Safeguards (ACRS), an independent statutory committee established to provide advice to the NRC on reactor safety, reviews each application for a construction permit or an operating license for a commercial nuclear power plant. The ACRS is composed of a maximum of fifteen members who, though not full time NRC employees, are appointed by the NRC for terms of four years each. The members are experienced, technically trained individuals selected from various technical disciplines, having applicable experience in industry, research activities, and in the academic area. The ACRS also makes use of consultants in specialized technical disciplines.

The staff prepares one or more supplements to the Safety Evaluation Report to address the safety issues raised by the ACRS in its report and to include any other information made available since issuance of the original Safety Evaluation Report.

Either concurrently with or separately from the radiological safety review, an environmental review is performed by the staff and its consultants to evaluate the potential environmental impact of the proposed plant, as well as to provide comparisons between the benefits to be derived and the possible risk to the environment. After completion of this review, a Draft Environmental Statement (DES), containing conclusions on environmental matters, is issued. The DES is circulated for review and comments by the appropriate Federal, State and local agencies as well as by individuals and by organizations representing the public. After receipt of all comments and resolution of any outstanding issues, a Final Environmental Statement (FES) is issued and also is made public.

The law requires that a public hearing(s) be held before a construction permit may be issued for a nuclear power plant. Soon after an application is docketed the NRC issues a notice of the hearing(s) which will be held after completion of the safety and environmental reviews. In addition, the hearing is advertised in several newspapers in the vicinity of the proposed facility and a public announcement is issued by the NRC. Opportunity is afforded to interested members of the public to participate in the hearing. Interested parties may submit written statements to the licensing board to be entered into the hearing record, they may appear to give direct statements as limited participants in the hearing, or they may petition for leave to intervene as full participants in the hearing, thereby being granted the right of cross-examining all direct testimony in the proceeding. At an early stage in the review process, potential intervenors are invited to meet informally and discuss with the staff their concerns with respect to the proposed facility.

The public hearing(s) is conducted by a three-member Atomic Safety and Licensing Board (board) appointed from the NRC's Atomic Safety and Licensing Board Panel. The board is composed of one lawyer, who acts as chairman for the proceeding, and two other technically qualified persons.

The Safety Evaluation, its supplements and the Final Environmental Statement are offered as evidence by the staff at the public hearing(s). The board considers all the evidence which has been presented, together with findings of fact and conclusions of law filed by the parties and issues an initial decision. If the initial decision regarding NEPA and safety matters is favorable, a construction permit is issued to the applicant by the Director of Nuclear Reactor Regulation. The board's initial decision is subject to review by an Atomic Safety and Licensing Appeal Board on its own motion, or if exceptions are filed by any party to the proceeding. Under certain circumstances the initial decision may be reviewed by the Commissioners.

Prior to a decision on a construction permit, Commission regulations provide that the Director of Nuclear Reactor Regulation may authorize limited amounts of work to be carried out prior to the issuance of the construction permit. This authorization is known as a Limited Work Authorization (LWA). The regulations provide for the authorization of two types of work. Under one type, he may authorize site preparation work, installation of temporary construction support facilities, excavation, construction of service facilities and certain other construction not subject to the quality assurance requirements. Under the second type of LWA, he may authorize the installation of structural foundations.

Any LWA may be granted only after the hearing board has made all of the National Environmental Policy Act (NEPA) findings required by the Commission's regulations in 10 CFR Part 51 for the issuance of a construction permit and has determined that there is reasonable assurance that the proposed site is a suitable location for a nuclear power reactor of the general size and type proposed from a radiological health and safety standpoint. The second type may be granted if, in addition to the findings described above, the hearing board determines that there are no unresolved safety issues relating to the work to be authorized.

It should also be noted that the Commission's regulations also provide that hearing boards commence hearings on the LWA as soon as practicable after issuance of the FES but no later than 30 days after its issuance. The hearing board is also directed to issue an initial decision on NEPA findings and site suitability. The LWA may not be granted unless there is a favorable decision on these matters.

The law requires that antitrust aspects of a nuclear power plant license application must be considered in the licensing process. The antitrust information submitted by the applicant is sent to the Attorney General for his advice on whether activities under the proposed license would create or maintain a situation inconsistent with the antitrust laws. Upon receipt, the Attorney General's advice is promptly published and opportunity is provided for interested parties to raise antitrust issues. An antitrust hearing may be held based on the recommendation of the Attorney General or on the petition of an interested party.

In any event, the NRC must make a finding on antitrust matters in each case where the issue is raised. Antitrust hearings are held separately from hearings on environmental and safety matters.

When the construction of the nuclear facility has progressed to the point where final design information and plans for operation are ready, the applicant submits the Final Safety Analysis Report in support of an application for an operating license. The FSAR sets forth the pertinent details on the final design of the facility, including final containment design, design of the nuclear core, and waste handling system. The FSAR also supplies plans for operation and procedures for coping with emergencies. Again the staff makes a detailed review of the information. Amendments to the spplication and reports may be submitted from time to time. The staff again prepares a Safety Evaluation Report (re the operating license) and, as during the construction permit stage, the ACRS again makes an independent evaluation and presents its advice to the Commission by letter. This second Safety Evaluation Report and its Supplements, the ACRS meetings and their letter to the Commission are available to or may be attended by the public.

A public hearing is not mandatory prior to the issuance of an operating license. However, soon after acceptance of the operating license application, the Commission publishes notice that it is considering issuance of the license. The notice provides that any person whose interest may be affected by the proceeding may petition the NRC to hold a hearing.

The requirements for a valid petition are the same as those described at the construction permit stage. If a public hearing is held, the same decision process described for the construction permit hearing is applicable.

Each license for operation of a nuclear reactor contains Technical Specifications, which set forth the particular safety and environmental protection measures to be imposed upon the facility, and the conditions of its operation that are to be met in order to assure protection of the health and safety of the public and of the surrounding environment.

Through its inspection and enforcement program the NRC maintains surveillance over construction and operation of a plant throughout its lifetime to assure compliance with Commission regulations for the protection of public health and safety and the environment.

APPENDIX III

LICENSING DOCUMENTATION AND FILE STRUCTURE

Prior to the time a CP application is tendered for acceptance review it is assigned a project number; when the application is accepted, it is likewise assigned a docket number; the docket number is retained throughout the (40-year) existence of the project to assist in project identification. The docket or project number is affixed to each document generated internally or externally on that project. A copy of all documents so generated, as qualified below, is stored in the Docket File, including a chronological record of their receipt.

The Docket File is the official Nuclear Regulatory Commission "record" for that project. Docket files are maintained for each 10 CFR Part 40, 50, 70 and 115 project. Documents retained in the Docket Files as a "record" of the project include but are not limited to:

- Application, amendments and related correspondence
- PSAR with all supplements and amendments
- FSAR with all supplements and amendments
- SER with all supplements and related material
- CP, amendments and related correspondence
- OL, amendments and related correspondence
- Memoranda to the Commission and ACRS
- Internal memoranda
- Correspondence to and from State and other government officials
- Consultant correspondence
- Hearings and intervention correspondence and information
- Hearing transcripts
- Antitrust information and correspondence
- Proprietary information and reports
- Inspection reports and correspondence
- Operating reports
- Correspondence relating to license fees
- Environmental information including correspondence and reports (Environmental Report, DES and FES)
- Financial qualifications information
- Insurance and Indemnity information
- Miscellaneous inquiry and protest letters

The "record" of a project, for filing purposes, includes any book, paper, map, photograph, brochure, punch card, magnetic tape, paper tape, sould recording, pamphlet, slide, motion picture, or other documentary material regardless of form or characteristics made by, in the possession of, or under the control of the NRC pursuant to Federal law or in connection with the transaction of public business as evidence of NRC organization, functions, policies, decisions, procedures, operations, programs or other activities. Any identifiable record, whether in the possession of the NRC, its contractors, its subcontractors or others, may be made available for inspection and copying pursuant to the provisions of 10 CFR Part 9 upon the request of any member of the public with the exception of exempt records as discussed below.

Certain types of records contained in the Docket File are exempt from public disclosure. In addition to material designated as proprietary and information relating to industrial security, these include, in certain cases, notations or memoranda which reflect advice, opinion, or recommendations, rather than statements of fact. However, it should be noted that documents that reflect opinion, advice, or recommendations have on occasion been released to the public under the Freedom of Information Act. The restructured rules (10 CFR Parts 2 and 50) broaden the scope of documents which are considered to be part of the official docket record. The majority of material which was previously exempt under previous rules and practices may now be available to the public in general, and intervenors in particular.

Subject File

The Subject File includes all written material, principally typed or reproduced in printed form, that is generated, internally or externally, as a result of Regulatory activities. This includes proprietary information, topical reports, and undocketed applications that have been assigned a project number. However, it does not contain material specifically relating to a docketed project; this information is filed in the Docket File. The material in the Subject File includes areas of information such as:

I. Regulatory Standards

a. Site and Environmental
b. Reactor Building (Containment)
c. Reactor Coolant System
d. Reactor Core
e. Control, Instrumentation and Power
f. Auxiliary and Emergency Systems
g. Accident Analysis
h. General Studies
i. Safety Criteria and Research
j. Miscellaneous

II. Reactor Project Files (undocketed)

a. Non-licensed ERDA and Department of Defense reactors (operated on a government-controlled site)

b. Proposed reactors that may eventually be licensed under Part 50 (e.g., those undergoing a preliminary review, those rejected for not being adequately complete). (These files are incorporated with the Docket File when an application is accepted.)

III. Other Subjects

a. Budget, Accounting and Finance
b. Communications and Records
c. Equipment and Supplies
d. Information and Publications
e. International Affairs
f. Isotopes Development
g. Legal
h. Materials
i. Medicine, Health and Safety
j. Organization and Management
k. Personnel
l. Plant, Laboratories, Buildings and Land
m. Procurement and Contracts
n. Reactor Development
o. Research and Development
p. Security
q. Transportation

Reactor License Authority File

This file contains all current documents of an authoritative nature that represent the license authority granted to each reactor licensee by the Commission. The authority file is bound in a number of hard cover, looseleaf, three-ring binders--one for each reactor facility that has been granted an OL. Two copies of each file are maintained--a file copy and a copy that may be checked out by any staff or field office member. Typically, each binder contains the following:

a. OL
b. Tech Specs
c. Orders from the Directorate of Licensing
d. Special authorizations and exemptions

e. SER and supplements
f. Special reports
g. All amendments and changes to the OL with supporting staff evaluation

Classified Technical Reports

A document accountability system is maintained for classified research and development reports that are orginated by the NRC, and NRC contractors and subcontractors. Access to these reports is based on the need of individuals for the information in the performance of their official duties.

APPENDIX IV

SOURCE GUIDE TO MICROFICHE INFORMATION SYSTEMS

A. Structuring of reference listings. For ease of reference, listings are separated into three categories: Section I - Federal Government; Section II - Municipal Agencies; and Section III - Commercial Organizations. Corporate names, addresses and telephone numbers reflect data current at this time, although company mergers, moves or other changes may obsolete this information over a period of time. Where two listings are furnished for a company, the second address is that of the local Washington, D.C., area representative.

Addressograph Multigraph Corporation
19701 S. Miles Road
Warrensville, OH 44128
216-587-6660

AIL Information Systems
8332 Osage Avenue
Los Angeles, CA 90045
213-670-9063

American Videonetics Corporation
795 Kifer Road
Sunnyvale, CA 94086
408-732-2000

Applied Data Research, Inc.
800 Follin Lane
Vienna, VA 22180
703-281-2000

Arcata Microfilm
1105 Fairchild Drive
Winston-Salem, NC 27105
919-767-7886

Bell and Howell
6800 McCormick Road
Chicago, IL 60645
312-675-7600

Bell and Howell
4820 Fairmont Avenue
Bethesda, MD 20014
301-986-1600

The Boeing Company
7755 E. Marginal Way
Seattle, WA 98124
206-773-0464

Bruning Division/A-M Corporation
1824 Walden Office Square
Schaumburg, IL 60172
312-397-1600

Business Efficiency Aids, Inc.
8114 N. Lawndale Avenue
Skokie, IL 60076
312-673-0520

Computer Microfilm Int'l Corporation
1455 Tully Circle - Suite 121
Atlanta, GA 30329
404-321-0886

Computer Microfilm Int'l Corporation
2020 14th Street
Arlington, VA 22201
703-841-1212

Data General Corporation
7777 Leesburg Pike - Suite 20
Falls Church, VA 22043
703-893-0910

Datacorp
711 W. 40th Street
Baltimore, MD 21211
301-366-1810

Datadyne, Inc.
Box 81
Pontiac, IL 61764
815-844-5463

Diebold, Inc.
828 Mulberry Street
Canton, OH 44711
216-453-4592

Dietzgen Corporation
2425 N. Sheffield Avenue
Chicago, IL 60614
312-549-3300

Dietzgen Corporation
2000 L Street, N.W.
Washington, DC 20036
202-233-8130

Dymat Photomatrix Corporation
2225 Colorado Avenue
Santa Monica, CA 90404
213-828-9585

Dynamic Information Systems, Inc.
Airlake Park
Lakeville, MN 55044
612-469-3411

Section I. FEDERAL GOVERNMENTAL AGENCIES

Bureau of Census
Suitland, MD 20023

Defense Documentation Center
Cameron Station
Alexandria, VA 22314

Department of State
Washington, DC 20520

GSA
National Personnel Records Center
St. Louis, MO 63132

Library of Congress
Photoduplication Service
Washington, DC 20002

Office of the Federal Records Center
National Archives and Records Service
GSA
Washington, DC 20408

U.S. Air Force Military Personnel Center
Randolph Air Force Base, TX 78148

U.S. Air Force, 9th TIS
Langley Air Force Base, VA 23665

U.S. Army Finance Center
Ft. Benjamin Harrison
Indianapolis, IN 46249

U.S. Army Tank - Automotive Command
Warren, MI 48089

U.S. Navy Microfile Conversion Group
Arlington Navy Annex
Washington, DC 20370

Section II. MUNICIPAL AGENCIES

Dayton Police Department
Safety Building
335 W. 3rd Street
Dayton, OH 45401

New Orleans Police Department
715 S. Broad Street
New Orleans, LA 70119

New York City Department of Health
93 Worth Street
New York, NY 10013

Norfolk Police Department
811 City Hall Avenue
Norfolk, VA 23504

Section III. COMMERCIAL ORGANIZATIONS

A. B. Dick Company
5700 W. Touhy Avenue
Chicago, IL 60648
312-763-1900

A. B. Dick Company
6400 Arlington Boulevard
Seven Corners, VA 22042
703-534-2700

Access Corporation
4815 Para Drive
Cincinnati, OH 45237
513-242-4220

Access Corporation
6701 Elkridge Landing Road
Linthicum, MD 21090
301-796-4670

Acme Visible Records, Inc.
Crozet, VA 22932
703-823-4351

Acme Visible Records, Inc.
1600 Wilson Boulevard - Suite 702
Rosslyn, VA 22209
703-841-1310

Eastman Kodak Company
343 State Street
Rochester, NY 14650
716-325-2000

Eastman Kodak Company
500 12th Street, S.W.
Washington, DC 20024
202-554-9300

Electro-Optical Mechanisms, Inc.
2865 Metropolitan Place
Pomona, CA 91767
714-593-2515

Emtex Corporation
100 Merrick Road
Rockville Center, NY 11570
516-536-4940

Extek Microsystems, Inc.
15424 Cabrito Road
Van Nuys, CA 91406
213-989-2630

First National City Bank
111 Wall Street
New York, NY 10015
212-825-5000

GAF Corporation
140 W. 51st Street
New York, NY 10020
212-582-7600

GAF Corporation
4601 Lydell Road
Cheverly, MD 20781
301-322-3130

Harris Corporation (Radiation Labs)
P.O. Box 37
Melbourne, FL 32901
305-727-4743

Harris Corporation
2600 Virginia Avenue, N.W. - Suite 704
Washington, DC 20037
202-337-4914

Horizons Research
23800 Merchantile Road
Cleveland, OH 44122
216-464-2424

Image Systems, Inc.
11244 Playa Court
Culver City, CA 90230
213-390-3378

Information Handling Services
5500 S. Valentia Way
Englewood, CO 80110
303-771-2600

Kalvar Corporation
907 S. Broad Street
New Orleans, LA 70125
504-822-1600

Kalvar Corporation
150 S. Washington Street - Suite 403
Falls Church, VA 22046
703-536-2500

Keuffel and Esser Company
20 Whippany Road
Morristown, NJ 07960
201-285-5315

Kingsport Press
Kingsport, TN 37662
615-246-7131

Lumonics
P.O. Box 1800
Kanata, Ontario
613-592-1460

The Frederic Luther Company
P.O. Box 20224
Indianapolis, IN 46220
317-253-3446

Gordon Lysle, Inc.
514 Larkfield Road - Suite 8
East Northport, NY 11731
516-266-2338

Gordon Lysle, Inc.
1901 Ft. Meyer Drive - Suite 812
Rosslyn, VA 22209
703-527-6301

Metagraphic Systems
1624 Stillwell Avenue
New York, NY 10461
212-892-3700

The Micobra Corporation
176 King Street, Box 1187
Hanover, MA 02339
617-871-2610

Micro Information Systems, Inc.
467 Armour Circle, N.E.
Atlanta, GA 30324
404-873-4421

Microx Corporation
1901 Ft. Meyer Drive - Suite 812
Rosslyn, VA 22209
703-527-6301

Mid-Atlantic Industries
P.O. Box 942
Baltimore, MD 21203
301-465-6506

Millifile, Inc.
3 Westchester Plaza
Elmsford, NY 10523
914-592-5524

3M Company
3M Center
St. Paul, MN 55101
612-733-6986

3M Company
5570 Port Royal Road
Springfield, VA 22151
703-321-8400

Mohawk Industrial Laboratories, Inc.
One Ward Street
Vernon, NY 13476
315-829-2781

National Capital Systems, Inc.
1815 N. Ft. Meyer Drive
Arlington, VA 22209
703-527-0803

National Educational Consultants, Inc.
5604 Rhode Island Avenue
Hyattsville, MD 20781
301-699-9300

National Microfilm Systems, Inc.
850 Sligo Avenue - Suite 401
Silver Spring, MD 20910
301-588-3200

NB Jackets Company
54-18 37th Avenue
Woodside, NY 11377
212-672-9000

NCR Corporation
Main & K Streets, Building 26
Dayton, OH 45479
513-499-5135

NCR
5011 Herzel Place
Beltsville, MD 20705
301-937-5840

New York University
Elmer Holmes Bobst Library
70 Washington Square South
New York, NY 10012
212-598-2009

Oce - Industries, Inc.
6500 N. Lincoln Avenue
Chicago, IL 60645
312-673-0900

Oce - Industries, Inc.
510 Warren Road
Cockeysville, MD 21030
301-666-8126

Pepco Division
Computer Specialties Corporation
87 Burlews Court
Hackensack, NJ 07601
201-487-4116

PMS Industries, Inc.
283-285 Central Avenue
Silver Creek, NY 14136
716-934-2681

PRC Information Sciences Company
7600 Old Springhouse Road
McLean, VA 22101
703-893-1810

Pride Industries Corporation
22 Walter Street
Pearl River, NY 10965
914-735-7777

Ragen Precision Industries
9 Prete Avenue
North Arlington, NJ 07032
201-997-1000

Randomatic Data Systems, Inc.
344 W. State Street
Trenton, NJ 08618
609-695-3447

Realist, Inc.
P.O. Box 67
Menomonee Falls, WI 53051
414-251-8100

Realist, Inc.
8710 Kerry Lane
Springfield, VA 22152
703-569-9488

Scott-Graphics, Inc.
Holyoke, MA 20852
413-536-7800

Scott-Graphics, Inc.
6000 Executive Boulevard
Rockville, MD 20852
301-881-7505

Security Engineered Machinery Co., Inc.
Five Walkup Drive
Westboro, MA 01581
617-366-1488

Sperry-Univac Systems Division
P.O. Box 1000
Blue Bell, PA 19422
215-542-4011

Sperry-Univac Systems Division
2233 Wisconsin Avenue, N.W.
Washington, DC 20007
202-338-7400

Stromberg Datagraphix, Inc.
P.O. Box 2449
San Diego, CA 92112
714-291-9960

Supreme Equipment and Systems Corp.
170 53rd Street
Brooklyn, NY 11232
212-492-7777

Taylor-Merchant Corporation
25 W. 45th Street
New York, NY 10036
212-757-7700

Teledyne Post
700 Northwest Highway
Des Plaines, IL 60016
312-299-1111

Terminal Data Corporation
21221 Oxnard Street
Woodland Hills, CA 91364
213-887-4900

Trans-a-File Systems Company
371 Santa Trainita Boulevard
Sunnyvale, CA 94086
408-732-9600

TRW, Inc.
One Space Park
Redondo Beach, CA 90278
213-535-0133

Tymshare, Inc./Data Services Div.
10261 Bubb Road
Supertino, CA 95014
408-257-6550

UMF Systems, Inc.
2541 Prairie Avenue
Evanston, IL 60271
312-869-4900

University Microfilms, Inc.
P.O. Box 1346
Ann Arbor, MI 48106
313-761-4700

U.S. Datacorp
U.S. Bank Plaza, 555 S.W. Oak Street
Portland, OR 97208
503-225-5070

Varian
470 San Antonio Road
Palo Alto, CA 94306
415-328-1350

Washington Scientific Industries, Inc.
Long Lake, MN 55356
612-473-1271

Xerox Commercial Microsystems
300 N. Zeeb Road
Ann Arbor, MI 48106
313-769-9620

Xerox Corporation
1911 N. Ft. Meyer Drive - 12th Floor
Arlington, VA 22209
703-527-0700

Xidex Corporation
305 Soquel Way
Sunnyvale, CA 94086

ADDENDUM

A. B. Dick/Scott
Alvord Street
South Hadley, MA 01075
413-536-7850

Emtex Corporation
100 Merrick Road
Rockville Center, NY 11570
516-536-4940

Energy Conversion Devices, Inc.
1695 West Maple Road
Troy, MI 48084
313-549-7300

Microform Data Systems, Inc.
830 Maude Avenue
Mountain View, CA 94043
415-964-4635

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7. AUTHOR(S) Harry McNeill, NRC Consultant	5. DATE REPORT COMPLETED July 1978
9. PERFORMING ORGANIZATION NAME AND MAILING ADDRESS *(Include Zip Code)* Harry McNeill 7 Cypress Road West Hartford, CT 06117	DATE REPORT ISSUED MONTH November YEAR 1978
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12. SPONSORING ORGANIZATION NAME AND MAILING ADDRESS *(Include Zip Code)* Executive Director for Operations U.S. Nuclear Regulatory Commission Washington, D.C. 20555	10. PROJECT/TASK/WORK UNIT NO.
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16. ABSTRACT *(200 words or less)*

Current and future information processing requirements at the U.S. Nuclear Regulatory Commission (NRC) indicate that present information handling procedures may prove inadequate. In early 1975, a study was initiated to investigate the use of a computer interfaced Information Storage and Retrieval System in the information processing requirements of the NRC. The project was named PLATO after the simulator used in the investigation.

17. KEY WORDS AND DOCUMENT ANALYSIS	17a. DESCRIPTORS
17b. IDENTIFIERS/OPEN-ENDED TERMS	

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