NUREG–1394
Rev. 1

Emergency Response Data System (ERDS) Implementation

U.S. Nuclear Regulatory Commission

Office for Analysis and Evaluation of Operational Data

J. Jolicoeur

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ABSTRACT

The U.S. Nuclear Regulatory Commission has begun implementation of the Emergency Response Data System (ERDS) to upgrade its ability to acquire data from nuclear power plants in the event of an emergency at the plant. ERDS provides a direct real-time transfer of data from licensee plant computers to the NRC Operations Center. The system has been designed to be activated by the licensee during an emergency which has been classified at an ALERT or higher level. The NRC portion of ERDS will receive the data stream, sort and file the data. The users will include the NRC Operations Center, the NRC Regional Office of the affected plant, and if requested the States which are within the ten mile EPZ of the site. The currently installed Emergency Notification System will be used to supplement ERDS data.

This report provides the minimum guidance for implementation of ERDS at licensee sites. It is intended to be used for planning implementation under the current voluntary program as well as for providing the minimum standards for implementing the proposed ERDS rule.

NUREG-1394 (Rev. 1) is being issued to provide guidance that NRC staff believes should be followed to meet the requirements of the ERDS rule. NUREG-1394 (Rev. 1) is not a substitute for the regulations, and compliance is not a requirement. However, an approach or method different from the guidance contained here will be accepted only if the substitute approach or method provides a basis for determining that the above-cited regulatory requirements have been met.

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ACKNOWLEDGMENTS

The author wishes to acknowledge the efforts of Mr. T. LaRosa and Ms. L. Saul of the EI Division of NUS Corporation, the NRC ERDS implementation contractor. A number of the appendices enclosed in this report are the direct result of their efforts in managing the development of the ERDS system.

EMERGENCY RESPONSE DATA SYSTEM (ERDS)

1. Introduction

As a result of the Three Mile Island Unit 2 accident on March 28, 1979, the NRC and others recognized a need to substantially improve the NRC's ability to acquire data on plant conditions during emergencies. Before designing a system to accomplish that task, the NRC first needed to resolve a number of background issues. These issues were: (1) What is the appropriate role for the Commission during an accident? (2) What information is needed by the Commission to support this role? and (3) Are any changes necessary in Commission authority to enhance Commission response to nuclear emergencies?

The Commission has defined the NRC's role in the event of an emergency primarily as one of monitoring the licensee to assure that appropriate recommendations are made with respect to offsite protective actions. Other aspects of the NRC role include supporting the licensee with technical analysis and logistic support, supporting offsite authorities (including confirming the licensee's recommendations to offsite authorities), keeping other Federal agencies and entities informed of the status of the incident, and keeping the media informed on the NRC's knowledge of the status of the incident including coordination with other public affairs groups. This role was studied by the Office of the Executive Legal Director (now Office of the General Counsel) who determined that the NRC's legal authority provides a sufficient basis for the Commission's emergency response role.

To fulfill the NRC's role, the NRC requires accurate timely data on four types of parameters: (1) core and coolant system conditions must be known well enough to assess the extent or likelihood of core damage; (2) conditions inside the containment building must be known well enough to assess the likelihood and consequence of its failure; (3) radioactivity release rates must be available promptly to assess the immediacy and degree of public danger; and (4) the data from the plant's meteorological tower is necessary to assess the likely patterns of potential or actual impact on the public.

Experience with the voice only emergency communications link, currently utilized for data transmission, has demonstrated that excessive amounts of time are needed for the routine transmission of data and for verification or correction of data that appear questionable. Error rates have been excessive; and there have been problems in getting new data and frequent updates. In addition, the current system creates an excessive drain on the time of valuable experts. When errors occur, they can create false issues which, at best, divert experts from the real problems for long periods of time. At worst, incorrect data may cause the NRC to respond to offsite officials with inaccurate or outdated advice that results in inappropriate actions.

2. ERDS Information

2.1 ERDS Design Concept

The system selected to fulfill the data collection needs of the NRC is the Emergency Response Data System (ERDS). The Emergency Response Data System concept is a direct electronic transmission of selected parameters (Figures 1 and 2) from the electronic data systems that are currently installed at licensee facilities.

The ERDS design (Figure 3) utilizes DEC MicroVAX 3600 mini computers as system mainframes. These will be used to receive, sort, and file the incoming data stream. User stations will be PC based stations where the data may be accessed, processed, and displayed. System users will include the NRC Operations Center in Bethesda, MD, the NRC Regional Office, the NRC Technical Training Center, and if requested the States which are within the ten mile EPZ of the site.

The ERDS would be for use only during emergencies and would be activated by the licensees during declared emergencies classified at the ALERT or higher level to begin transmission to the NRC Operations Center. The ERDS would be supplemented with voice transmission of essential data not available on licensee's systems rather than require a modification to the existing system.

2.2 Concept Tests

The concept of electronic data transmission was first tested on July 19, 1984 from the Duke Power Company system at the McGuire facility. The data transfer was accomplished using an electronic mail type arrangement which, although not a real-time system, allowed for electronic data transfer. The data set was limited to a list of 69 specific data points to test the appropriateness of the NRC's parameter list.

A test of data transmission of 60 specific data points was successfully conducted on August 13, 1985 from the Commonwealth Edison system at the LaSalle facility.

A data transmission system was also established for the Zion Federal Field Exercise. The data transmission and receipt methodologies were essentially the same as the test conducted with LaSalle, but several data display techniques for the NRC Operations Center were used. The data set consisted of 65 data points.

The tests of the ERDS concept have demonstrated that there is great value in using electronic data transmission for obtaining a limited set of reliable, time tagged data. The NRC response teams functioned more efficiently and their assessments were more timely. Major improvements in ability to focus on the significant factors and to predict the course of events were noted. The questions that were asked of the licensee were focused on overall status and course of action rather than simple data requests, therefore reducing the volume of communication and increasing the quality of the communication.

2.3 Survey Of Licensee Capabilities

An ERDS Requirements Analysis was conducted in 1986 that included survey visits at 59 plant sites representing 92 reactor units. The focus of the site surveys was to review the design of the data systems on site and availability of the data to be provided to the NRC. The following summarizes the availability of the ERDS parameters for the surveyed facilities:

- The average availability of points for applicable parameters at BWRs is 78.7 percent. No BWRs had 100 percent of the applicable parameters available as transmittable computer points.

- The average availability of points for applicable parameters at PWRs is 92.6 percent. Eleven PWRs had 100 percent availability.

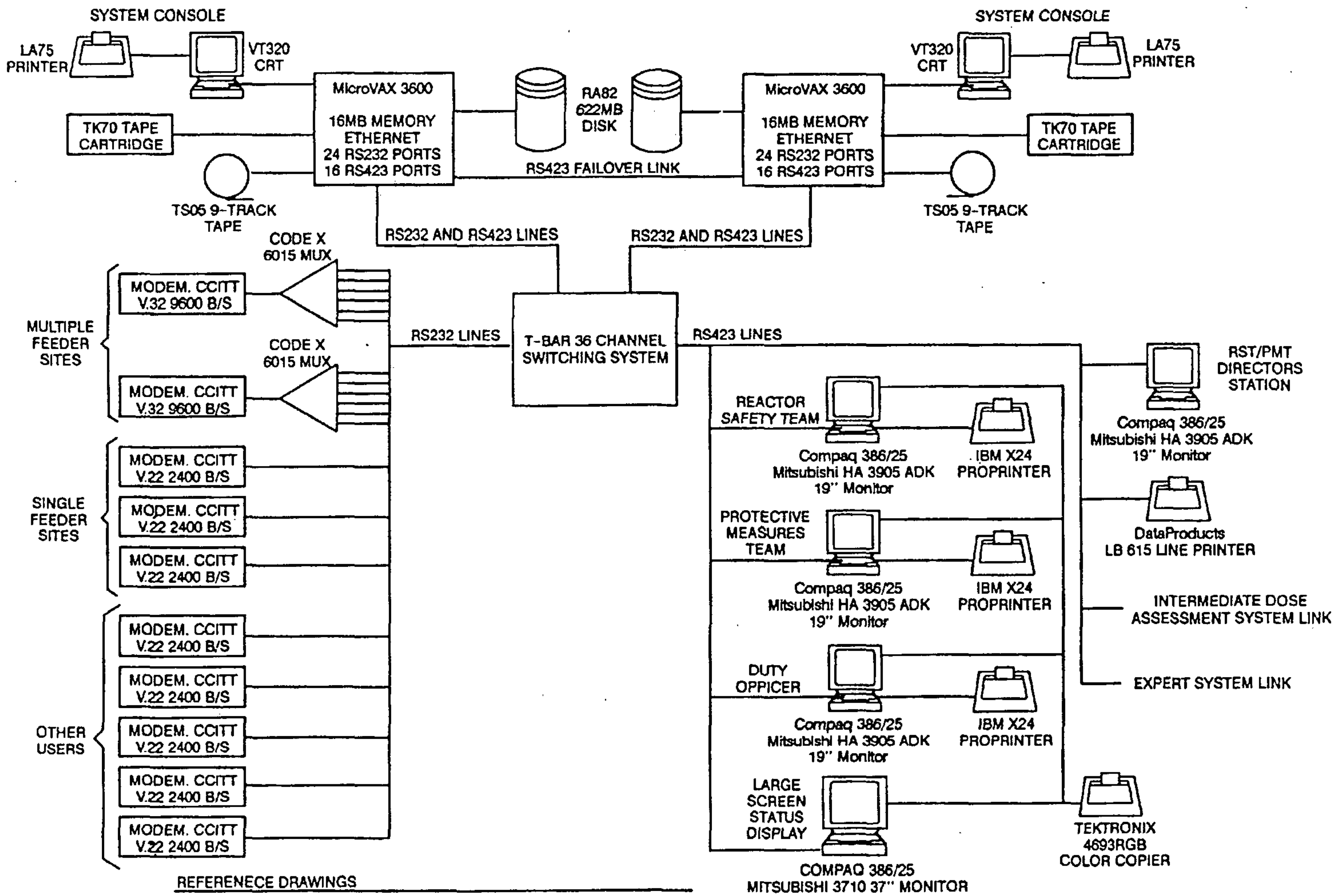
- With regard to the capability of the current hardware environment at the sites to support the generation of a data feed to ERDS, approximately 5 to 10 percent of the licensee systems are running at close to 100 percent processing capability now in the post trip or incident environment and approximately 10 to 15 percent of the licensee systems are hardware limited (e.g., no available output port for an ERDS connection). In many cases however, the licensees with hardware limitations are planning equipment upgrades in the near future for reasons other than supporting ERDS.

Primary Coolant System	Pressure Temperatures—Hot Leg Temperatures—Cold Leg Temperatures—Core Exit Thermocouples Subcooling Margin Pressurizer Level RCS Charging/Makeup Flow Reactor Vessel Level (When Available) Reactor Coolant Flow Reactor Power
Secondary Coolant System	Steam Generator Levels Steam Generator Pressures Main Feedwater Flows Auxiliary/Emergency Feedwater Flows
Safety Injection	High Pressure Safety Injection Flows Low Pressure Safety Injection Flows Safety Injection Flows (Westinghouse) Borated Water Storage Tank Level
Containment	Containment Pressure Containment Temperatures Hydrogen Concentration Containment Sump Levels
Radiation Monitoring System	Reactor Coolant Radioactivity Containment Radiation Level Condenser Air Removal Radiation Level Effluent Radiation Monitors Process Radiation Monitor Levels
Meteorological	Wind Speed Wind Direction Atmospheric Stability

Figure 1. PWR Parameter List

Primary Coolant System	Reactor Pressure Reactor Vessel Level Feedwater Flow Reactor Power
Safety Injection	RCIC Flow HPCI/HPCS Flow Core Spray Flow LPCI Flow Condensate Storage Tank Level
Containment	Drywell Pressure Drywell Temperatures Hydrogen and Oxygen Concentration Drywell Sump Levels Suppression Pool Temperature Suppression Pool Level
Radiation Monitoring System	Reactor Coolant Radioactivity Level Primary Containment Radiation Level Condenser Off-Gas Radiation Level Effluent Radiation Monitor Process Radiation Levels
Meteorological	Wind Speed Wind Direction Atmospheric Stability

Figure 2. BWR Parameter List



REFERENECE DRAWINGS

BF6-T003DD - ERDS HOST COMPUTER CONFIGURATION
BF6-T004DD - ERDS OPERATIONS CENTER EQUIPMENT CONFIGURATION
BF6-T010DD - ERDS COMMUNICATIONS INTERCONNECTIONS

FIGURE 3. NRC EMERGENCY RESPONSE DATA SYSTEM

3. Implementation

3.1 ERDS Implementation Overview

As an ERDS participant, the licensee is expected to provide a real time data stream of data point values from an existing computer system(s) to NRC provided equipment. Since ERDS treats each reactor unit as an individual plant, a separate data stream is required for each reactor unit. The licensee is expected to provide the software to extract the data point engineering values from their system, organize them into a standard sequence, and to translate values from internal computer format into ASCII or EBCDIC. The data points to be included in the transmission are those which to the greatest possible extent satisfy the NRC desired parameter list. Any parameter which is not available to be electronically transmitted from a licensee system will not be backfit, but will instead be provided in verbal transmissions as needed during an emergency. In addition to the data point identifiers and values, the transmission should include the quality (validated, questionable, bad, etc.) of the data point value. The data will be transmitted to the NRC over dial-up telephone lines. The NRC is planning an upgrade of its Emergency Telecommunications System that would include ERDS, but the details of this upgrade have not been decided. In addition to the computer related aspects of ERDS implementation, administrative and quality assurance/configuration controls must be established. The steps necessary for a licensee to implement the ERDS program are outlined in the following sections.

3.2 ERDS Transmission/Reception Plan

The ERDS Transmission/Reception Plan (Appendix A) was developed by NUS Corporation, EI Division, the NRC ERDS implementation contractor, to provide a procedure for licensees to follow in completing the computer application portions of the ERDS implementation. It establishes the sequence for correspondence, meetings, computer application development, and testing.

3.3 ERDS Communications Description And Survey Questionnaire

The ERDS Communications Description and Survey Questionnaire (Appendix B) was designed to provide the hardware, communications, data point, and administrative information necessary to design the ERDS system interface and data base for each reactor unit. When instructed to forward this questionnaire to the NRC in Appendix A, it should be forwarded to the NRC in accordance with the regulatory requirements set forth in 10 CFR Part 50.

Also included in Appendix B is the description of the data communication methodology to be used in the ERDS implementation. Individual computer system limitations which prohibit the use of the generic communication protocol should be addressed in the questionnaire.

3.4 Data Point Library

The Data Point Library as described in Appendix C will be used to provide background information concerning each individual data point in the licensee data stream to better define the data point for the NRC technical teams. This provision was made to compensate for plant to plant differences in instrumentation. The data points outlined in the ERDS desired parameter list will be used to define generic displays for PWR and BWR units. Experience to date with early ERDS volunteers has shown a desire on the part of some licensees to send parameters not included in the desired list. The individual data bases for each unit will have a limited amount of additional space to allow for the addition of plant specific data points to the data stream. Plant specific data points which a licensee considers valuable to the assessment of critical safety functions may be submitted for consideration as possible additions to the data point library. Appendices D, E, F, G, H, and I provide amplifying information to be used to aid in computer point selection and Data Point Library completion.

3.5 System Isolation Requirements

While it is recognized that ERDS is not a safety system, it is conceivable that a licensee's ERDS interface could communicate with a safety system. In this case appropriate isolation devices would be required at these interfaces.

3.6 Administrative Implementation Requirements

ERDS implementation will entail a change in the way the licensees provide data to the NRC during a plant emergency. As such, Emergency Plan Implementing procedures should be modified to require ERDS to be activated as soon as possible within one hour of the declaration of an Alert or higher emergency classification level.

Configuration management is an integral part of assuring the quality of a data network of this size. Part of the implementation plan must address procedures which will be followed to ensure the integrity of the ERDS hardware and software configuration at each reactor unit. These procedures should include provisions to allow NRC to review proposed system modifications which could affect the data communication protocol in advance of these changes to ensure that the changes are compatible with the ERDS. Changes to the Data Point Library should be submitted using the Data Point Library Reference File Form from Appendix C within thirty days of the change.

3.7 Periodic Testing

In order to verify system connectivity, periodic tests of the ERDS data link will be conducted with each licensee. The tests will be coordinated by the NRC and consist of operational tests of the licensee's ERDS data communications. The initial testing periodicity will be quarterly.

3.8 ERDS Questions And Answers

Appendix J provides answers to frequently asked questions concerning the ERDS implementation program.

3.9 ERDS Implementation Plan

Licensees implementing ERDS under the currently proposed rule would be required to submit an implementation plan within 75 days of the effective date of the final rule. In submitting implementation plans, the licensee should address (including a proposed schedule) all items noted in the ERDS Transmission/Reception Plan (Appendix A). With regard to item 1 of the Transmission/Reception Plan, all licensees will be considered to have received the site survey questionnaire as a result of receiving this document (see Appendices B through I). The administrative requirements of section 3.6 should also be addressed in the implementation plan.

3.10 Point Of Contact

Any questions concerning the ERDS implementation program should be referred to:

John R. Jolicoeur
ERDS Project Manager
U.S. Nuclear Regulatory Commission
Mail Stop MNBB 3206
Washington, DC 20555

Tel: (301) 492–4155

4. References

1. U.S. Nuclear Regulatory Commission, "Report to Congress on NRC Emergency Communications", USNRC Report NUREG–0729, September 1980

2. U.S. Nuclear Regulatory Commission, "Report to Congress on the Acquisition of Reactor Data for the NRC Operations Center," USNRC Report NUREG–0730, September, 1980

3. U.S. Nuclear Regulatory Commission, "Emergency Response Data System Generic Letter No. 89–15," August 21, 1989

4. EI International, Inc., "Hardware Design Document," Report Number, NRC–201, July 1, 1988

APPENDIX A

EMERGENCY RESPONSE DATA SYSTEM (ERDS) TRANSMISSION/RECEPTION PLAN

EI International, Inc.

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Introduction

The purpose of this document is to describe a plan which will allow the Nuclear Regulatory Commission (NRC) to survey and incorporate the utilities which have agreed to participate in the Emergency Response Data System (ERDS) program into the Emergency Response Data System.

Scope of Work

A significant portion of the work scope for the ERDS includes developing a communications link with each of the participating nuclear utilities. This link will establish a means for the utility's plant computer(s) to automatically transmit predefined data points to the ERDS computer at the request of the Nuclear Regulatory Commission.

To perform this function, both the ERDS and plant computers must be software and hardware compatible. This compatibility exists at the data transmission interface level.

Hardware Requirements

Accomplishing the hardware interface for the ERDS is straightforward and consist of standard off-the-shelf components.

The hardware interface requires:

Single-feeder Sites:

- an RS-232C asynchronous modem control port and modem on each end of the communication line.

Multiple-feeder Sites:

- Multiple-feeder plants will require a multiplexer to be placed between the modems and computer(s) RS-232C ports.
- Multiple-feeder sites may be converted to single feeder sites utilizing the approach described in step 7 of this Appendix and item 15 of Appendix J. This approach simplifies the implementation of ERDS for multiple-feeder sites by reducing software development efforts. This option provides a pretested ERDS interface supplied by NRC.

Software Tasks

The software tasks associated with the data interface are plant-specific with a data reception communications program residing on the ERDS computer. In certain situations limited custom software will be written for the ERDS.

The plant-specific software includes transmitting the actual data points to the Data Point Library (DPL) in the ERDS. These data points will essentially comprise a database (formally referred to as the DPL) which will reside on the ERDS and be made available to the users whenever a utility is transmitting data.

Establishing the DPL and the Plant Attribute Library (PAL)

Since the focal point of the ERDS is the DPL, a concentrated effort must be put forth to ensure that the DPL for each utility is accurate and that the software protocol for transferring these values is known to the ERDS software.

The ERDS database, or DPL, contains specific information about each data point, i.e., point ID, description, engineering units, etc. Storing this information in the ERDS eliminates the necessity to transmit the information with each data set.

The Plant Attribute Library (PAL) contains the communications information necessary to communicate with each utility and remains on file within the system as a reference to establish the utility's software protocol requirements which the ERDS can expect to accommodate during data transmission. Without the PAL information, it would not be possible to communicate with the plant computer.

Incorporating the Utility Into the ERDS

The plan for incorporating each utility into the ERDS consists of the steps outlined below and are common among all the participating licensees.

In preparing this plan, the activities required to incorporate the utility into the ERDS were identified based on experience gained from the few site surveys that have been conducted to date. Understanding that not all utilities operate in the same manner, the steps described herein represent the basic or minimum effort required to incorporate the plant into the ERDS.

Depending on the utility's and NRC's schedule, tasks can be added or rearranged to accommodate the situation.

Steps Required to Incorporate the Plant Into the ERDS

The required activities for participating in the ERDS program are:

- 1) The NRC notifies the contractor, NUS Corporation, EI Division (NUS-EI), that a utility has received a site survey questionnaire.

This questionnaire consists of several enclosures which inquire about the plant computer capabilities and the available data points to be transmitted to the ERDS.

Identification of these data points is the most tedious effort required of the utility because the response essentially forms the ERDS database (the DPL) and, as described in previous sections, the DPL is the focal point of the ERDS. Efforts must be made to ensure the accuracy of the DPL and that the software protocol for transferring these values is known to the ERDS software.

- 2) After the utility has received the questionnaire, they will be contacted by NUS-EI.

NUS-EI personnel will contact the utility to discuss the items within the site survey questionnaire along with typical utility responses, to describe NUS-EI's involvement in the ERDS program, to answer general and specific questions regarding what is expected of both the utility and NUS-EI, and to convey NUS-EI's experiences and/or problems learned from other participating utilities. If the utility was not part of the pre-ERDS survey, an NUS-EI representative will assist the utility in selecting plant data points which fulfill the NRC's requested parameter list.

- 3) A site visit will be arranged.

A visit is not mandatory but should be conducted prior to the licensee's return of the DPL and PAL in an effort to minimize errors in answering the questionnaire. If necessary, the visit can occur after the DPL and PAL are submitted. In a very few circumstances, a visit may not be necessary; however, this is not recommended.

- 4) The NRC will install phone lines at the site.

- 5) The utility then answers and returns the site survey questionnaire containing the DPL and PAL information to the NRC.

Verbal communications between the utility's contact and NUS-EI personnel are ongoing during this phase in preparation for software development on both ends of the data link and establishment of the ERDS database.

- 6) If the plant's computer system requires customized ERDS reception software, specific ERDS code will be developed and implemented by NUS-EI.

This may not be required if the licensee's system can conform to the "generic" software protocols of the ERDS.

- 7) In parallel with NUS-EI software development, the utility will design and write their data transmission software. The NRC ERDS implementation contractor is developing a PC based ERDS interface which will perform all ERDS communication protocol functions for single-feeder or multiple-feeder plants (see Appendix J, item 15).

During this phase, NUS-EI will continue to provide consulting assistance to the utility's programmers in preparation for a preliminary software test. Any required transmission equipment including modem(s) and, if necessary, multiplexer(s) will be shipped to the utility during this phase.

- 8) Preliminary software testing is the next step and is the first attempt at transferring data between the plant and ERDS computers. The preliminary software test performs initial data transmission testing of the utility's software and any custom code NUS-EI has developed. This is in actuality the software debugging period and problems are to be expected.

This step is complete when data can be transmitted by the utility's plant or development computer and the ERDS computer without error.

- 9) Following the preliminary software tests and the initial data transference between the plant and the ERDS computers, a formal test will be conducted at NUS-EI prior to adding the licensee to the ERDS.

Upon successful completion of this test, the DPL, PAL, and any special software routines will be incorporated into the ERDS production computer. At this time, the utility will be transmitting data from their plant computer and not their development system.

- 10) A formal test is then conducted on the ERDS computer at the Operations Center. This is the final test to demonstrate system functionality. Again, data transmission will be from the designated plant computer system.

- 11) The final step in the schedule has the utility on-line with all development and testing completed.

Summary

The eleven (11) steps as outlined on the previous pages are to be used as a guideline for scheduling and accomplishing the tasks required to incorporate the utilities into the ERDS. Again, understanding that not all utilities operate in the same manner, the steps as previously outlined represent only the basic approach to the efforts required. Tasks can be added or rearranged to accommodate each utility.

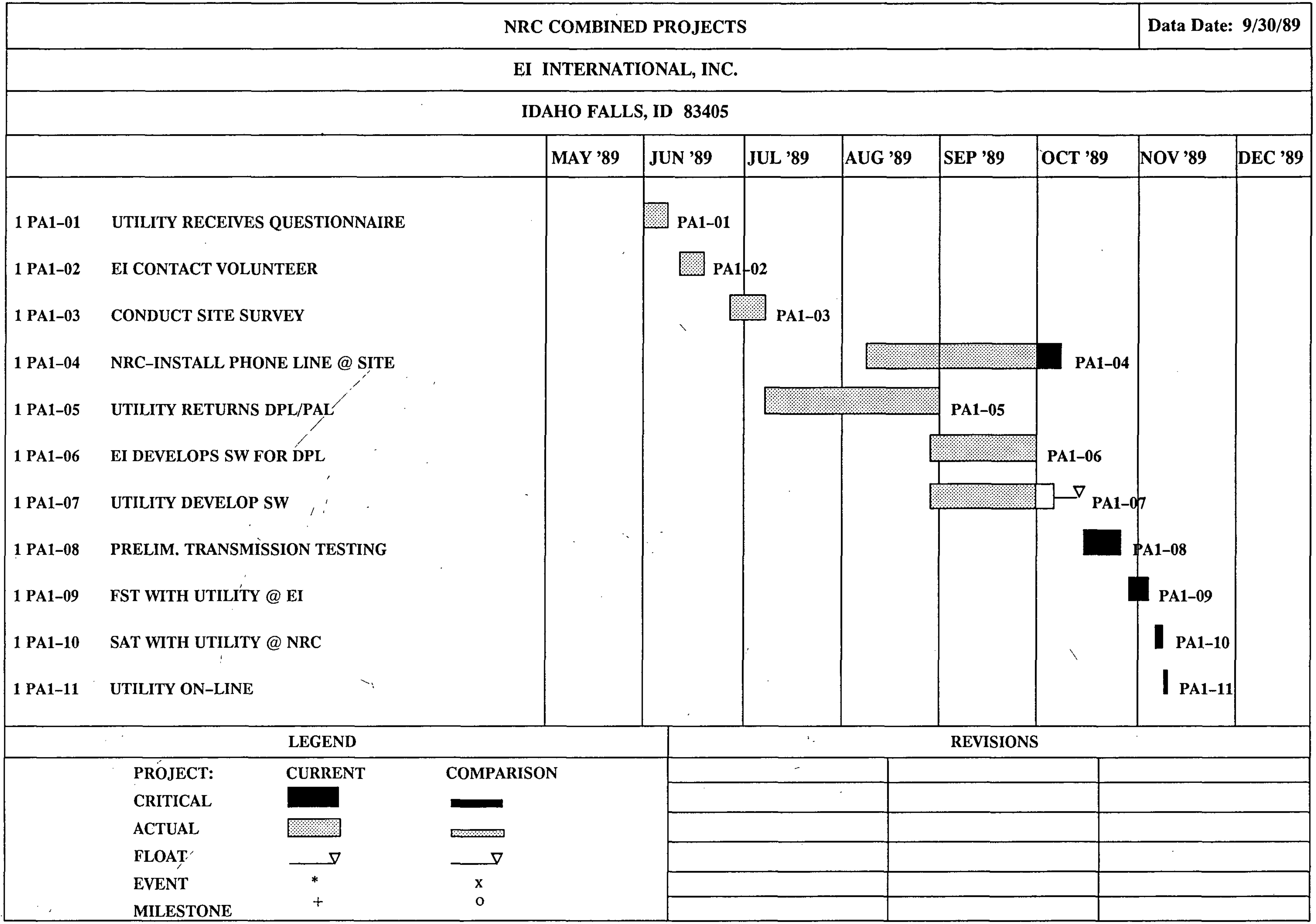
The most significant portion of the work scope of this plan is the development of the communications link with each of the participating utilities. While the hardware interface for the ERDS is straightforward, consisting of off-the-shelf hardware, the software tasks are plant-specific and require a dedicated effort in establishing the

Data Point Library and the Plant Attribute Library. The ERDS Communications Description and Survey Questionnaire (site survey questionnaire) explains in detail the purpose of collecting this data, provides descriptions and examples of the data streams the ERDS is expecting to see transmitted over the communications lines, and provides samples of forms to be filled out and returned as part of implementing this Transmission/Reception Plan.

It is of vital importance that a dedicated effort be put forth to ensure the accuracy of the information in the questionnaire (the DPL) for each utility. The contractor's (NUS-EI's) personnel are available to assist the utility during all phases of this plan including the selection of hardware and software interfaces and, most importantly, during the selection of the required data points.

Schedule

The attached sample schedule (Attachment A) presents a visual display of the milestones associated with the implementation of this plan and is an actual schedule of a participating plant. This schedule can be used as a guide for each utility to project schedules and testing dates. The scheduled milestones represent the eleven (11) steps as outlined in this plan.



ATTACHMENT A — Sample Schedule

APPENDIX B

ERDS COMMUNICATIONS DESCRIPTION AND SURVEY QUESTIONNAIRE

APPENDIX B

ERDS COMMUNICATIONS DESCRIPTION AND SURVEY QUESTIONNAIRE

The following is a questionnaire pertaining to the Nuclear Regulatory Commission's (NRC) Emergency Response Data System (ERDS). It consists of a series of questions concerning plant I/0 points, software protocols, data formats, transmission frequencies, and other plant computer specific information to be used in the ERDS computer database files. Also, included here are descriptions and examples of data streams that the NRC is expecting to see transmitted over the communication line.

The purpose of collecting the data is to develop a plant-specific database that will be retrieved into the ERDS once the system is activated by a utility. It will also be used to design and implement ERDS software that can receive the utility's data transmission. In essence, this information will provide the basis for building a profile of the plant in the ERDS database.

In some cases, the I/0 point data may be distributed over several computers. The ERDS considers this situation a multi-feeder site and Section IV must be filled out for each feeder.

For plants that utilize the PC based interface described in Appendix J, item 15, Section IV must be filled out for the ERDS interface PC as well as each computer which feeds data to the interface PC.

This request is covered by Office of Management and Budget Clearance Number 3150–0150 which expires March 31, 1992. The estimated average burden hours is 32 person hours per licensee response, including staff and management review and preparation of the requested response. These estimated average burden hours pertain only to those identified response-related matters and do **not** include the time for any follow on implementation. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Records and Reports Management Branch, Division of Information Support Services, Office of Information Resources Management, U.S. Nuclear Regulatory Commission, Washington, DC 20555; and to the Paperwork Reduction Project (3150–0150), Office of Management and Budget, Washington, DC 20503.

I. Contacts

Note: Please provide name, title, mailing address, and phone number.

A. Survey Coordinator (i.e., contact for later clarification of questionnaire answers):

B. Computer Hardware Specialist(s):

C. Systems Software Specialist(s):

D. Application-level Software Specialist(s):

E. Telephone Systems Specialist(s):

II. ERDS Communications Description

A. Hardware

The following hardware will be supplied:

- for a single-feeder site:

  Codex 2235 modem or equivalent – V.22 2400 bps, asynchronous, auto-dialing, auto-answer, error-correcting, using the AT command set

- for a multiple-feeder site:

  Codex 6015 multiplexer,
  Codex 2264 modem or equivalent – V.32 9600 bps, asynchronous, auto-dialing, auto-answer, error-correcting, using the AT command set
  (for an alternate approach see Appendix A, Item 7)

The modems are intended to be operated in the auto-reliable link mode (referred to as MNP in the modem manuals). There are several modem parameters that affect MNP operation. These are discussed in the sections of the modem manuals pertaining to MNP. The single feeder modems at the NRC Operations Center are configured for auto-reliable link mode, local terminal flow control, and default break handling.

B. Software

1. Data Transmission

All transmissions, from both the site and the ERDS, will be terminated with a carriage return (<CR>).

a. Site will initiate a link request in ASCII using:

   - the three-character site designator,
   - the word LINK,
   - local site time and date in the format MM/DD/YY/HH:MM:SS, and
   - a <CR>.

   If the site does not receive a response from the ERDS within one minute, it should send another link request message and continue sending them at one-minute intervals. If more than five minutes elapses without a response, site personnel should notify the NRC before disconnecting the line.

b. ERDS will respond in ASCII with:

   - the three-character site designator,
   - the word ACCEPTED or DENIED, and
   - a <CR>.

   If the ERDS responds with the denied message, the site should wait one minute and then send a link request message and continue sending them at one-minute intervals. If more than five minutes elapses without a response, site personnel should notify the NRC before disconnecting the line.

c. When the ERDS is ready to receive data, it will send an initiate message in ASCII using:

   - the three-character site designator,
   - the word INITIATE, and
   - a <CR>.

   If the ERDS does not send an initiate message within one minute of the accept message, the site should send the link reconnect message (described in Section II.B.1.f.).

d. Upon receipt of the initiate message, the plant begins transmission of data at a 15-second rate. The data string consists of:

   - a header containing the three-character site designator and date and time in the format MM/DD/YY/HH:MM:SS,
   - the data packet sequenced with point identifier, value, and quality tag,
   - a trailer containing the checksum value of the data packet, and a <CR>.

e. When the site or ERDS wishes to terminate the connection, an ASCII message will be sent containing:

   - the three-character site designator,
   - the word TERMINATE, and
   - a <CR>.

f. If a site is inadvertently terminated (due to loss of communications or receipt of terminate message) and the incident is still underway, the site should reconnect with the ERDS by redialing and using the link reconnect message. The link reconnect message should be used any time the phone line is lost after the receipt of an Accept Message (described in Section II.B.1.b). This message is in ASCII and will contain:

   - the three-character site designator,
   - the word RECONNECT,
   - local site time and date in the format MM/DD/YY/HH:MM:SS, and
   - a <CR>.

   Upon receipt of this message, the ERDS will respond with the accept and initiate messages as described in Sections II.B.1.b and II.B.1.c. If the ERDS responds with a link deny message (described in Section II.B.1.b), the site should stop trying to reconnect and send a link request message (described in Section II.B.1.a). If the ERDS does not respond to the site's reconnect request within one minute, the site should send another reconnect request and continue sending reconnect requests once a minute. If more than five minutes elapses without a response, site personnel should notify the NRC before disconnecting the line. It is the responsibility of the site to monitor the outgoing line for loss of communications.

   Once a physical connection has been established with the NRC, the site should not disconnect the phone line until a TERMINATE message (described in section

II.B.1.e) has been transmitted. If problems are encountered in the link request sequence, do not hang up the line but proceed with the steps outlined above.

g. If the site will transmit in EBCDIC rather than ASCII, the following applies:

   (1) The link request message (defined in II.B.1.a) and the reconnect message (defined in II.B.1.f) must be in ASCII.
   (2) All replies sent by the ERDS to the site will be in ASCII.
   (3) The terminate message sent by the site may be in EBCDIC or ASCII.
   (4) All update sets sent by the site must be in EBCDIC.

2. Data Format

The following three delimiters have been identified:

(1) field delimiter (*),

(2) data set delimiter (\), and

(3) carriage return (<CR>).

Note: The length of the messages sent by the ERDS (e.g., ACCEPTED, DENIED, INITIATE, TERMINATE) are variable and it is recommended that the site software use the data set delimiter as the message delimiter for messages received from the ERDS.

a. Link requests will be in ASCII as described in II.B.1.a. with each field separated by a field delimiter and the request terminated with a data set delimiter. For example, PA1*LINK*01/12/89/11:48:50\<CR>.

b. The ERDS response will be in ASCII as described in II.B.1.b. with each field separated by a field delimiter and the response terminated with a data set delimiter. For example, PA1*ACCEPTED\<CR>.

c. When the ERDS is ready to receive data it will respond in ASCII as described in II.B.1.c with each field separated by a field delimiter and the response terminated with a data set delimiter. For example, PA1*INITIATE\<CR>.

d. Data streams will be in ASCII and will consist of three parts (header, data, and trailer) as described in II.B.1.d. with each field separated by a field delimiter and each of the three parts separated by a data set delimiter. For example,

   Header: PA1*01/12/89/11:50:30\

   Data: B21CP004*-0.1234E+00*3*.....(for each parameter)\

   Trailer: 0000056000\<CR>

e. The point identifier may be up to 12 characters in length.

f. The value may be up to 20 characters in length.

g. The following quality tags will be accepted by the ERDS:

Good	= 0	Value is within range tolerance for discreet points or input points are within tolerance for composed points.
Off-scan	= 1	Point is currently out-of-service.
Suspect	= 2	Value is not bad yet should not be considered good. This quality will occur primarily on composed values when enough good inputs are present to allow the calculation to be made yet a bad quality on other inputs may make the result questionable.
Bad	= 3	Value is not within tolerance for discreet points or calculation of a composed point may not be made due to the qualities of its inputs.
Unknown	= 4	No quality indicator available.
Operator Entered	= 5	Value has been manually entered, overriding the discreet or composed value.
High Alarm	= 6	Value is in high alarm.
Low Alarm	= 7	Value is in low alarm.

h. The checksum which accompanies each update set will be an integer value calculated by summing each of the bytes of the transmission, up to and including the dataset delimiter following the body of the update set (the body of the update set being the portion containing the parameter, value, and quality indications). This integer checksum value will then be encoded into the update set as a 10-digit value, left-padded with zeros as required to fill the 10-digit field. The checksum is the sum of the transmitted bytes.

i. The reconnect link request message will be in ASCII as described in Section II.B.1.f with each field separated by a field delimiter and the request terminated with a data set delimiter. For example, PA1*RECONNECT*01/12/89/11:48:50\<CR>.

3. Protocol

a. ERDS will use XON/XOFF to stop, resume, or suspend data transmission for the site.

b. Communication parameters:

- eight data bits
- 1 stop bit
- parity = none

4. Exceptions

Please note any exceptions which must be taken to Section II and explain why.

III. Selection Of Data Feeders

A. How many data feeders are there (six maximum)?

B. Identify the selected data feeders and provide the following for each:

(1) a short description of the categories of data points it will provide (e.g., met, rad, or plant data points, by unit) and

(2) the rationale for selecting it if another system can also provide its categories of data points.

C. Which data feeder is the site time determining feeder? This should be the feeder which is providing the majority of the data points.

IV. Data Feeder Information

Note: A new Section IV must be filled out for each feeder system selected.

General Questions

1. Identification of Data Feeder

a. What is the name in local parlance given to this data feeder (e.g., Emergency Response Information System)? Please give both the acronym and the words forming it.

b. Is this the site time determining feeder?

c. How often will this feeder transmit an update set to the ERDS (in seconds)?

2. Hardware/Software Environment

a. Identify the manufacturer and model number of the data feeder hardware.

b. Identify the operating system.

c. What method of timekeeping is implemented on this feeder system (Daylight Savings, Standard, Greenwich)?

d. In what time zone is this feeder located?

3. Data Communication Details

a. Can this data feeder provide asynchronous serial data communication (RS–232-C) with full-modem control?

b. Will this feeder transmit in ASCII or EBCDIC?

c. Can this feeder transmit at a serial baud rate of 2400 bps? If not, at what baud rate can it transmit?

d. Does the operating system support XON/XOFF flow control?

   1. Are any problems foreseen with the NRC using XON/XOFF to control the transmission of data?

e. If it is not feasible to reconfigure a serial port for the ERDS linkup (i.e., change the baud rate, parity, etc.), please explain why.

f. Do any ports currently exist for the ERDS linkup?

   1. If not, is it possible to add additional ports?

2. If yes, will the port be used solely by the ERDS or shared with other non-emergency-time users? Give details.

4. Data Feeder Physical Environment and Management

a. Where is the data feeder located in terms of the TSC, EOF, and control room?

b. Is the data feeder protected from loss of supply of electricity?

c. Is there a human operator for this data feeder?

1. If so, how many hours a day is the feeder attended?

APPENDIX C

DATA POINT LIBRARY

APPENDIX C
DATA POINT LIBRARY

The Data Point Library is a site-specific database residing on the ERDS computer which expands upon the basic information in a typical data point dictionary. The data being displayed at the NRC's Operations Center for the ERDS parameter will be the same as the plant's Emergency Response Team's data. That is, it will have the same value, timestamp, and be in the same engineering units. This requires that the Operations Center personnel adjust their thinking to accommodate the plant, functioning in terms of the plant's unique design and communicating with the plant's Response Team in the latter's unique engineering and operational "language". In order to do this, the Operations Center personnel need information which relates the data both to the plant's design and to the manner in which the plant's team utilizes and reacts to the data.

The types of information contained in the Data Point Library are the data point identifier, description, engineering units, range, alarms and/or technical specification limits and engineering system data. There will be one record in the plant's Data Point Library for each data point the plant will be sending to the ERDS.

Because the points selected for transmission to the ERDS are indicative of plant "health" and are associated with Critical Safety Functions, they are the indicators the plant's Response Team uses to determine the proper actions to take to mitigate an incident. Where required and useful, the Data Point Library will present textual information to the Operations Center user to provide information supplementing the point's value which will be useful in understanding how the plant team interprets the data. For instance, associated with a transmitted data point representing the reactor vessel level, the Data Point Library should contain the physical zero reference point, conversion factor for the height above the top of active fuel, type of detectors, effects of running reactor coolant pumps, effects of cold calibration, effects of elevated containment temperature, etc. Associated with a reactor water storage tank level transmitted as a percentage should be the capacity of that tank in gallons, number of reactor water storage tanks at the plant site, zero reference point, conversion factor from percent to gallons, etc.

The Data Point Library will be particularly useful to the Operations Center user when evaluating the plant's action in predicting off-site radioactive releases. Associated with an effluent gaseous release data point expressed in CPM, the Data Point Library Reference Sheet should indicate the assumptions regarding isotopic mix, the current calibration factors of detectors, the discharge point or points for monitored releases, expected stack flow rates under various fan combinations, and any default values used by the plant team in their calculations.

Two examples of typical Data Point Library entries are included. The first is an example for a BWR and the second is an example for a PWR.

BWR DATA POINT LIBRARY REFERENCE FILE

Date:	06/05/89
Reactor Unit:	XYZ
Data Feeder:	N/A
NRC ERDS Parameter:	CST Level
Point ID:	C345Z04
Plant Spec Point Desc.:	CS TNK IA LVL
Generic/Cond Desc.:	Condensate Storage Tank A Level
Analog/Digital:	A
Engr Units/Dig States:	%
Engr Units Conversion:	Each 1% = 1692 Gallons
Minimum Instr Range:	0
Maximum Instr Range:	100
Zero Point Reference:	SEALEV
Reference Point Notes:	At 0% 245,000 Gals Remain In Tank
PROC or SENS:	P
Number of Sensors:	2
How Processed:	Average
Sensor Locations:	245,000 Gal Above Tank Bottom
Alarm/Trip Set Points:	Low Level At 12%
NI Detector Power Supply Cut-off Power Level:	N/A
NI Detector Power Supply Turn-on Power Level:	N/A
Instrument Failure Mode:	Low
Temperature Compensation For DP Transmitters:	N/A
Level Reference Leg:	N/A
Unique System Desc.:	This averaged sensor reading is for the normally used volume of the tank. The remaining 245,000 gallons are monitored by two discrete alarms at 150,000 and 50,000 gallons total remaining tank contents. Total tank volume is 414,200 gallons.

NOTE: A second identical tank normally dedicated to XYZ Unit 1 is available for cross-connecting to this tank at the bottom (ECCS) suction line.

PWR DATA POINT LIBRARY REFERENCE FILE

Date:	06/05/89
Reactor Unit:	ABC
Data Feeder:	ERIS
NRC ERDS Parameter:	AX FD FL 1/A
Point ID:	AF105A
Plant Spec Point Desc.:	AFW Flow SG 11 MTR
Generic/Cond Desc.:	AFW Flow SG 11 Frm Elec AFW Pump
Analog/Digital:	A
Engr Units/Dig States:	GPM
Engr Units Conversion:	N/A
Minimum Instr Range:	0
Maximum Instr Range:	500
Zero Point Reference:	N/A
Reference Point Notes:	N/A
PROC or SENS:	S
Number of Sensors:	1
How Processed:	N/A
Sensor Locations:	On Line To SG 11 Outside Containment
Alarm/Trip Set Points:	High Flow At 500 GPM
NI Detector Power Supply Cut-off Power Level:	N/A
NI Detector Power Supply Turn-on Power Level:	N/A
Instrument Failure Mode:	Low
Temperature Compensation For DP Transmitters:	N/A
Level Reference Leg:	N/A
Unique System Desc.:	There are one electric and two turbine-driven AFW pumps. The electric pump has dedicated discharge lines to each SG. The flow element for this point represents the last sensor prior to the line entering containment. The two turbine-driven pumps use separate piping to the SGs. Maximum rated flow for this pump is 450 GPM. Shutoff head is 1200 PSIG.

DATA POINT LIBRARY REFERENCE FILE

Date: __/__/__

Reactor Unit: ____________________

Data Feeder: ____________________

NRC ERDS Parameter: ____________________

Point ID: ____________________

Plant Spec Point Desc.: ____________________

Generic/Cond Desc.: ____________________

Analog/Digital: __________

Engr Units/Dig States: __________

Engr Units Conversion: ____________________

Minimum Instr Range: __________

Maximum Instr Range: __________

Zero Point Reference: __________

Reference Point Notes: ____________________

PROC or SENS: ____________________

Number of Sensors: __________

How Processed: __________

Sensor Locations: ____________________

Alarm/Trip Set Points: ____________________

NI Detector Power Supply
Cut-off Power Level: ____________________

NI Detector Power Supply
Turn-on Power Level: ____________________

Instrument Failure Mode: ____________________

Temperature Compensation
For DP Transmitters: ____________________

Level Reference Leg: ____________________

Unique System Desc.: ____________________

____

____

____

____

APPENDIX D

DATA POINT LIBRARY REFERENCE FILE DEFINITIONS

APPENDIX D

DATA POINT LIBRARY REFERENCE FILE DEFINITIONS

Date:	The date that this form is filled out or modified. (Eight characters)
Reactor Unit:	The nuclear power plant name and abbreviation from the enclosed list of sites. (Three characters)
Data Feeder:	If there is more than one data feeder for your system, enter the acronym for the data feeder from which the point comes. If there is only one data feeder, enter "N/A" in this field. (Ten characters)
NRC ERDS Parameter:	One of the parameters from the enclosed BWR or PWR parameter list. A single value should be transmitted for each parameter for each loop. If not on the list, insert "Not Listed" or "NL". (Twelve characters)
Point ID:	Alphanumeric point description used to label the point during transmission. (Twelve characters)
Plant-Specific Point Description:	Licensee computer point description for the transmitted point. (Forty characters).
Generic Or Condensed Description:	Parameter description from the enclosed list of points for a BWR or PWR. If not on the list, condense the plant-specific point description. (Thirty-two characters)
Analog/Digital:	"A" if the signal is analog or numerical or "D" if the signal is off/on. (One character)
Engineering Units Or Digital States:	Engineering units used by the licensee for display on licensee output devices. Use the engineering units abbreviations from the enclosed list when possible. When specifying pressure, use "PSIA" or "PSIG" rather than "PSI". For digital signals, give the "OFF" and "ON" state descriptors. (Twelve characters)
Engineering Units Conversion:	Notes about any special features of the A/D conversion and scaling. (Forty characters)
Minimum Instrument Range:	Engineering units value below which data cannot go (bottom-of-scale value). (Ten characters)
Maximum Instrument Range:	Engineering units value above which data cannot go (top of-scale value). (Ten characters)
Zero Reference Point:	Zero-point of engineering units scale, used primarily for levels or heights. Use the zero reference point abbreviations from the enclosed list when possible. (Six characters)

Reference Point Notes:	Notes about the reference point or other important and special features of the parameter. (Forty characters)
PROC or SENS:	Is the point formed by processing more than one signal, or is the source a single sensor ("P" or "S")? (One character)
Number of Sensors:	The number of signals processed in a full calculation assuming no bypassed or inoperative sensors. (Three characters)
How Processed:	The processing algorithm (sum, average, weighted average, highest, lowest, or a short description). (Forty characters)
Sensor Locations:	Description of the location(s) of the instrument(s) used. (Forty characters)
Alarm or Trip Setpoints:	The most important setpoints for the parameter. State whether the limit is high or low. (Forty characters)
NI Detector Power Supply Cut-off Power Level:	The power level at which the power supply for the NI detector switches off. (Fifteen characters)
NI Detector Power Supply Turn-on Power Level:	The power level at which the power supply for the NI detector switches on. (Fifteen characters)
Instrument Failure Mode:	The mode in which this instrument fails. Possible answers are HIGH, MEDIUM, or LOW. If available, provide the numeric value at which the instrument fails. (Thirty characters)
Temperature Compensation For DP Transmitters:	This question pertains to differential pressure transmitters. Possible answers are "YES" or "NO" ("Y" or "N"). If the answer is "NO", please attach a copy of the correction curve. (One character)
Level Reference Leg:	The type of level measurement (dry or wet) used on the level reference leg. (Three characters)
Unique System Description:	Additional important information which will assist the NRC Operations Center personnel in understanding how the plant team interprets the data. (600 characters)

APPENDIX E

CRITICAL SAFETY FUNCTION PARAMETERS

Critical Safety Function Parameters For Boiling Water Reactors

Reactivity Control	**Parameter Description**	**Typical Units**
NI POWER RNG	Nuclear Instruments, Power Range	%
NI INTER RNG	Nuclear Instruments, Intermediate Range	AMP
NI SOURC RNG	Nuclear Instruments, Source Range	C/SEC
CORE COOLING		
REAC VES LEV	Reactor Vessel Water Level	IN
MAIN FD FLOW	Feedwater Flow into the Reactor System	%
RCIC FLOW	Reactor Core Isolation Cooling Flow	GPM
RCS INTEGRITY		
RCS PRESSURE	Reactor Coolant System Pressure	PSIG
HPCI FLOW	High Pressure Coolant Injection Flow	GPM
LPCI FLOW	Low Pressure Coolant Injection Flow	GPM
CR SPRAY FL	Core Spray Cooling System Flow	GPM
DW FD SMP LV	Drywell Floor Drain Sump Level	IN
RADIOACTIVITY CONTROL		
EFF GAS RAD	Radioactivity of Released Gasses	MCI/HR
EFF LIQ RAD	Radioactivity of Released Liquids	MCI/HR
CND A/E RAD	Condenser Air Ejector Radioactivity	C/MIN
DW RAD	Radiation Level in the Drywell	R/HR
MN STEAM RAD	Radiation Level of the Main Steam Line	MR/HR
CONTAINMENT CONDITIONS		
DW PRESS	Drywell Pressure	PSIG
DW TEMP	Drywell Temperature	F
SP TEMP	Suppression Pool Temperature	F
SP LEVEL	Suppression Pool Water Level	IN
H2 CONC	Drywell or Torus Hydrogen Concentration	%
O2 CONC	Drywell or Torus Oxygen Concentration	%
MISCELLANEOUS PARAMETERS		
CST LEVEL	Condensate Storage Tank Level	%
WIND SPEED	Wind Speed at the Reactor Site	MPH
WIND DIR	Wind Direction at the Reactor Site	DEG
STAB CLASS	Air Stability at the Reactor Site	

Critical Safety Function Parameters For Pressurized Water Reactors

Reactivity Control	Parameter Description	Typical Units
NI POWER RNG	Nuclear Instruments, Power Range	%
NI INTER RNG	Nuclear Instruments, Intermediate Range	AMP
NI SOURC RNG	Nuclear Instruments, Source Range	C/SEC
CORE COOLING		
REAC VES LEV	Reactor Vessel Water Level	IN
TEMP CORE EX	Highest Temperature at the Core Exit	F
SUB MARGIN	Saturation Temperature—Highest CET	F
CORE FLOW	Total Reactor Coolant Flow	MLB/HR
STEAM GENERATORS		
SG LEVEL 1/A	Steam Generator 1 (or A) Water Level	%
SG LEVEL 2/B	Steam Generator 2 (or B) Water Level	%
SG LEVEL 3/C	Steam Generator 3 (or C) Water Level	%
SG LEVEL 4/D	Steam Generator 4 (or D) Water Level	%
SG PRESS 1/A	Steam Generator 1 (or A) Pressure	PSIG
SG PRESS 2/B	Steam Generator 2 (or B) Pressure	PSIG
SG PRESS 3/C	Steam Generator 3 (or C) Pressure	PSIG
SG PRESS 4/D	Steam Generator 4 (or D) Pressure	PSIG
MN FD FL 1/A	Stm Gen 1 (or A) Main Feedwater Flow	LBM/HR
MN FD FL 2/B	Stm Gen 2 (or B) Main Feedwater Flow	LBM/HR
MN FD FL 3/C	Stm Gen 3 (or C) Main Feedwater Flow	LBM/HR
MN FD FL 4/D	Stm Gen 4 (or D) Main Feedwater Flow	LBM/HR
AX FD FL 1/A	Stm Gen 1 (or A) Auxiliary FW Flow	GPM
AX FD FL 2/B	Stm Gen 2 (or B) Auxiliary FW Flow	GPM
AX FD FL 3/C	Stm Gen 3 (or C) Auxiliary FW Flow	GPM
AX FD FL 4/D	Stm Gen 4 (or D) Auxiliary FW Flow	GPM
HL TEMP 1/A	Stm Gen 1 (or A) Inlet Temperature	F
HL TEMP 2/B	Stm Gen 2 (or B) Inlet Temperature	F
HL TEMP 3/C	Stm Gen 3 (or C) Inlet Temperature	F
HL TEMP 4/D	Stm Gen 4 (or D) Inlet Temperature	F
CL TEMP 1/A	Stm Gen 1 (or A) Outlet Temperature	F
CL TEMP 2/B	Stm Gen 2 (or B) Outlet Temperature	F
CL TEMP 3/C	Stm Gen 3 (or C) Outlet Temperature	F
CL TEMP 4/D	Stm Gen 4 (or D) Outlet Temperature	F

Critical Safety Function Parameters For Pressurized Water Reactors
(Cont'd)

Reactivity Control	Parameter Description	Typical Units
RCS INTEGRITY		
RCS PRESSURE	Reactor Coolant System Pressure	PSIG
PRZR LEVEL	Primary System Pressurizer Level	%
RCS CHG/MU	Primary System Charging or Makeup Flow	GPM
HP SI FLOW	High Pressure Safety Injection Flow	GPM
LP SI FLOW	Low Pressure Safety Injection Flow	GPM
CTMNT SMP NR	Containment Sump Narrow Range Level	IN
CTMNT SMP WR	Containment Sump Wide Range Level	IN
RADIOACTIVITY CONTROL		
EFF GAS RAD	Radioactivity of Released Gasses	MCI/HR
EFF LIQ RAD	Radioactivity of Released Liquids	MCI/HR
COND A/E RAD	Condenser Air Ejector Radioactivity	C/MIN
CNTMNT RAD	Radiation Level in the Containment	R/HR
RCS LTDN RAD	Rad Level of the RCS Letdown Line	C/SEC
MAIN SL 1/A	Stm Gen 1 (or A) Steam Line Rad Level	MR/HR
MAIN SL 2/B	Stm Gen 2 (or B) Steam Line Rad Level	MR/HR
MAIN SL 3/C	Stm Gen 3 (or C) Steam Line Rad Level	MR/HR
MAIN SL 4/D	Stm Gen 4 (or D) Steam Line Rad Level	MR/HR
SG BD RAD 1A	Stm Gen 1 (or A) Blowdown Rad Level	MR/HR
SG BD RAD 2B	Stm Gen 2 (or B) Blowdown Rad Level	MR/HR
SG BD RAD 3C	Stm Gen 3 (or C) Blowdown Rad Level	MR/HR
SG BD RAD 4D	Stm Gen 4 (or D) Blowdown Rad Level	MR/HR
CONTAINMENT CONDITIONS		
CTMNT PRESS	Containment Pressure	PSIG
CTMNT TEMP	Containment Temperature	F
H2 CONC	Containment Hydrogen Concentration	%
MISCELLANEOUS PARAMETERS		
BWST LEVEL	Borated Water Storage Tank Level	%
WIND SPEED	Wind Speed at the Reactor Site	MPH
WIND DIR	Wind Direction at the Reactor Site	DEG
STAB CLASS	Air Stability at the Reactor Site	

APPENDIX F

ENGINEERING UNITS CODING SCHEME

APPENDIX F

ENGINEERING UNITS CODING SCHEME

PSIG	=	Pounds per square inch gauge
PSIA	=	Pounds per square inch absolute
INH_2O	=	Inches of Water Pressure
%	=	Percent
INCHES		
FEET		
FT&IN	=	Feet and inches
FTDEC	=	Feet and decimal feet
GAL	=	Gallons
LB	=	Pounds or pounds mass
GPM	=	Gallons per minute
KGPM	=	Thousands of gallons per minute
LB/HR	=	Pounds per hour
KLB/HR	=	Thousands of pounds per hour
MLB/HR	=	Millions of pounds per hour
CPM	=	Counts per minute
CPS	=	Counts per second
AMPS		
MAMPS	=	Milliamps
μAMPS	=	Microamps
DEGF	=	Degrees Fahrenheit
DEGC	=	Degrees Centigrade
MR/HR	=	Millirem per hour
R/HR	=	Rem per hour
CI/CC	=	Curies per CC
CI/ML	=	Curies per ML
μCI/CC	=	Microcuries per CC
μCI/ML	=	Microcuries per ML
CI/S	=	Curies per second
μCI/S	=	Microcuries per second
DEGFR	=	Degrees true (for wind direction from)
DEGTO	=	Degrees true (for wind direction to)
DF/FT	=	Degrees Fahrenheit per foot
DC/M	=	Degrees Centigrade per meter
DC/HM	=	Degrees Centigrade per 100 meters
DF/HFT	=	Degrees Fahrenheit per 100 feet
STABA	=	Stability class in form of A - G
STABI	=	Stability class in form of integer, where A = 1, B = 2
MPH	=	Miles per hour
M/S	=	Meters per second

APPENDIX G

ZERO REFERENCE CODING SCHEME

APPENDIX G

ZERO REFERENCE CODING SCHEME

This field applies to levels and heights only. Leave it blank for temperatures, pressure, and flows. Give the physical point represented by the number zero for the parameter from the choices below.

TAF	=	Top of active fuel
UPHEAD	=	Upper head
LWHEAD	=	Lower head
MSSKRT	=	Moisture separator skirt
TOPHTR	=	Top of pressurizer heater bank
SURGE	=	Surge line penetration
SPRAY	=	At the spray nozzle
UTUBES	=	Top of S/GU tubes
TUBSHT	=	At S/G tube sheet
TNKBOT	=	Bottom of tank sump (e.g., CST)
COMPLX	=	Reference too complex for database entry
CNTFLR	=	Containment floor
SEALEV	=	Mean sea level

APPENDIX H

CODING SCHEME FOR UNIT NAME AND UNIT 1D

APPENDIX H

CODING SCHEME
FOR UNIT NAME AND UNIT ID

ARKANSAS NUCLEAR ONE-1 . AN1
ARKANSAS NUCLEAR ONE-2 . AN2
BEAVER VALLEY-1 .... BV1
BEAVER VALLEY-2 .... BV2
BELLEFONTE-1 .... BE1
BELLEFONTE-2 .... BE2
BRAIDWOOD-1 .... BR1
BRAIDWOOD-2 .... BR2
BROWNS FERRY-1 .... BF1
BROWNS FERRY-2 .... BF2
BROWNS FERRY-3 .... BF3
BRUNSWICK-1 .... BK1
BRUNSWICK-2 .... BK2
BYRON-1 .... BY1
BYRON-2 .... BY2
CALLAWAY-1 .... CW1
CALVERT CLIFFS-1 .... CC1
CALVERT CLIFFS-2 .... CC2
CATAWBA-1 .... CT1
CATAWBA-2 .... CT2
CLINTON-1 .... CL1
COMANCHE PEAK-1 .... CP1
COMANCHE PEAK-2 .... CP2
CONNECTICUT YANKEE HN1
COOK-1 .... CK1
COOK-2 .... CK2
COOPER CO1
CRYSTAL RIVER-3 .... CR3
DAVIS BESSE-1 .... DB1
DIABLO CANYON-1 .... DC1
DIABLO CANYON-2 .... DC2
DRESDEN-2 .... DN2
DRESDEN-3 .... DN3
DUANE ARNOLD DA1
FARLEY-1 .... FA1
FARLEY-2 .... FA2
FERMI-2 .... FE2
FORT CALHOUN-1 .... FC1
GINNA GI1
GRAND GULF-1 .... GG1
HATCH-1 .... HT1
HATCH-2 .... HT2
HOPE CREEK-1 .... HC1
INDIAN POINT-2 .... IP2
INDIAN POINT-3 .... IP3
JAMES A FITZPATRICK FZ1
KEWAUNEE KW1
LASALLE COUNTY-1 .... LS1
LASALLE COUNTY-2 .... LS2
LIMERICK-1 .... LM1
LIMERICK-2 .... LM2
MAINE YANKEE MY1
MCGUIRE-1 .... MC1
MCGUIRE-2 .... MC2
MILLSTONE-1 .... MS1
MILLSTONE-2 .... MS2
MILLSTONE-3 .... MS3
MONTICELLO MO1
NINE MILE POINT-1 .... NM1
NINE MILE POINT-2 .... NM2
NORTH ANNA-1 .... NA1
NORTH ANNA-2 .... NA2
OCONEE-1 .... OC1
OCONEE-2 .... OC2
OCONEE-3 .... OC3
OYSTER CREEK OY1
PALISADES PA1
PALO VERDE-1 .... PV1
PALO VERDE-2 .... PV2
PALO VERDE-3 .... PV3
PEACH BOTTOM-2 .... PE2
PEACH BOTTOM-3 .... PE3
PERRY-1 .... PY1
PILGRIM-1 .... PG1
POINT BEACH-1 .... PB1
POINT BEACH-2 .... PB2
PRAIRIE ISLAND-1 .... PI1
PRAIRIE ISLAND-2 .... PI2
QUAD CITIES-1 .... QC1
QUAD CITIES-2 .... QC2
RIVER BEND-1 .... RB1
ROBINSON-2 .... RO2
SALEM-1 .... SA1
SALEM-2 .... SA2
SAN ONOFRE-1 .... SO1
SAN ONOFRE-2 .... SO2
SAN ONOFRE-3 .... SO3
SEABROOK-1 .... SB1
SEQUOYAH-1 .... SE1
SEQUOYAH-2 .... SE2
SHEARON HARRIS-1 .... HR1
SORTH TEXAS PROJECT-1 .... ST1
SOUTH TEXAS PROJECT-2 .... ST2
ST. LUCIE-1 .... SL1
ST. LUCIE-2 .... SL2
SURRY-1 .... SU1
SURRY-2 .... SU2
SUSQUEHANNA-1 .... SQ1
SUSQUEHANNA-2 .... SQ2
THREE MILE ISLAND-1 .... TM1
TROJAN TR1
TURKEY POINT-3 .... TP3
TURKEY POINT-4 .... TP4
V. C. SUMMER VS1
VERMONT YANKEE VY1
VOGTLE-1 .... VO1
VOGTLE-2 .... VO2
WATERFORD-3 .... WF3
WATTS BAR-1 .... WB1
WATTS BAR-2 .... WB2
WNP-2 .... WP2
WOLF CREEK WC1
YANKEE-ROWE YR1
ZION-1 .... ZN1
ZION-2 .... ZN2

APPENDIX I

COMPUTER POINT SELECTION

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COMPUTER POINT SELECTION

The main theme of the computer point selection process is to identify the minimum set of computer points, available on the fewest (preferably one) number of feeders from a site, which fully describe each of the parameters on the ERDS Parameter List.

When multiple computer points exist to describe a certain parameter, there is usually one point or a small subset of points which meet the following desirability criteria:

- For fluids systems (e.g., HPCI, Building Ventilation, Main Feedwater, etc.) the points representing the farthest location downstream in the system are most desirable. Examples:
  - If the ventilation system exhausts from all buildings in the power block converge and ascend up a single plant vent stack, then only the effluent process radiation monitors on the plant stack need be described under "gaseous effluent" versus describing the individual effluent monitors which may exist for each of the exhaust lines which converge.
  - If an injection or feedwater system has a set of points available which include flows measured at the pump discharges, at a combined header and at the point in the system just prior to injection into the loops or steam generators, then the points which should be selected as potential ERDS feeds are the furthest downstream points (flow measured just prior to injection into loops or steam generators).
- Computer points which have undergone the maximum amount of range checking and other data point validation schemes should be selected. We are aware that many utilities are in the process of upgrading computer system validation techniques and that what exists now may be replaced at some future date.
- Computer points representing the widest expected range of the parameter should be selected. For example: If there is a choice of computer points for "Containment Pressure" with one representing the range -5 to +5 PSIG and another representing the range -5 to +100 PSIG, the wide-range -5 to +100 PSIG computer point should be selected; even though its accuracy may not be as great near the normally expected pressure of -1 to +1 PSIG.
- The point composed of the maximum number of inputs should be used. The desirable point may be composed (processed) within the feeder computer or may be composed by a separate microprocessor outside the feeder as in the case of PWR Reactor Vessel Level Indication (RVLIS), Subcooling Margin Monitors (SMM) and meteorological tower systems. The philosophy of selecting the most composed points should not be applied in the case of parameters associated with PWR coolant loops (e.g., T-hot, T-cold, S/G Pressure, S/G Level, Main Feedwater Flow, etc.) to the extent of selecting points such as "Average T-hot", because loop-specific parameters are preferable for use in coolant-loop-specific accidents such as Steam Generator Tube Breaks. Composed points such as "Average T-hot Loop 1", "Average T-hot Loop 2 , etc., should be selected.

APPENDIX J

ERDS QUESTIONS AND ANSWERS

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ERDS QUESTIONS AND ANSWERS

1. **Will the implementation of the ERDS affect the NRC response role or the way that role is fulfilled?**

   No. The NRC response role was defined and approved by the Commission and would not change due to the ERDS. Current response activities, including discussions with the licensee, will be done more quickly and efficiently due to ERDS implementation but would not materially change.

2. **What is the current program schedule?**

   The NRC ERDS was delivered to the Operations Center in April 1990. Following operational testing, ERDS was placed in service in June 1990. There are currently thirteen reactor units capable of transmitting data to ERDS. To date 27 licensees comprising 67 reactor units have volunteered to implement ERDS. Implementation at all units is scheduled to be completed by the end of 1992.

3. **Will the implementation of the ERDS require significant equipment modification or addition by licensees?**

   The only equipment requirements are for the hardware that is needed to provide a data stream for each unit from the current licensee equipment that processes the requested data on site. For those licensees where no new hardware is required, the costs per reactor unit are estimated in the range of $20K to $50K. This estimate includes labor costs associated with software development, design change notice documentation, testing, and procedure development. Approximately 5 to 10 percent of the licensee's systems are running at close to 100 percent processing capacity in the post trip or incident environment, and approximately 10 to 15 percent of the licensee systems are hardware limited (e.g., no available output port for an ERDS connection). At the upper end of the cost spectrum, the ERDS feasibility study revealed that two plant sites would require additional computer equipment to provide the necessary ERDS feed. The hardware costs were estimated at $150K plus licensee staff time required to set up a custom system development effort with the appropriate contractor.

4. **Will the ERDS be considered safety grade or require redundant equipment?**

   No. The ERDS feed will be as reliable as the current licensee equipment providing data to the licensee's own TSC and EOF. The addition of new plant instrumentation or computer data points to provide ERDS data will not be required.

5. **Will the current data list be expanded?**

   No. The issue has been well studied since the Nuclear Data Link was originally proposed after TMI. The development of the data list followed our determination of our role in an emergency and provides the information we need to perform that role. The data list is intended to be generic in nature. There is a limited amount of space in each unit's data base to accommodate plant specific data points which are not on the data list, but would be useful in assessing plant conditions. Experience from the implementation program to date has indicated that there are parameters that licensees would like to send as a part of the ERDS data stream. Licensee recommendations for additional data points will be considered for addition to individual unit data bases. Needed data not transmitted over ERDS will still be passed over the ENS.

6. **Must the ERDS be used to transmit drill data?**

   That is not a design requirement. For those system configurations which only allow the transmission of real data, no modification will be expected. However, if the licensee system is used for drills and can provide the transmission of the drill data, we would like to use the capability for our drill participation.

7. **Will the ERDS be an LCO of Tech Spec item?**

   No.

8. **How soon does the NRC expect the system to be initiated after an Alert declaration?**

   The ERDS should be initiated as soon as possible following the declaration of an Alert or higher emergency classification, not to exceed one hour from the time of the declaration.

9. **Will the transmission of data point values for times prior to the time of the ERDS activation be required?**

   No. Only the data values from the time of the link initiation will be required over the ERDS. Information on initiating conditions and plant status will be provided over the verbal communication line as necessary.

10. **Once the ERDS is implemented, will continuous manning of the ENS (Red Phone) still be required?**

    Yes. The ERDS will not eliminate the need for verbal transmission of information such as licensee actions, recommended protective actions, and supplemental event specific data not provided by ERDS. Emphasis will be given to producing no new impact on Control Room personnel due to the transmission of data over the ERDS.

11. **Will the ERDS data be provided to State authorities?**

    Although the NRC is not soliciting or recommending State participation in the ERDS program, one provision of the system design is user ports for States within the 10 mile plume exposure EPZ. This provision was made to reduce the likelihood of different data being provided to the NRC and a State because of differing data sets where the State has decided to collect data. This provision is not expected to affect States that already have a data collection system. If a State expresses a desire to participate in the ERDS program, the NRC will provide ERDS data to that State under a specific Memorandum of Understanding. The purpose of this Memorandum of Understanding would be to specify communication protocols for clarification of ERDS data and data security requirements. The NRC would provide those States with contractor developed software and make one output port available to the State from the NRC Operations Center. The States would have to obtain compatible PC hardware and licensed software used in the ERDS system to receive data. The specifications for a State ERDS workstation is attached at the end of the Questions and Answers for your information. These provisions will ensure that all parties involved are using the same data base for their analysis. Any request made by a state to set up the capability to receive ERDS data will be discussed with the utility.

12. **Will the NRC require a periodic test of the ERDS, and if so how frequently?**

The NRC does expect that periodic testing will be required to ensure system operability. Currently we expect that testing will be done quarterly. Should system reliability permit, the frequency of testing may be reduced. Testing of a State link portion of the system will be done with the NRC. Therefore, no licensee participation will be required for this test.

13. **Will participation in the ERDS program remain voluntary?**

The NRC has initiated rulemaking to require the implementation of ERDS at all nuclear power plants. It is anticipated that the provisions of the proposed rule would be the same as those of the voluntary implementation program currently in effect.

14. **What will be the boundary of system maintenance responsibility?**

The NRC will be responsible for maintenance of all parts of the ERDS system installed starting at the input port of the first ERDS-specific piece of hardware (e.g., modem for single feeder plants and multiplexer for multi-feeder plants.)

15. **Will the NRC develop a generic ERDS interface for use by licensees?**

The ERDS implementation contractor (NUS/EI Division) will develop a UNIX based PC application which will provide an acceptable interface with ERDS. If a licensee desires to utilize this interface, they would be required to procure the PC and provide the data feed to the PC which would then handle all ERDS related communication functions. As is the case with ERDS modems, it would be expected that the PC would be powered from a power source that has the same reliability as that of the computer used to provide the data. Licensees desiring to explore the possibility of utilizing this generic interface program should contact the NRC ERDS project manager. The ERDS interface software, with source code, will be provided to licensees at no cost by the NRC.

WORKSTATION DESCRIPTION FOR THE STATE'S INTERFACE TO THE NRC'S EMERGENCY RESPONSE DATA SYSTEM

Hardware

1. Compaq 386/25 with:

   40 MByte Hard Disk (Minimum)
   640K Memory (Minimum)
   5 1/4 inch and/or 3 1/2 inch floppy drive
   EGA/VGA Card (640 x 480 Resolution)
   Serial Communications Port
   Parallel Printer Port

2. EGA Monitor (640 X 480 Resolution)
3. Mouse or Trackball with Card and Windows Driver
4. Desk Top Printer
5. Codex 2235 Modem or equivalent

Software

6. Microsoft Windows 286
7. Winterm 8820
8. DOS 3.3

NOTE: Items 2, 3, 5, 6, 7, and 8 are required components. A functional equivalent for item 1 is acceptable as long as the required items are supported. Item 4 is optional.

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10. SUPPLEMENTARY NOTES

11. ABSTRACT (200 words or less)

The U.S. Nuclear Regulatory Commission has begun implementation of the Emergency Response Data System (ERDS) to upgrade its ability to acquire data from nuclear power plants in the event of an emergency at the plant. ERDS provides a direct real-time transfer of data from licensee plant computers to the NRC Operations Center. The system has been designed to be activated by the licensee during an emergency which has been classified at an ALERT or higher level. The NRC portion of ERDS will receive the data stream, sort and file the data. The users will include the NRC Operations Center, the NRC Regional Office of the affected plant, and if requested, the States which are within the ten mile EPZ of the site. The currently installed Emergency Notification System will be used to supplement ERDS data.

This report provides the minimum guidance for implementation of ERDS at licensee sites. It is intended to be used for planning implementation under the current voluntary program as well as for providing the minimum standards for implementing the proposed ERDS rule.

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