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Implementation Plan

SAFETY PARAMETER DISPLAY SYSTEM IMPLEMENTATION PLAN

FOR

DUANE ARNOLD ENERGY CENTER

Iowa Electric Light and Power Company

December 30, 1983

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1.0 INTRODUCTION

1.1 General

This implementation plan provides a general description of the administrative and technical approach being used in the implementation of the Safety Parameter Display System (SPDS) to be installed in Iowa Electric Light and Power Company's (IELP) Duane Arnold Energy Center (DAEC). This plan emcompasses design activities, verification and validation (V&V), configuration management, and project quality assurance. IELP's approach to implementing the SPDS consists of two phases as described below.

Phase I of this effort will be completed by January, 1984, and consists of the following major activities:

- Establishing design requirements and preparing a Design Requirements Listing (DRL),
- Completing the SPDS Safety Analysis Report (SAR) and Implementation Plan,
- Completing the SPDS preliminary design in the form of a System Design Engineering Specification, Procurement Specification, and supporting documentation.

Phase II of this effort consists of the detailed design, hardware procurement, software development, system integration, engineering, installation, testing, and operator training required for the implementation of the SPDS system at DAEC.

The implementation of the SPDS constitutes only a portion of IELP's Emergency Response Facility Program Project.

1.2 Implementation Schedule

The schedule for completing the SPDS is directly related to the cycle 7-8 refueling outage at DAEC, currently scheduled for September-December, 1984. The following major milestones are planned in support of the required operational date for the SPDS:

o Award Phase II Contract	January, 1984
o Software Development and Hardware Delivery to Vendor Complete	July, 1984
o System Integration and Factory Validation Test Complete	August, 1984
o Install System	Cycle 7-8 Refueling Outage
o System Field Verification Test, Startup, Turnover, and Operator Training Complete	60 days after Cycle 8 startup

In order to have an SPDS operational in the shortest practical time to meet the intent of Supplement 1 to NUREG-0737, the SPDS implementation will utilize only existing DAEC instrumentation. The installed SPDS will provide the operators with displays of necessary variables. In the course of preparing the DAEC position on meeting the guidance of Regulatory Guide 1.97 per the requirements of Supplement 1 to NUREG-0737, it may be found that additional or modified instrumentation is required. These instrumentation changes, if required, will be accomplished in accordance with the DAEC schedule for implementation of Regulatory Guide 1.97. The DAEC schedule for implementing Regulatory Guide 1.97 as specified in Supplement 1 of NUREG-0737 will be submitted to the NRC 90 days after the

Cycle 8 startup. Final implementation of the DAEC EOPs and performance of the supplemental Detailed Control Room Design Review will complete the requirements of Supplement 1 to NUREG-0737 concerning the SPDS.

2.0 DESIGN ACTIVITIES

The SPDS is being designed in accordance with accepted engineering practices to ensure that an adequate SPDS is implemented for the DAEC. The design and implementation of the SPDS has been broken down into specific design activities.

These design activities include the preparation of a Task Description and Plan, a Design Requirements Listing (DRL), a written Safety Analysis Report (SAR) and a Design Change Package (DCP). A Design Verification will be performed on each SPDS design activity, as appropriate, to ensure that the designed SPDS will meet regulatory requirements of existing safety-related systems of the DAEC and will not result in an unreviewed safety question. In addition, a Verification and Validation (V&V) Program will be applied to the SPDS task to ensure that the implemented SPDS meets the requirements of NUREG-0737, Supplement 1. All design activities will be performed as detailed in IELP's Emergency Response Facilities Program Project Manual.

Each design activity is briefly discussed below. The V&V activities are discussed in Section 3.0.

2.1 Task Description and Plan

A statement detailing the task objectives and a method of accomplishing the objectives has been prepared for implementing a SPDS at the DAEC. This statement is referred to as a Task Description and Plan.

The Task Description for the SPDS includes a summary of the overall objective of the task, the methods for meeting the objective, and general design criteria to be applied. A list of the systems, other tasks, and/or projects which have a direct or indirect influence and/or interface on the accomplishment of this task, along with a description of the nature and extent of the influence and/or interface is provided in the Task Description. In addition, a list of all applicable documents which pertain to the SPDS task is provided.

The Task Plan is a flow chart of the SPDS task work sequence which lists sequentially all project activities and associated procedures that are required to complete the task. A brief description of the information and document flow between steps of the task will also be provided.

Together, the SPDS Task Description and Plan provides a statement of the objectives of the SPDS and a method and plan for accomplishing those objectives.

2.2 Design Requirements Listing

The requirements which must be met to accomplish the above objectives are provided in the Design Requirements Listing (DRL) which provides the general design basis for the SPDS. The DRL addresses the description of design change, the design requirements, and the safety evaluation, as detailed below:

Description of Design Change. This description concisely and accurately describes the design change associated with implementing the SPDS, the reason for the change, and the method of accomplishing the change. P&ID's and/or electrical drawings are used as attachments, as needed, in order to clarify location and description of system components.

Design Requirements. Another portion of the DRL provides a compilation of the specific design requirements for the SPDS, each of which must be satisfied by the final SPDS design. Included in this listing are the specific design requirements provided in Supplement 1 to NUREG 0737, and any other design requirements that are necessary in order for the SPDS to meet the design bases. An evaluation of the quality assurance requirements for the SPDS implementation is also provided.

Safety Evaluation. A documented safety evaluation on the design change of the SPDS is also provided as a part of the DRL. The safety evaluation was performed in accordance with 10CFR Part 50.59 which provides the basis for the review of the design to determine that the SPDS implementation does not involve an unreviewed safety question.

2.3 Safety Analysis Report

A written safety analysis, or Safety Analysis Report (SAR), has been prepared, in accordance with Supplement 1 to NUREG 0737, Section 4.2, to ensure the adequacy of the proposed SPDS. This Safety Analysis Report describes the basis on which the selected SPDS safety parameters and associated variables have been determined to be sufficient to assess the overall safety status of the plant. Assessment included the five identified critical safety functions (ie. reactor core cooling, containment conditions, reactor coolant system integrity, reactivity control and radiation control). The analysis encompasses a wide range of events including symptoms of severe accidents, as defined by the DAEC UFSAR, and the various modes of reactor operation.

This analysis is directly related to developing the SPDS Signal List in order to assure, through human engineering principles, that not only are there sufficient variables being monitored but also that the data grouping, processing, and presentation are done in a fashion which will not tend to mislead the operator.

2.4 Design Change Package

The Design Change Package (DCP) will contain the documentation used to show all changes to the existing equipment and addition of any new equipment required to implement the SPDS. This package will include the DRL, Design Change Request Form, new and revised drawings, material specifications, contract/procurement documents, quality assurance

documents, design correspondence, design review documentation, and design change documentation. After the DCP has been verified, reviewed and approved, it will be issued for construction.

During the closeout of the DCP, the package will be updated to include all field-originated data, with which all plant drawings and data sources will be updated.

2.5 Design Verification

Design verifications of the safety-related portions of the SPDS design will be performed in accordance with IELP procedures. A design verification will be performed for each SPDS design document to ensure that the design correctly and adequately incorporates the criteria, bases and/or other design requirements established by the present plant design basis and reflects any new requirements, that are applicable. The design verification method shall involve at least one of the following:

- Design Review
- Alternative Calculations
- Qualification Testing

Design reviews will be performed by competent individuals or groups who have not participated in the original design, but who may be from the same organization entity. The results of design reviews will be documented and will include, as a minimum, identification of the reviewers, the method, and the specific design documentation verified.

Alternate calculations, if used, will include a review to address the appropriateness of the assumptions, input data and code or other calculation methods used.

Qualification testing, if used, shall be performed in accordance with written test procedures which incorporate or reference the requirements and acceptance limits contained in applicable design documents. Test results shall be documented and evaluated to assure that test requirements have been satisfied.

Whenever changes are made to previously verified design documentation, design verification shall be performed on the changes. The design verification shall include an evaluation of the effects of those changes on the overall design.

Documentation of the results of a design verification will be audited. Design reviews conducted as part of the Quality Assurance Program will verify the following:

- The appropriateness of the design bases and criteria, including assumptions, applicable regulations, codes and standards.
- That the design is adequate for the intended application.
- That changes in the selected design basis and criteria have been reviewed specifically to determine that the minimum requirements of the previously established design bases and criteria are satisfied.

Design verification, as described above, will be performed only for activities on safety-related portions of the SPDS. Verification and Validation Program activities, as described in Section 3.0, are applicable to the entire SPDS.

3.0 VERIFICATION AND VALIDATION

To assure that the SPDS will fully meet all NRC and IELP requirements, IELP has established a formal Verification and Validation program that is consistent with the guidance of NSAC 39. The overall philosophy and specific requirements for the program are contained in a controlled IELP document entitled "Verification and Validation Plan for the Safety Parameter Display System" (SPDS V&V Plan).

The SPDS V&V Plan describes the level of V&V effort to be applied at each stage of the SPDS design process, the organizations that will perform each V&V activity (i.e. IELP or contractor), and the procedures and documentation required. The Plan also defines the relationship between the V&V program and the normal ANSI N45.2.11 design verification activities. In general, the V&V program augments (rather than replaces or duplicates) the normal design verification activities. It provides an added degree of confidence that each step of the system design process will be correct, well documented and traceable, and that the final system will meet all applicable requirements. The V&V program places considerable emphasis on software and human factor aspects of the design.

The SPDS V&V Plan defines the terms verification and validation as follows:

- Verification - The review of the requirements to see that the right problem is being solved and the review of the design to see that it meets the requirements.

- o Validation - The test and evaluation of the integrated hardware and software system to determine compliance with the functional, performance, and interface requirements.

Consistent with these definitions, the SPDS V&V Plan prescribes the following major areas of V&V activity:

- o Requirements Verification
- o Design Verification
- o Validation Testing
- o Field Verification Testing

3.1 Requirements Verification

Requirements verification consists of a series of verification activities conducted to ensure that a complete, adequate, and unambiguous set of requirements for the SPDS is documented and that the requirements are traceable.

3.2 Design Verification

Design verification consists of verification activities conducted to ensure that the SPDS design, including all hardware and software, meets the requirements previously identified. This includes verifying that the display formats and display hardware are consistent with accepted human factors principles and that the Safety Analysis required by Supplement 1 to NUREG 0737 adequately supports the selection of safety parameters and variables displayed. All design documentation will undergo verification to the extent necessary to assure that it is fully adequate for its intended purposes.

3.3 Validation Testing

Validation testing consists of a test or series of tests conducted at the SPDS vendor's facility to demonstrate that the integrated system meets all previously defined requirements. The design must also be analyzed to ensure that non-testable requirements are also met. Simulated input signals will be used for both static and dynamic testing.

3.4 Field Verification Testing

Field verification testing consists of a test or series of tests conducted after installation of the SPDS at DAEC to verify that the previously validated system has been properly installed and that it operates correctly. Extensive checks will be included to assure that information displayed by the SPDS is consistent with other control room indicators. Field verification testing will be integrated with the post installation modification testing (PIMT) normally required by DAEC for all safety related plant modifications. This will avoid duplication while ensuring that the objectives of both test programs are satisfied.

In accordance with the SPDS V&V Plan, all V&V activities will be conducted by individuals who are independent of the design effort and who have sufficient experience and expertise to evaluate the adequacy of the design and testing of the SPDS. Within IELP, a V&V Engineering Section has been established to conduct and/or oversee all V&V activities on the Emergency Response Facility Program Project, including those delegated to the SPDS contractor. The V&V Engineering Section is responsible for approving all V&V personnel assignments and V&V procedures, instructions and reports, and is independent of IELP's design organization.

The SPDS V&V Plan also provides specific requirements for documentation and procedures which must be followed in resolving all deficiencies and open items identified. Strict controls are in place to ensure that all deficiencies and open items will be tracked to successful resolution prior to final turnover of the SPDS at DAEC.

4.0 CONFIGURATION MANAGEMENT PLAN

The Configuration Management Program established at Iowa Electric's DAEC, will assure that documentation representing the most current configuration of the SPDS hardware and software at the DAEC is being utilized, and that revisions to the SPDS are being controlled in accordance with accepted procedures.

The Configuration Management Plan for Computer Hardware and Software, prepared for use in meeting the Emergency Response Capability requirements of Supplement 1 to NUREG-0737 is designed to apply technical and administrative direction and surveillance to:

- identify and document the functional and physical characteristics of configuration items;
- control and document revisions to those items; and,
- record and report revision processing and implementation status.

The Configuration Management Plan defines a Configuration Item as follows:

> Configuration Item - An aggregation of computer hardware and/or software, or any of its discrete portions that satisfies an end use function and is designated for Configuration Management.

The SPDS will be a Configuration Item, and will include the SPDS hardware, including the CPU, DAS equipment and input/output devices, and SPDS software, including the operating system and all other programs executed by the SPDS hardware.

The SPDS will be placed under Configuration Management through a process known as "Baselining." This consists of documenting the configuration of the SPDS at a designated time. Each baselined document is identified by a unique document number, a document revision number, and a means of labeling the document so as to identify the Configuration Item it relates to.

In order to control the SPDS through its development and installation, the requirements discussed above have been placed upon the Contractor supplying the SPDS for the ERF Program Project. Following installation of the SPDS at the DAEC these requirements will be applied via the Configuration Management Program at the DAEC.

Revisions to the SPDS during all stages of the project will be controlled through procedures which identify who is authorized to make and to approve revisions, what documentation and records are required, and what requirements exist for verification and validation.

SPDS documentation to be controlled in accordance with the Configuration Management Program will include the SPDS hardware and software specifications, hardware location and detail drawings, hardware wiring diagrams, system configuration drawings, electrical schematics and electrical one-line drawings, software source code listings (excluding those for the operating systems), computer system test and maintenance procedures, instructions, system manuals, and operations and maintenance training materials.

5.0 PROJECT QUALITY PLAN

A Project Quality Plan (PQP) has been established and implemented to address and highlight the importance of assuring the quality requirements and the unique activities associated with the Emergency Response Facilities Program Project, which include the SPDS. The PQP was published during the earliest activities of the Project (February 17, 1983) and is required to be applied to design and subsequent activities.

The PQP for the ERF Project is a controlled document which addresses specified quality requirements and control measures for carrying out the Corporate Quality Assurance Program on the SPDS and other ERF related tasks. The data acquisition portion of the SPDS contains safety related signal isolation functions that require application of the Corporate Quality Assurance Program. The PQP specifies the applicable quality elements identified in 10CFR50 Appendix B and identifies the corresponding IELP implementing procedures for each element.

The PQP addresses each of the criteria of 10CFR50, Appendix B, with the exception of Special Processes. It identifies, among other things, the organizational responsibilities, relationship to the Corporate QA Manual, and other organizations manuals, design and procurement controls, inspections and tests, nonconformances, corrective action, records and audits.

Special emphasis is given in the PQP to the following major areas:

- Organization
- Design Control
- Audits

A description of the organization depicting the responsibilities and functions of each organizational project element and interfaces is provided in the PQP. The functions of the Project Quality Assurance Engineer both within the Project and outside the Project (Quality Assurance Department), are also described.

The largest involvement of the Project personnel in QA controlled activities is in the area of engineering and design. Thus, a description of special design control requirements and functions were identified, including the interface and function of the Verification and Validation organization.

In addition, the provision for internal surveillance functions, by the Project Quality Assurance Engineer, for compliance with Project procedures and audits by the QA Department are described.

The Project Quality Plan provides a unique QA Plan tailored to the requirements of the ERF Project. The Plan provides the members of the Project with a definition of the applicability of the corporate program to the Project. The Plan is made a part of the ERF Procedures Manual, authorized by both the Manager of the QA Department and the ERF Project Manager, making it a requirement on the Project members. The Plan, by this dual authority, allows the flexibility necessary for assurance of compliance with Corporate QA Manual requirements as applied to the ERF Project.

6.0 CONCLUSION

Based upon this Implementation Plan the completion of Phase II of this effort will result in the turnover of a complete and operable SPDS System which meets the intent of Supplement 1 to NUREG-0737, utilizing only existing DAEC instrumentation. A review of this Implementation Plan together with the Safety Analysis Report will provide the necessary assurance that the changes to the DAEC do not involve an unreviewed safety question.