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AN EXPLORATORY INVESTIGATION OF THE TRANSLATION OF PACIFIC NORTHWEST LABORATORY'S PRINT MANUALS SYSTEM TO AN ON-LINE MANUALS SYSTEM

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EXECUTIVE SUMMARY

INTRODUCTION

Information management technology has proliferated in the past decade in response to the information explosion. As documentation accumulates, the need to access information residing in manuals, handbooks and regulations conveniently, accurately, and quickly has increased. However, studies show that only fractions of the available information is read (Martin, 1978). Consequently, one of the biggest challenges in linking information and electronic management of information is to use the power of communication technology to meet the information needs of the audience.

Pacific Northwest Laboratories' (PNL) investigation of translating its print manual system to an on-line system fits this challenge precisely. PNL's manuals contain a tremendous amount of information for which manual holders are responsible. To perform their tasks in compliance with policy and procedure guidelines, users need to access information accurately, conveniently, and quickly.

In order to select and use information management tools wisely, answers must be sought to a few basic questions. Communication experts cite four key questions:

- what do users want
- what do users need
- what characteristics of an on-line information system affect its usefulness, and
- who are the users whose wants and needs are to be met?

Once these questions are answered, attention can be focused on finding the best match between user requirements and technology characteristics and weighing the costs and benefits of proposed options.

APPROACH

In order to answer the basic questions, this task followed a standard set of recommended research steps to investigate the issues surrounding the adoption of an on-line manuals system: asking people what they want from the current print system and from an on-line system; asking them what they need to perform their tasks; exploring on-line software capabilities; outlining the match between on-line characteristics and user requirements; and proposing a field test and evaluation to assess user reaction to an early version (Grice, 1989, Hackos, 1991, Horton, 1990, Wieringa, 1991).

More specifically, task members within TPAC investigated current PNL print manual use patterns, examined computer support available to PNL staff, identified users' preferred on-line document features, examined text retrieval information system (TRIS) capabilities, reviewed suitable candidate TRIS products, identified constraints within PNL of adopting an on-line manual system, and reviewed current practice and current research. Information was gathered through the following activities:

- a literature review
- a focus group with subject matter experts
- a series of interviews with selected PNL staff
- a short user survey, and
- a review of TRIS software products.

FINDINGS

A number of consistent findings emerged from the different activities. These findings pertain to the following topic areas: ease of on-line system use; meeting users' needs; computer support; phased implementation of an on-line system; manual revision; and preferred on-line features. Each of these topics is discussed briefly in the following section and in fuller detail in the reports from the separate activities.

MEETING USERS' NEEDS

Meeting users' needs emerged as the over-arching issue in any on-line information system or print manual system. Current research and literature stresses that the key to the success of on-line documentation rests in structuring, delivering, and maintaining the system to meet users' needs. Indeed, experts strongly urge anyone considering adopting an on-line system to first identify users' needs and wants and to characterize users' tasks. The importance of this issue was reinforced in the focus group's consensus that the PNL system must meet users' needs and in the interviews in the repeated identification of users' needs as the key element in a successful on-line or print manual system. Indeed, it was strongly reiterated that unless the proposed system meets users' needs, it would be perceived as not only waste of time, but, in the words of one manager, "a boondoggle".

For PNL as well as other organizations, there are two groups of manual users; those who use the manuals as a reference, and those who manage the manual system. Meeting the needs of both groups must be considered in planning an on-line system and/or improving the current print system.

EASE OF USE

On-line text retrieval information systems must be easy to use if they are to avoid the all too common pattern of on-line systems being rarely used. A standard recommendation states that on-line systems must be quick, accurate, and convenient to use. In addition, they must "meet or beat" the existing system on these criteria.

Key factors which determine ease of use include: familiarity, ease of learning, navigability, ease of modification, and appearance. Among these, providing a system which is easy to learn is critical to its success. As one staff member stated: "Only make me learn how to operate [the system] to get what I want--not extra features or information." This statement reflects reminders by experts that the primary function of any information system is to help users get a job done, i.e., the system is a means to an end, not an end in and of itself.

The user-computer interface (UCI) is a critical element in creating a user-friendly on-line system. Four central UCI useability factors emerged from the literature, interviews, and the focus group comments and recommendations: the search mechanism, the pacing of the information displayed, the flexibility offered users, and a simple HELP function.

ON-LINE SYSTEM PREFERRED FEATURES

On-line document systems range in complexity from systems which simply store documents for automatic revision and text display to systems which offer artificial intelligence (AI) search and query capabilities. PNL staff members consistently identified a select number of features they felt were essential:

- comprehensive indexing
- thorough cross-referencing
- multiple platforms (i.e., both IBM/PC and MacIntosh)
- revision currency and notification
- multiple location use capability, and
- document control.

REVISION

The on-line revision capability serves two different sets of performance criteria, revision management and technical manual use. Managers, scientists, engineers, and technical services staff who use the manual to assist them in the performance of their jobs voiced concerns about the following set of issues:

- retaining historical records of PNL's manuals
- ensuring currency of the manuals
- ensuring users' awareness of revision content
- being aware of cross-manual impacts, and
- paying for the necessary revision management staff.

In addition to these issues, document system managers' concerns focused

on formatting, distributing, coordinating, and maintaining an automated revision system.

CONSTRAINTS AFFECTING ON-LINE SYSTEMS

Key factors which constrain the development, delivery, and use of an on-line system include computer hardware characteristics and availability and software features offered by the on-line system and carried by the hardware. Common hardware factors which limit an on-line system include: inadequate terminal characteristics, inadequate memory space, restricted disk storage, and the presence of a mixture of computer hardware available throughout an organization. An on-line system may be further constrained if it lacks windowing, multi-task processing, network capabilities, and data management facilities. The PNL on-line system developers and managers are faced at present with a mixture of computer hardware, inadequate computer function, lack of complete computer station network connections, lack of system-wide windowing software, and the challenge of providing comprehensive data management support.

PHASED IMPLEMENTATION

Recommendations from experts urge the adoption of a systems development approach to planning, designing, implementing, testing and evaluating, and revising an on-line system. In addition to these recommendations, PNL staff asked for a phased approach to improving the manual system beginning with changes to the current print manual system. PNL staff members identified a five-phase implementation plan:

1. add supplemental reference materials to the print manual system
2. translate key manuals to an on-line system
3. test and evaluate the fielded on-line manuals
4. implement manual-wide on-line indexing and cross-referencing capabilities,
5. institute a full on-line system with automatic revision, version control, referencing, search, etc.

The phased approach and attention paid to improving the current manual and manual management system are founded in the premise that an on-line manual system's primary task is to meet users' basic needs rather than to offer a system packed with features which often go unused. A key factor in delivering a system which meets users' basic needs is conducting a test and evaluation prior to full system definition and delivery.

REMAINING ISSUES AND CONCERNS

Information gained from the literature review, focus group, interviews, and survey identified a number of issues which raise important questions even though they were not reflected consistently in the results from each activity. Answers to the questions listed below will impact PNL's on-line system definition, use, and maintenance.

- what will be the relationship between the print and on-line manuals
- how will the on-line system be implemented
- to what degree will employees be held responsible for information contained in an on-line system through which they will have access to the full range of manual contents
- how will print copies of on-line manual text be controlled
- how will revisions be distributed to ensure users' knowledge of changes in policies, procedures, and practices
- who will maintain the on-line system
- how will the system be funded, and
- how will users' obtain the necessary computer hardware and software to enable use of an on-line system?

The following reports of each activity provide detailed information about the major findings consistent throughout the activities, dominant topics which appear in the technical communications literature, specific concerns and recommendations of PNL staff, data about PNL manual use, and computer hardware and software support available to PNL manual users.

ORGANIZATION OF THE REPORT

This report summarizes information gathered from each of the activities identified in the previous section. The information from each activity is discussed in a separate section and includes a brief statement of the implications, issues, and/or questions raised, and recommendations where appropriate.

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1.0 ON-LINE MANUALS LITERATURE REVIEW

1.1 INTRODUCTION

This review concentrates on the characteristics of on-line documentation systems which pertain directly to on-line manuals. The on-line documentation literature focuses heavily on the importance of ensuring that the system satisfies the needs of the users. The on-line documentation literature also stresses the importance of examining the suitability of translating particular print material to electronic media. A number of related human-computer interface issues point to specific text retrieval information system (TRIS) features essential to user satisfaction. On-line maintenance, revision, and writing style have also emerged as important text retrieval system issues. In addition, the literature discusses problems associated with on-line documentation and recommends strongly a purposeful test and evaluation process as part of the development process.

The summary omits discussion of the technical software and hardware issues surrounding on-line documentation which, while important, are beyond the scope of this activity. Excellent technical information about software and hardware development and delivery can be found in a variety of sources such as Horton's (1990) Designing and Writing Online Documentation and in the capabilities criteria developed for PNL's on-line manuals by IS. Further, the summary also omits a discussion of experimental research and development relevant to on-line documentation. As basic on-line manual questions are answered, attention might be turned to such exciting experimental and development research as:

- artificial intelligence systems which recognize the type of help needed (Fisher, et al, 1985)
- mixed media presentations of information (Christodoulakis, et.al., 1986)
- hypertext document browsers (Conklin, 1987)

The literature reviewed below focuses on basic on-line documentation issues and problems. One of the first basic questions that must be answered prior to translating documents to an on-line system, is whether the documents

are appropriate for on-line format.

1.2 DOCUMENT APPROPRIATENESS FOR ON-LINE MEDIA

Document types vary in their appropriateness for on-line presentation. Horton (1990) identified the following types of documents, among others, as suitable for on-line presentation because they are enhanced by the speed, storage, and display capabilities of the on-line medium:

- documents that contain urgent information
- documents that evolve, i.e., undergo frequent updating or revision
- documents that contain interrelated information, and
- documents that are large reference works.

On-line documentation allows for immediate distribution of information and can reduce time and costs accrued from printing and distribution significantly. Time-critical information such as procedure changes and safety warnings and cautions increase the value of placing the document on-line.

Documents that undergo frequent revision are also prime candidates for on-line presentation. They avoid the tedious paper collating, inserting, and removing required for updating print documents. On-line documents also avoid the potential loss of information due to losing pages bound in loose-leaf notebooks (Terzich, 1988). In addition, on-line document users can be assured of accessing the latest version of a document.

On-line documents carry the further and significant potential benefit of helping users find answers to complex questions by linking many pieces of separate information within a document and among separate documents. Placing highly cross-referenced material on-line has the following advantages:

- the computer can maintain the cross-references as the documents are revised
- the computer can retrieve the cross-referenced material, thereby reducing the time spent searching through multiple documents, and

- the computer can search numerous documents for patterns of words in the absence of explicit references (Horton, 1990).

These capabilities rely heavily, of course, on the explicit representation of the interrelationships within the computer software.

Significant benefits can also be gained by placing sets of related documents on-line. Within sets of documents, information is often duplicated repeatedly. On-line documentation addresses these issues in the following ways:

- Duplicate material occurs in one location and the changes to that information are reflected or attached to the information throughout the suite of documents.
- Different documents or sections of documents can be displayed simultaneously.
- The reader can switch easily from document to document.

While many documents are suitable for on-line presentation, other types of documents are better suited to a print medium. Documents better suited to print presentation include the following:

- documents that require lengthy and/or critical reading
- documents needed away from the computer
- legal documents
- documents for non-computer users

Katzin (1984) asserted that documents which require careful or lengthy review, overviews, conceptual topics, or in-depth policy statements are more suited to print format or "away from office" reading. Further, tasks which require using technical documents away from a computer are ill-suited for on-line presentation. Legal issues surrounding on-line presentation of legal documents remain unresolved. For the present, experts recommend retaining legal documents in print format and consulting an attorney prior to placing legal documents on-line. Lastly, on-line systems are weakened by inadequate hardware and software support and by a user population who opposes computer use.

1.3 RELATIONSHIP BETWEEN ON-LINE AND PRINT DOCUMENTATION

Current trends in on-line implementation show that the transition from paper to on-line documentation will continue to be gradual and show considerable overlap. It is also anticipated, however, that on-line documentation will increase and be accompanied by a reliance on on-line documentation as an information resource. Prophecies of an "paperless office" or "paperless society" seem countered by forecasts in which paper retains an important, but changed role (Glushko and Bianchi, 1982). The reason for this may be that people who have been reared in a paper-dominant society, simply prefer to use both media (Raymond and Tompa, 1988). Indeed, responses from people attending the 32nd International Technical Communication Conference showed that they did not want on-line information to function as a complete replacement for printed information (Fisher, et al., 1987). On-line and print documentation may co-exist in a variety of relationships. On-going research and development projects are investigating a variety of relationships including: delivering all documentation on-line with a subset of material delivered in print form, delivering all documentation on-line with no print facility, or delivering fully overlapping on-line and print systems (Walker, 1987).

A number of possible relationships exist even in systems in which documentation is delivered in both on-line and print systems. In an *independent* relationship, the systems are developed and maintained separately. The arrangement is costly and may cause readers' difficulty due to inconsistencies in terminology and information treatment. A *page facsimile* arrangement uses the printed documentation as a base that is simply displayed on-line. This arrangement limits development costs, but may pose on-screen readability problems. *Shared source or data base* systems use one information source, but organize the information in different ways according to the specific characteristics of on-line and print delivery. This approach requires a little more work for writers than preparation for paper delivery alone, but allows readers to choose the media depending of their preference or task demands (Walker, 1987).

1.4 PRINTING

A popular notion holds that on-line systems eliminate the need for paper documentation. In practice, on-line systems usually result in an increase in the amount of paper documentation produced. An interesting case study illustrates one pattern of on-line and paper documentation. The DOCUMENT system used at Lawrence Livermore National Laboratory allows users to view documents on screen and print on a local printer. During the first two years of operation, users printed over 100 pages for every page viewed on screen (Girill and Luk, 1983). Over the next nine years, the print ratio dropped steadily to 17 pages printed for every screen viewed (Girill and Luk, 1987). This case presents a widely noted pattern of accelerated paper use immediately after implementing an on-line system followed by a drop in use, and ending at a stabilized level of paper use higher than that existing prior to implementing the on-line system. Instead of interpreting this pattern as showing the weaknesses of on-line systems, Horton proposed that it stresses the function of on-line systems as information location and document selection tools (1990).

1.5 EASE OF USE

While current and emerging information retrieval technology offer significant promise of managing information (searching, collating, revising), the potential will not be used unless the system offers users a convenient, quick, and accurate tool for using the information. Users of Control Data Corporation's CONTEXT system reported in written and phone surveys that they used the on-line manuals "mainly for quick look-up of information with which they were already somewhat familiar" (Hasslein, 1986). Indeed, experts in the field state that on-line documentation is rarely used, is used only to get a job done, or is used only as a last resort (Hackos, 1991, Grice, 1989). In order to counteract these potential use patterns, the on-line system developers must find ways to make the system useful to those who will use it, easy to use by the projected user population, and be attractive as well.

Grice identified six factors which impact use of on-line information. The factors include:

- familiarity of the subject matter, presentation and conventions
- support of users' tasks
- ease of learning and speed of becoming productive on the system
- navigability to ensure easy location of information and movement within the system, and
- ease of modification allowing users to customize and adapt the system to their needs appearance (1989, p.34).

1.5.1 Familiarity

Use of an on-line system is made easier when the conventions and traditions of other computer systems and print media are adapted for the on-line system. Care must be taken, however, in too closely mirroring the characteristics of print media. This can result in users ignoring the potential of the automated system through the paradigm of print media. A number of guidelines have been developed to help developers of on-line systems design consistent applications across the computing environment, e.g., IBM's Common User Access (CUA).

1.5.2 Support Tasks

On-line document systems must provide support for the tasks users are required to perform in the order in which they are performed and/or as they are requested. If the system asks users to move through a series of steps they would not ordinarily use, the system will likely go unused. On-line system users need to be able to retrieve the information they want, read it, manipulate it, and leave it easily.

1.5.3 Ease of Learning

The initial ease of using an on-line system can produce a lasting first-impression of the system. Even if the system is easy to use once people learn it, when initial use is confusing or time-consuming, users may never adopt the system. The system must allow users to perform the tasks they need and to

ignore the other features. The HELP function is a critical element of any system. It must itself be easy to learn and provide the desired help easily.

1.5.4 Navigability

An on-line system presents new problems of navigation and understanding location within a document. Users of a print document may navigate and locate information by recalling visual cues, position in the full document or, the pattern of typesetting or headings, by finding their highlighting of specific text; by placing their fingers in multiple document sections, or by placing bookmarks in important places. These techniques apply less well to an electronic format.

A variety of on-line aids are available that tell users where they are, where they have been, where they might go next, and how to leave their current location. Designating navigation function keys, e.g., ESCAPE, QUIT, RETURN, lessens the recall requirements for operating the system. Guideposts that mark the relative position in the information help users maintain a reference point, e.g., a "thermometer" that indicates relative position. The usefulness of navigation aids must be linked directly to the structure of the on-line document. For example, while bookmark position indicators are meaningful in system equivalent to an automatic library of booklike text, alternative position indicators must be sought for systems which do not replicate an automatic library of booklike text.

1.6 READABILITY

For most purposes, people prefer reading text longer than a paragraph in print form (Horton, 1990; Walker, 1987). In 1987, Shneiderman showed that reading text on-line is slower and less accurate than reading print text. Shneiderman's findings support other experts' recommendations that text which requires critical reading, deals with conceptual issues, or requires detailed study better fits a print format (Horton, 1990). Further readability research has shown that extended reading of on-screen text can result in increased eyestrain (Rockley, 1987). Rockley's and Shneiderman's research helps to explain why people use on-line systems predominantly to scan and retrieve

information.

Prior to making a decision to read text on-line or to print a paper copy of the text, users must find the desired information. Raymond and Tompa (1988) reported that users of the Online English Dictionary used the on-line version to find words and then switched to the paper version for reading. People have learned efficient ways to find information within lengthy documents; in addition to other strategies, they scan for keywords, look for visual cues, and attend to location within the entire document. On-line documentation developers face the challenge of providing users with a fast information location strategy which takes advantage of well-learned patterns (Horton, 1990).

1.6.1 Ease of Modification

Some degree of control over on-line information can alter users perception of the system and effect their use of the information (Grice, 1989). The system might allow users to rearrange the order of menu items, change the names of commands, add synonyms, change the weighting on the search list, or modify the text of message. Changes initiated by users must not alter the basic system, however.

1.6.2 Appearance

The appearance of on-line information has received considerable research attention. Common research variables include type font and size, text density, color, and "special effects" such as highlighting and the use of sound. While the appearance of information contributes to a system's ease of use and overall user impression, it may not be as important as the factors described above. Type font and type size research suggests that type size and line length are not a major factors, and that mixed case type is preferred (Fryser and Sterling, 1984). On-line experts recommend caution in using color. They cite its strengths in calling attention to system functions and features and its weaknesses related to color blindness, suitable foreground-background distinction, and overuse of color detracting from the color convention or symbolic meaning. (Grice, 1989).

1.7 USER INTERACTION AND INTERFACE

A user-friendly human-computer interface (HCI) is essential to the success of an on-line document system. While a great deal of HCI research has been conducted on a wide variety of topics, this discussion focuses solely on HCI topics identified in the on-line document literature.

1.7.1 Speed and Reliability

The two most important qualities of software in a text retrieval system are speed and reliability (Walker, 1987). Speed of response effects the use of a system. Even for systems whose users evaluate the interface highly, a slow on-line help function may result in the system not being used (Seybold, 1981). A target time interval of 2 to 10 seconds has been proposed for the interval between requesting information and its first appearance on screen although the faster it appears the better (Shneiderman, 1984).

An on-line system must perform reliably for people to use it confidently. Reliability for an on-line manuals system would include complete assurance that the system:

- contains all current revisions
- contains no outdated information
- reports the absence of information rather than doing nothing or reporting an error
- locates full sets of relevant topics.

When users discover inconsistencies, omissions, and errors, they stop trusting the search mechanism and may stop using the system.

1.7.2 Searching

The retrieval of information from the data base is a central issue identified in the on-line documentation literature. Researchers in information retrieval study ways of accessing information through choosing keywords and classifying topics (Salton, 1983). A number of different means of accessing or searching information have been used: direct command, menu systems; tree-structured document readers; and index-oriented systems (Walker,

1987). In their examination of candidate TRIS products, PNL's information systems experts specified a number of search capabilities including keyword and boolean querying functions, an on-line thesaurus, a facility for developing "concept-based" searches, and returning search results in a relevancy ranking (Appendix A).

1.7.3 Pacing

Visibility of displayed information is an important characteristic of a user-friendly system. Providing users control over when information appears, where it appears, and when it disappears from the screen allows users to manage the pace of the information flow (Walker, 1987).

1.7.4 Flexibility

Flexibility is important in offering users the ability to change focus in their search for information. Walker identified four important facilities which simplify users' operation of an on-line system:

- moving from one topic to another without exiting the program
- marking the user's position in another platform for easy return
- constructing a "history" of items a user has been accessing, and
- returning to the original context in which the user was working.

1.8 CONSTRAINTS

A variety of factors, human, hardware and software compatibility, availability, and of course budget and schedule constrain on-line documentation development and delivery choices. These factors will be discussed separately as user, hardware, and software constraints.

1.8.1 Hardware Factors

Terminal characteristics, memory space, and disk storage impact the options for an on-line system. The terminals used in an organization may seriously constrain an on-line system through limited screen size, function key restrictions, and time-consuming screen re-display. In addition, the mixture of hardware accumulated over time within a single organization may

include equipment incapable of accommodating the on-line system. Walker (1987) recommended large screen bitmap terminals as the delivery system of choice, but also stated that user control and flexibility can be attained through strong use of arrow tabbing keys for positioning. Walker also recommended designing the on-line system to accommodate the critical functional requirements even though an organization may have a good deal of hardware incapable of holding the system. In other words, the system should not be designed to accommodate the least common denominator.

The lack of sufficient memory space or a network server can seriously constrain the delivery of an on-line system. If the on-line system cannot be supported by a LAN, the organization must be prepared to ensure that disks available are adequate in both size and performance.

1.8.2 Software Factors

An on-line system will be constrained in design and use if it lacks windowing, multi-processing, networking, and data management facilities. Without a windowing facility, users cannot view their document and application simultaneously or compare a number of related portions of text. Because document use usually requires switching between the documents and an application, it is particularly important that users not lose their working context in either of the sources with which they are working. Using a server approach reduces the constraints inherent in a disk storage system. Lastly, any on-line system will be severely constrained if the document data base is not maintained consistently (Horton, 1990).

1.8.3 Human Factors

As in all fields and applications, human variability and differing task requirements complicate or constrain technology design. The variation in computer experience places demands on the on-line system to accommodate novice to expert computer users. Users' task goals suggest the facility to support direct questions, task-oriented searching, and undirected browsing. People differ also in their learning style. Some users need a system which allows

them to progress in a controlled manner through small ordered steps Carroll, 1984). Others want to explore with few constraints and are quite willing to find dead ends and return to a starting point.

The characteristics of the tasks users perform in conjunction with an on-line system place additional demands on the system's design. People using an on-line system are often:

- hurried
- focused on another task, i.e., using the on-line manual is not the goal, and
- confused, annoyed, or frustrated because they are forced to stop what they are doing and switch to an information location task

While these factors are not directly related to software functions, the system design must respect these operating issues in order to ensure use of the on-line system (Walker, 1987).

1.9 RESEARCH, TEST, AND EVALUATION OF THE ON-LINE SYSTEM

In order to select, use, and manage information tools wisely, answers must be obtained to basic questions prior to design, during design testing, and after implementation. Experts in the field have recommended a series of research, test, and evaluation steps to provide a solid basis for designing an on-line system:

- audience analysis (Caernarven-Smith, 1983)
- task analysis (Ward, 1987)
- product analysis (Grice, 1989), and
- project analysis (Caernarven-Smith, 1988).

The most basic question asks, Who are the users? Once the audience analysis has been completed, a second set of questions must be answered: What do users want? and What do users need? During the task analysis, Ward (1987) suggested defining the tasks users will perform, the environment in which they work, and the information required to perform their work. Product analysis is

a critical step in matching the audience, task, and product. The product analysis should include performing competitive evaluations on related information products, identifying and testing the equipment available in the organization to support an on-line system, and conducting tests to determine how well people like the on-line system and how well they can use it (Grice, 1989). While testing is often perceived to be prohibitively expensive, it can be conducted in ways which reduce cost and provide the information essential to developing an effective system which will be used by the intended workforce. Grice (1989) recommended an iterative testing which aims to improve, not to test for statistical results. A number of informal means can be used carefully to analyze the project and provide feedback to those responsible for redesigning and delivering the on-line system including telephone surveys, short print surveys, audience meetings (focus group and nominal group technique), and observations of user-system interaction in the users' work environment (Grice, 1989).

2.0 ON-LINE MANUAL FOCUS GROUP RESULTS

2.1 INTRODUCTION

The Quality Program office at Pacific Northwest Laboratory (PNL) requested that staff in the Technology Planning and Analysis Center (TPAC) explore the issues, benefits, detriments, technological impacts and practical implications of automating manuals and other PNL documentation. The purpose of this tasking was to gather information to be used in the on-line manual decision making process.

As part of TPAC's effort to explore the issue of on-line documentation and to provide information for construction of open-ended interviews, a focus group consisting of personnel interested in the topic of on-line documentation met on June 25, 1991 to identify the advantages and disadvantages of on-line documentation, and to characterize a useful automated system. The twelve members of the group represented a cross section of PNL personnel and included representatives from areas such as Lab Safety, Quality Programs, Utility Operations and Human Factors.

The focus group was tasked with discussing the following question:

- why put PNL's manual system on-line
- what do we want the on-line system to do and what are the constraints on that system, and
- how should an on-line system and print manuals co-exist?

The summary of the results of their discussion on each of these questions is provided in the following paragraphs. A detailed description of the focus group's composition with details of their discussions is provided in the meeting notes which are provided as Appendix(?).

Why put PNL's manual system on-line? Several participants stated their belief that on-line documentation could be a more efficient system for users of documents, and also for the people responsible for generating documents. They felt that an on-line system has the potential for impacting the use of manuals, and such a system can have the capability for providing an audit

trail of the use of the documents. Others felt that an automated system should also have the capability of capturing the decision making rational for the interpretations that are made of DOE orders and the way that orders are reflected in manuals.

Implications: An ideal automated documentation system would be a powerful tool. It would encourage use of documents, capture decision making rational and would provide audit trails.

What should an on-line system be able to do? Group members quickly identified at least two types of users whose expectations need to be addressed in any description of a desirable on-line system. One type of user they identified are the people who receive the manuals and use them for guidance and information. A second type that was identified are the people responsible for creating documents and updating manuals.

Participants described the probable requirements of on-line system from a manual users perspective as including: a user friendly system; a system that solved more problems than it created; and a system capable of operating on a mixed software/hardware platform. In addition, several participants envisioned an optimal scenario that would include an expert system.

When participants described the requirements of document generators, they identified several capability features:

- document control capability
- verification control
- capability for peer review of documents
- provide change notification to users, and
- distribution controls, status and checks.

As participants discussed the requirements of document users and generators, they also recognized the need for system maintainers to ensure a reliably functioning system.

Implications: An automated system will most likely have multiple kinds of users and must be capable of meeting primary needs identified by each kind of user. The complexity of multiple kinds of users and multiple requirements indicates that cost effectiveness of an on-line system should be evaluated along with capability to meet user requirements.

What constraints make on-line manual systems less desirable? The most frequently mentioned constraints dealt with administrative/management issues rather than technical issues. Among these constraints were the cost of a system, lab-wide availability of on-line documentation, multiple platforms, and the effort required to transfer current manual operations to on-line documents.

Implications: There are many issues that must be addressed before an on-line system can become a reality. These issues spread across organizations and cannot be resolved within a single department or center. Resolution of issues will require centralized coordination and tracking of the issues and their resolution.

How should on-line manuals and print manuals co-exist? This question wasn't directly addressed by the participants. Instead, the group chose to focus on "next steps" and on possible scenarios for implementing a test system.

Implications: The focus group participants clearly expressed their interest in further pursuing the possibility of an on-line system. Their enthusiasm and interest provide a starting point for expanding the investigation into the pros and cons related to an automated documentation system.

2.2 CONCLUSION

The consensus at the conclusion of the focus group was that several important issues were identified and that it would be beneficial to continue gathering information on automated systems for manuals. TPAC staff members planned to extend the information gathering process by conducting open-ended interviews with other PNL personnel. The staff planned to use several questions that participants in the focus session identified as a protocol for the interviews. The focus group provided a basis for further, more expanded, investigation of the benefits and issues related to on-line documentation.

3.0 ON-LINE MANUALS INTERVIEW RESULTS

3.1 INTRODUCTION

Interviews are an effective method of generating information about the content and pattern of daily experience. Interviews were particularly well-suited to pursuing the objectives of this task. They carry the unique benefit of being able to encourage promising avenues of discussion, to clarify questions and responses in "real time", to allow respondents to talk without over-specifying the substance of the discussion, and to elicit examples. A protocol based on information from relevant on-line documentation literature, focus group results, and project objectives served as a guide for the interviews (Appendix B).

3.1.1 Interview Protocol

Participants answered questions regarding PNL's current print manual system and a potential PNL on-line manual system. The questions about print manuals focused on four basic areas: 1) reasons for using manuals; 2) patterns of manual use; 3) orientation to the manuals; and 4) manual revisions. The on-line manual questions sought information in three main areas: 1) use of an on-line system, 2) on-line manual revision, and 3) factors which could constrain an automated manual system (Appendix B).

3.2 PRINT MANUAL FINDINGS

3.2.1 Reasons for Using PNL'S Manuals

The PNL staff interviewed reported using the manuals to answer specific policy and procedure questions. The manuals are seldom used to explore a general area of interest. The prime reason for seeking such information is to ensure compliance with all applicable requirements and regulations. For example, managers, supervisors, and project staff need to know the bio-protection guidance. Manuals are also used heavily for policy guidance, e.g., direction for staff appraisals, prescriptions for recording compensation time, etc.

3.2.2 Pattern of Use

Locating information. Participants' responses show that manual users seek information through two primary avenues. They first conduct a quick search of the manual/s. "I can just turn, pull it out, and, boom, I have it!" If that search is unsuccessful, they call someone in the organization asking for either the exact information or the location of the information. Users reported using the table of contents, labelled tab dividers, visual characteristics of the manual's format and text, and place markers ("yellow stickies") to help them search, but limit the time spent using these aides. When the initial manual search does not produce the needed information, particularly when time is limited; users call others for that information. They call colleagues, manual authors, contacts in the related organization/s, and/or support staff. Secretaries not only store manuals in their offices; they functions as resources for particular types of information contained in the manuals as well, "Just ask the secretary, they know these things."

It takes time, however, for technical users to learn the manual contents. A number of respondents cited three years as the period required to learn their manuals. Once they learn the manual content, they use them less often. When they do look for information then, it tends to be specific pieces of information to support knowledge gained through experience.

Implications: Must meet or beat the print system.

Frequency of use. Users reported varied patterns of frequency of use which were determined by the particular manuals and users' roles. Some manuals are used daily while others may only be used once a year. Collectively, manuals are most frequently used on a monthly basis. One person explained this pattern by saying that when you become familiar with a manual, you begin to use it less and less.

Implications: The simplicity of the on-line interface increases in importance in a system in which a number of documents are used infrequently.

Multiple document, multiple section use. Users who are trying to answer a question often seek multiple pieces of information to answer their question from more than one section in a manual or from more than one manual and related document concurrently. They may use a technical manual in conjunction with the policy manual, a number or related manuals, or a manual and a technical handbook. Users also report switching back and forth between sections in a manual comparing information and seeking greater detail. The switching may be supported by attaching paper tags or paper clips or trying to keep places with fingers.

Implications: An on-line system needs to provide the functional equivalent of viewing multiple related sections. In addition, the system should allow users to work in their word processing system and search for and retrieve text from the on-line manual system. Since sections of an on-line system cannot be marked with a "yellow sticky", some functional equivalent of placing a marker in a book or manual would prove useful. This may occur electronically by customizing the information search or tagging the electronic index.

Annotation. While users tag specific parts of their manuals, few report writing annotations in their manuals. In fact, some viewed annotations as potential signals to auditors to look for weaknesses in the manual. This potentially troublesome connotation associated with annotations would apply to both manual and on-line systems.

Implications: An annotation capability is not a high priority item.

Multiple location use. Manuals contain information important for compliance with safety practice and organization policy and practices. In order to comply, users must have access to the information in the manuals. Most manuals were reported to be located either in a person's office, "as close to my desk as possible" or in an adjacent secretary's office. Single location manual use would transfer quite easily to an on-line system carried on compatible computer hardware. PNL staff frequently use their manuals outside of their office space, however. The manuals or copied sections of the manuals are carried to other offices, meeting and conference rooms, and to individuals' homes for a variety of purposes. One manager reported using the policy manual (salary decisions) or other manuals (guidance for calls

inquiring about procedures) at home as often as 3-4 times per week.

Implications: The pattern of multiple location use of print manuals carries implications for an on-line system. Multiple location use for an on-line system may require, for example, hardware support in the form of an overhead computer display for use during meetings. Home use and use in offices not equipped with the LAN may require maintaining a complete dual print and automated system.

3.2.3 Orientation

Participants stated unanimously that they received no orientation to the manuals. Recollections of new hire orientation included being informed that they might receive manuals to perform their job. Some recalled settling in their offices and being told, "Here they are" when they received the manuals associated with their job. The formal orientation to MA-70, Quality Assurance, provides an exception to the pattern.

Participants recommended a required orientation to the manuals which would provide an overview of the system's contents, the content relationship between the manuals, and a brief topical list for each manual.

Implications: Respondents' recommendations for a general introduction to PNL's manual system implies the need for a similar introduction to an on-line system. That orientation might occur as an on-line tutorial required prior to entering the system initially instead of a formal instructor-led class.

3.2.4 Revisions

Respondents described a revision process in which they received changes, inserted or had their secretaries insert revisions into the manuals, and decided how to distribute the information to other staff members. They all stated that the revisions are added to the manuals upon receipt even though recent PNL surveys show that only 58% of PNL's manuals contain all relevant revisions. While some people described the flow of revisions as continual, others reported receiving revisions infrequently.

Respondents cited a variety of other problems in the current manual revision practice. They expressed concern regarding the: lack of currency of the manuals, lack of detail about the revision sources and reasons for the changes, lack of consistency among manuals created by changing something in

one manual without changing related sections in other manuals, a lack of control over printed copies of the revisions, and a lack of clear instructions on how to process the revision.

Implications: The variety of problems cited regarding current print manual revision process points to easy revision solutions such as publishing a list of revisions periodically as well as to complex solutions such as maintaining revision consistency among all manuals.

Currency. Manual revisions signal currency of a manual. A manual may be perceived as being out-of-date when no revisions have been received for a long time or when the revision date seems old. A few individuals reported assembling supplementary files in support of manuals they felt were out-of-date or incomplete. Again, this may create a problem if staff look to the supplemented file as the "best" resource in preference to the manual which is the "official" resource. Manuals users also expressed a desire to know the status of recent and planned revisions affecting their manuals.

Implications: The revision system needs to assure users of its currency the manuals in order role as primary source of policy and correct practice and to avoid the creation of information surrogates which have no formal review for currency. Concerns regarding currency of old sections might be addressed by recording an approval date from a scheduled manual review.

Revision source and reason. Once the revisions are received and inserted into a manual, managers must decide how to disseminate the essential information from the revision. Some managers felt they lacked sufficient information to explain to their co-workers the reason for the changes or the source of the changes and recommended that such information be included in the revision distribution.

Implications: Users desire additional information about revisions which affect their work. Additional information might include a brief statement of the reasons for the change, source of the change (DOE, state regulation or legislation, PNL policy), and a point of contact for further questions.

Consistency. Participants also expressed concern about the impact of revision in one manual on the consistency of information between PNL manuals. In cases where the manuals contain inconsistent or contradictory information,

staff are vulnerable to being out-of-compliance and potentially of performing unsafe practices. For example, the requirement to revise the Lab Record Books (LRBs) was extracted specifically from the polivy manual, but the requirement remained in a remote section of the records management manual. In this case, auditors detected the discrepancy and recorded it as a finding.

Implications: The potential conflicts in information among manuals which occurs due to inconsistent revisions among manual raises issues about personal responsibility for information contained throughout the manual system, a difficult task in a print manual system. The potential inconsistencies also point toward the need for additional attention to revision management including the assessment of who needs what information.

Uncontrolled copies. The revision changes are communicated frequently to impacted employees via memo or discussions in meetings. For discussion purposes, copies of the revision and/or related sections of the manual may be distributed to group members. While this allows everyone to review the revision, it also creates the potential problem of distributing uncontrolled manual copies which may subsequently be used as the guide to procedure after they are outdated.

Individuals concerned with uncontrolled manual copies recommended requiring stamping the date and the words "uncontrolled copy" on all duplicated manual text.

Implications: An on-line system needs to allow users to access information about automatically inserted revisions. Users want information about cross-manual impacts, planned revisions, and a recent history of revisions per manual. They also want background information about the revisions. Concerns for document control apply to an on-line system as well as the current print system and call for an automatic date stamping and labelling "uncontrolled copy" each page printed from the on-line system.

A number of recipients recommended distributing a printed list of all revisions for a given period, e.g, quarterly or bi-annually. The list could also include planned revisions, and a list of revisions in process. On-line, this might be handled by highlighting sections involved in the revision process.

3.3 ON-LINE MANUAL FINDINGS

The on-line section of the interviews focused on identifying desired on-line manual features, identifying preferred search methods, describing preferred interface characteristics, describing the maintenance requirements, identifying factors which might constrain an on-line system at PNL, and discussing an on-line manuals revision process. The results discussed below also present additional issues that arose during the course of the interviews.

3.3.1 Ease of Use

Ease of use emerged as one of the primary themes of the on-line manuals discussions. Interviewees stated strongly that the system must operate as easily as PNL's Popfon software. A number of Popfon characteristics were cited as advantages. Information can be found quickly and accurately. If incorrect information is entered, the user can immediately and easily redirect the search. Popfon can be used without exiting current screen or program. It can be used virtually without prior instruction, i.e., its operation is self-evident. Respondents clearly indicated that they prefer a system that would require minimal learning, "Only make me learn how to operate the system to get what I want--not extra features of information." Popfon saves time; it takes less time to use the electronic phone directory than it does to find the information in hard copy. Again, the statement of one manual user presents the challenge for the on-line system, it must "Meet or Beat" current practice. If the on-line system could meet these criteria, its chances of being used would be significantly increased.

Implications: The demands for an on-line system to be easy to use, quick to use, require minimal learning, and provide accurate information point to the importance of a number of specific features such as multiple platforms, an interface which resembles Popfon, and ease of correction.

3.3.2 Preferred Features

Participants were asked to identify beneficial features of an on-line manual system from a list generated from a focus group session conducted earlier and from on-line documentation literature (Appendix C). The following discussion reflects the most highly preferred features.

Comprehensive index. Respondents unanimously identified a comprehensive index as a highly desired feature of an automated system.

Implications: The on-line system selected and/or developed by PNL needs to provide a comprehensive index to highly used manuals and associated references. Initially, the index might occur as a topical index provided in a print medium.

Cross-reference. Manual users report frustration in looking for additional sources beyond the set of A manuals. They want to know in which other documents a particular topic is discussed.

Implications: The on-line manual system should provide direction to additional sources of information within the manual system and in support documents. The automated cross-reference may be offered in a simple form including titles of documents or major sections or be offered as a comprehensive cross-reference. As a first step, a basic cross-reference might be offered in print format identifying linked sources of information.

Multiple platforms. Multiple platforms emerged as a dominant feature preferred for an on-line system. Multiple platforms allow users to maintain their current screen and program while they simultaneously work in another program, e.g., users can apply a word-processing program and access electronic mail without exiting either program. Multiple platforms support the type of common use described as switching back and forth within a manual and searching between manuals for information while applying a separate software program.

Implications: The on-line manual system should provide users with the ability to access and operate in multiple platforms.

Printing and moving text. Users described advantages and concerns about the ability to print and move text from the on-line manuals. The responses showed a consensus in the requirement for a print capability linked closely with a desire to avoid reading more than short paragraphs on screen. Cited benefits of printing selected portions of text included easier readability, highlighting or annotating for discussion purposes and easier referral in the future, and the ease of transporting to other locations for meetings. Users also reported a desire to select text from the on-line manuals and move it into a word processing file.

Concerns about printing and moving text from the on-line system include the increased volume of paper used for printing and the control of documents. A number of respondents recommended requiring the automatic identification of each printed or moved paragraph, page, or section with the revision date, date copied, and label "uncontrolled copy".

Implications: Before an on-line system is implemented, use policies regarding document control and print volume must be carefully considered.

Search. Most of the staff interviewed had difficulty identifying either positive or negative search features. This may be due to participants having limited experience working with an automated document system. Another reason may be the difficulty in describing positive interface features because effective interfaces tend to become transparent, i.e., we learn the interface and, unless it interferes with our work, it becomes an unconscious aspect of computer work.

Individual responses pointed to potential problems related to text search. Keyword searches are complicated when objects and processes are described using different words. Another concern focused on the potential flood of information resulting from a search and the resulting time required to select desired items from the large volume of feedback.

Implications: Word use differences will remain in the PNL manual system since the manuals are developed in different organizations and written by different authors. An on-line thesaurus would allow users to explore related search terms and counter the threat of missing the desired information due to terminology differences. In addition, the thesaurus must be modifiable the system administrators to accommodate changes in terminology. The system should also permit users to halt search feedback. Users may want to cancel what appears to be an unproductive search or to stop the feedback as soon as they get the information or references they sought.

3.3.3 On-Line Constraints

Hardware and software support. An on-line system requires computer hardware and software support. Users responses showed a mixed pattern of computer equipment, LAN availability, and software use. Due to the mix of computer equipment, the text retrieval software must run on a wide range of equipment and accommodate a variety of software (Appendix A).

Implications: Since the system must be supported on a local area network (LAN) based and manual users are not fully network supported, additional funds will be required to support delivery of the on-line system in individual offices and possibly in conference rooms accompanied by an overhead computer display unit. While the system selected or designed must run on the majority of PNL equipment, undoubtedly some of the computers used by manual holders will not accommodate a full text retrieval system, e.g., systems below the IBM-AT. The Text Retrieval System Specifications developed by PNL's Information Services experts identify hardware and software requirements to support an on-line manual system (Appendix A).

Financial support. A number of individuals reported concern about the cost of adopting and maintaining an on-line system. Costs would accrue from purchasing existing software, purchasing computers to accommodate the full-text retrieval system, in adding network stations, and increasing personnel to expand, customize the purchased software, and maintain the system.

A significant amount of staff expressed concern over the balance of cost and benefit to users. Research staff reported skepticism about funding an on-line program through assessments to their research projects for a system which may not improve demonstrably the efficiency of their work. The question was stated by one researcher as "What is the role of the on-line manual in the quality of life of PNL employees [technical scientist and engineering staff]?" This is a sensitive issue that should not be underestimated as contributing potentially to the existing antagonism between the research staff and support staff at PNL regarding funding.

Implications: Concerns over financing an on-line system and the resulting demonstrable benefit point again to the need for the system ensure that users can find accurate information as or more easily than in the existing print system to warrant the expense of an on-line system in the users perspective. Two additional questions should be answered:
1. How much more quickly and easily must users be able to access

accurate information to warrant an on-line system; and 2. How will on-line manuals operation and use be measured to determine effectiveness prior to full adoption of a system?

3.3.4 Revisions

Managers, scientists and engineers, and technical staff voiced a number of questions about automatic revisions within an on-line system. The questions were directed at the following issues:

- retaining historical records of PNL's manuals
- ensuring currency of the manuals
- ensuring users' awareness of changes and revision content
- identifying cross-manual impacts
- paying for staffing for revision processing.

Staff from document control and management focused on formatting, distributing, and maintaining an automated revision system. They recommended two separate, but related functions required to manage the automatic revision process, document control or configuration management and change control. The document control functions would format revisions, purge out-dated information, feed the historical file, and monitor revision distribution. The suggested change control board suggested would analyze manual changes and analyze impacts across the other manuals, horizontal integration, and propose appropriate adjustments to impacted manuals. It was suggested that these tasks could be accomplished by the addition of two full-time equivalent staff.

Implications: The on-line revision capability serves two different sets of performance criteria, revision management and technical manual use. Both groups need to be able to access revision information for their task without interacting with the fuller range of revision options.

3.3.5 Evolutionary Adoption

Respondents discussed a number of manual system changes that range between supplementing the existing print documents and instituting an on-line full-text retrieval and automatic revision system. One proposed option called for a stand alone on-line index which would identify the location of

information across the manual system. Another option would involve selecting key manuals, identified by risk and management priority, to place on-line with full search, retrieval, print, and revision features. The staff interviewed placed heavy emphasis on carefully assessing the performance, benefits, and cost, of a number of options prior to the adoption of a complete on-line system.

Implications: Users concern about the benefits and costs of an on-line system and their proposals for phased adoption of an on-line system suggest the need for a purposeful test and evaluation of a phased implementation of the selected on-line system.

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APPENDIX A

INTERVIEW PROTOCOL

PNL ONLINE DOCUMENTATION

Introduction of project and what information is being sought through the interview.

User Profile:

- . Work group: _____
- . Manual/s used: _____

- . Type of work: _____

PRINT MANUALS

1. Type of use (How and Why)

- . Please describe how you use your manual.
- . Why do you use the manual/s? (For what reasons, e.g., revisions, look for necessary information, PM, etc.)
- . What type of information do you look for in your manual? (Procedural, safety, policy, updates)
- . Are there specific part/s of the manual that you use primarily?
If so, what parts and why?
- . What parts or aspects of the manual/s make them easy to use?
- . What parts or aspects make them difficult to use?
- . With what parts of the manual/s are you most satisfied?
- . What would you most like to see change?
- . Do you need and/or use other materials print or online when you are using the manual/s?
If so,
 - . What kind of other materials/information do you need when you are using the manual/s? (phone book, other manuals, other references)
 - . How do you use them together?

2. Frequency of use

- . How often do you use your manual/s?
- . Do you use them on a regular basis?
If not,

- . How would you characterize the pattern of use related to frequency?
3. Location of information
- . How do you find information in the manual/s?
(Table of contents, index, section tabs, just know what part to use, last 10 pages, etc.)
 - . Is it easy to find the information you want?
If so,
 - . Why?
 - . If not,
 - . What do you find frustrating about locating information in the manual/s?
 - . Would you make it easier to use?
 - . What do you do when you cannot find the needed information?
4. Completeness
- . Is there enough detail in the current manuals to make them useful?
If not,
 - . What should be added?
5. Accessibility/location of manuals
- . Where do you keep your manuals?
 - . How far away is your primary work area from the manual?
 - . Do you ever need to have the actual section or page with you while you are working?
If so,
 - . Do you carry the manual, copy a section or page, etc.?
6. Annotations/personalization
- . Do you write in your manual?
If so,
 - . What kinds of things do you enter?
 - . How much annotating do you do?
 - . How do you use the annotations?
7. Orientation to print manuals
- . Have you received any orientation/formal introduction/or even directed OJT introduction to the PNL manual/s you use?
If so,

- . Describe the orientation/introduction.
- . What else would have been helpful?

If not,

- . Would an introduction be helpful?
- . What should be included in an orientation to manuals?

8. Revisions

- . How does your manual get revised?
 - . By what process?
 - . How frequently?
 - . For what reasons?
 - . What is the impact on you and your group?
- . Are you confident that the manuals you now have contain the most recent revisions/ are the most recent copies?
- . Who updates you manual?
- . Do you read the updates?
 - If no,
 - . Why?
 - . What things would make it easier fo you to update your manuals?
- . How should the manual revision process be changed?

ONLINE MANUALS

1. Computer Use

- . What kind/s of computer/s do you use in your work?
- . What kind/s of software applications do you use most frequently?
- . If you work in more than one office or laboratory space, what computers are available for you to use?

2. Information format preferences

- . For what types of tasks do you prefer to work with print materials?
 - . What are the advantages?
- . For what types of tasks do you prefer to work with your computer?
 - . What do you think are the advantages?

3. Online documentation experience and references

Online system

Developer

4. Online manual advantages

- . What features of an online manual system were/might be helpful?
- . Which of these features are the most important?
- . Why?
- . What features of the online system were helpful, unnecessary, or disruptive?
- . Why?
- . What features are MUSTS for an effective PNL online manual system?
- . Why?
- . What features are NICE, but NOT NECESSARY to PNL?
- . Why?
- . What features SHOULD BE OMITTED in a PNL system?
- . Why?

5. Reaction to/assessment of features/capabilities identified in the focus group and literature.

- cross-referencing
- multiple platforms
- comprehensive indexing
- reference to B manuals and their information
- reference to other source materials
- reference to human resources (staff)
- decision-tracking
- electronic revision/updating
- conceptual search
- annotation
- bulletin board notice of revision/policies
- revision validation & verification
- expert query of user
-
-

6. Reaction to an identification of constraints

- . What factors constrain or limit an online system?
How do they constrain?
Are there ways to compensate for those restraints?
- . How much change in hardware would be required to deliver and support an online manual system?

7. Locating information/search techniques

- . What types of computer search techniques have you used?
- . What search techniques do you think are the easiest to use?
Why?
- . What search techniques do you think are difficult to use?
Why?
- . What search technique do you think would be most useful in locating information in an online manual system?
- . How might such a technique operate?
- . Do you have software examples of effective search techniques?

8. Interface

- . Describe the specific features of the best/easiest online document or regular computer interface you have used?
- . What makes these features so important?
- . What features/processes should be avoided?
Why?

9. Maintenance

- . How might the maintenance system operate?
- . What are the basic requirements for maintaining an online system?
- . How within the PNL organization is most appropriate to maintain the system?

10. Revision

- . How should electronic updating be conducted using an online document such as PNL's manuals?
- . What sort of technology is required?
- . What sort of support personnel would be required?

APPENDIX B

PREFERRED ON-LINE FEATURES

PREFERRED ON-LINE FEATURES OR CAPABILITIES

- Cross-referencing (other manuals)
- Multiple platforms
- Comprehensive indexing
- Reference to B manuals and their information
- Reference to other sources (e.g., staff list, PM Handbook)
- Decision-tracking
- Electronic revision/updating
- Conceptual search
- Annotation
- Bulletin board notice of revision/policies
- Expert query
- Revision Validation and verification
- Peer review of documents
- Distribution control

END

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