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May 20, 1980

Mr. Roger J. Mattson
Director, Division of Safety Technology
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Mattson:

Enclosed for your information and consideration are recommendations on reactor plant data display and evaluation and related activities as developed by the AIF Subcommittee on Safety Parameter Integration. This information is provided pursuant to my letter of May 2, 1980 to Harold Denton in which we proposed a plan for implementing these items.

Stephen H. Howell
Chairman,
Subcommittee on Safety Parameter Integration

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ENCLOSURE 7

AIF Subcommittee on Safety Parameter Integration

April 17, 1980 Meeting

Recommendations of Subgroup A for a Minimum List of Critical Functions and Parameters

Subgroup A had as an objective to develop a list of critical functions and supporting parameters to be used as a safety status supervisory overview (or safety state vector) as outlined in the various requirements and regulations resulting from the Three Mile incident as well as events following Three Mile Island (e.g. the Crystal River loss of ICS power incident). The following documents the purpose of the critical function and supporting parameter list and requirements to be considered in implementing critical function monitoring on existing and future stations:

1. Purpose of Critical Function Monitoring:

   A. To provide a supervisory overview of plant critical safety functions in order to characterize the status of the plants. The information is for use by the operator in performing his duties in the control room and as a basic indication of overall plant conditions to technical support center personnel, and to government and regulatory agencies. These critical functions and supporting parameters are also intended to fulfill the monitoring requirements of a safety status panel should a utility elect to install such a device.

   B. The intent of the critical functions and supporting parameters is to support the operator in assessing the process of accomplishing or maintaining the critical functions of reactivity control, core cooling, RCS integrity, containment integrity, radioactive affluent control, and ESFAS actuations.

2. Requirements:

   A. It is not necessary that critical function monitoring be implemented as a safety related or safety grade systems since this information constitutes the enhanced display of information contained on indications and controls already available to the operator. The critical function monitoring however must be accomplished with highly reliable commercial grade display instrumentation. If critical function monitoring is required to be safety related a significant population of highly reliable display instrumentation will be unavailable for this purpose and hence the quality of the enhanced information will be seriously limited.

2. Requirements (con't)

B. Critical function monitoring should be incorporated into the existing control boards consistent with the specific plant design and human factors principles. It is judged to be counter productive to attempt to force fit a standard hardware design into every control room. The best approach is to integrate the required functions into existing control rooms to assure human factors guidelines are not compromised and further confusion is not introduced into the control room with this additional monitoring. As an example, the monitoring of critical functions can be accomplished through a separate "safety status panel", CRT displays, or other alternatives to optimize the Human Factors aspects of the specific control room.

C. The status or margin of each of the six critical functions should be indicated umambiguously to the operator. The parameter set associated with each of the critical functions are the minimum and sufficient parameters necessary in arriving at conclusions with regard to status or margin for each of the critical functions.

Subgroup A. Members

Bill Coley------Duke Power Co.
Larry Mills-----TVA
Tom Shultz------C-E
Dave Sommers----Consumers Power Co.
Ed Warman-------Stone & Webster

Recommended Safety Parameter Set

I. Reactivity Control

1. Neutron Flux
2. Control Rod Trip

II. Reactor Core Cooling

A. Core Heat Removal and RCS Inventory Control

1. RCS Temp (hot leg)
2. RCS Temp (cold leg)
3. RCS Pressure
4. Pressurizer Water Level

B. Heat Transfer Paths

1. Steam Generator Water Level
2. Steam Generator Pressure
3. Auxiliary Feedwater Flow
4. High Pressure Injection Flow
5. Low Pressure Injection Flow

III. Reactor Cooling System Integrity

1. RCS Pressure
2. Containment Pressure
3. RCS Temperature
4. Containment Radiation
5. Containment Sump Water Level
6. Secondary Side Radiation (Air ejector off-gas)

IV. Containment Integrity

1. Remotely Operated Containment Isolation Valve Position Indications
2. Containment Pressure
3. Containment Temperature
4. Containment Spray Flow
5. Cooling Water Flow to Recirculation Air Coolers
6. Cooling Water Temperature from Recirculation Air Coolers.
7. Containment Hydrogen Concentration

V. Radioactivity Release (Final Release Point Monitors)

VI. Engineered Safety Features Actuation Status

Recommendations of Subgroup B.
Safety Console

Purpose:

The Plant Safety Console is to: (1) provide real time indications of plant safety status using a minimum set of fundamental parameters and displaying these in one place; (2) assist operations and support staff in detecting and diagnosing accidents; and (3) determine plant safety status and provide feedback to plant staff on the results of their actions.

Discussion:

It is assumed that the installed Protection System and Engineering Safety Features Actuation System (ESFAS) respond to the changes in plant parameters and initiate their function as designed. The safety console is not intended to replace those functions. The function of the safety system is to display a few critical parameters in a concentrated way to allow easy assessment of plant conditions. The display system would compliment, not replace, existing displays. The information provided by the safety console would assure that key parameters are easily observable and trending in a safe direction following reactor trip or actuation of safety injection. The manner in which parameters are displayed should provide for the recognition of the most serious accident should a complex transient occur. The trending of parameters should be part of the display system and should be in a format or form such that the plant personnel can easily assess its behavior. The display system should operate continuously from a reliability standpoint and to allow assessment of proper functioning of the Protection System and ESFAS.

Monitoring of the status of the various safety systems needs to be performed in the control room. This can be separate from the safety console. The location of the safety console will be separate from the existing control boards because of the lack of space on the control boards. The location of the safety console in the control room should allow the displays to be easily observed by the operator from his present work station so that he can still manipulate the controls on the control board as required by the procedures to deal with the transient in progress.

Subgroup B Members

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Lee Gery -------Westinghouse
Ted Myers-------Toledo Edison Co.
Roger Newton----Wisconsin Electric Power Co.
Ward Wagland----Commonwealth Edison Co.

Recommendation of Subgroup C
Technical Support Center
Functional Requirements and Design Basis

TSC Purpose:

To provide and integrated facility for management and expert over view of reactor and plant operation to support accident mitigation and recovery without interfering with ongoing plant operations. Also, to provide broad access to plant situation data and design information.

TSC Functions:

1. Provide technical assessment and support, and management assistance independent of the control room..

2. Provide communication of information to the Emergency Operations Center and other support locations.

3. Maintain a dedicated communications interface with the main control room.

TSC Functional Scope:

In order to provide technical direction and assistance to the TSC staff the following should be available to the TSC:

1. Data base for possible analyses of thermodynamic and nuclear effects.

2. Access to historical data for prediction of instrument behavior when subjected to abnormal ambient conditions.

3. "As is" mechanical and electrical drawings.

4. Vendor prints and instruction manuals.

5. Directory of all safety-related equipment vendor contracts.

6. Procurement records of materials and components.

7. Communications links to the Control Room, Emergency Operations Center, NRC, NSS Supplier

8. Data transmission capability

Information bases include:

Phase A

(1) Parameters descriptive of plant safety state.

(2) Parameters comparable to Reg Guide 1.97 except with instrument ranges of existing instruments.

Phase B

(3) Full access to plant computer data base.

(4) Information descriptive of the plant safety systems status is desirable in the long-range development.

TSC Design Bases

1. Location: In proximity to and with access to the Control Room.

2. Essentiality: Operability not a limiting condition for continued operation. Use Control Room as back-up provision.

-----Seismic classification:
Non-seismic

-----Tornado protection: No

-----Maximum flood protection: No

3. Habitability objectives: Radiological concerns only

(a) Area and airborne radiological monitoring

(b) Capability to minimize internal contamination from atmospheric gaseous or particulate releases by ventilation isolation, shielding adequate to protect occupants assuming preset core inventory release, and life support facilities for up to 25 people or, (C) Sufficiently close proximity to the Control Room such that a minimum number of TSC personnel can shift to the Control Room and use it as a back-up TSC. (Remainder of TSC personnel would shift to the off-site Emergency Operations Center)

4. Size: Of sufficient size to house those operating the TSC, NRC representatives, and equipment and information indicated previously. Depending on how the utility plans to staff the TSC vis-a-vis the Emergency Oper .ions Center, the TSC facilities should support at least 12-15 working personnel

5. Equipment Classification: Reliable, non-seismic, non-1E

6. TSC Independence: Operation and habitability independent from off-site power

Subgroup C Members

Dan Cardinale -------Sargent & Lundy
George Daniels-------Rochester Gas & Electric Co.
William Gordon-------Bechtel Power Corp.
Elmer Patterson------Babcock & Wilcox
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Recommendations of Subgroup D
NUCLEAR DATA LINK

Purpose: Information only data link between each operating nuclear power plant and the NRC Operations Center in Bethesda, Md.

Function: Validate the safety status of affected nuclear power plant in a transient incident.

Objectives: (1) Provide NRC with accurate information.

(2) Verify that the essential safety functions are being satisfied.

(3) Assure corrective actions are being taken to maintain and return the plant to a safe condition.

Caveat: (1) No management of operation by NRC
(2) No more information than in TSC

Possible benefit: Provide accurate data to company HQ and NSSSupplier

Approach: The NDL should interface with the Tech Support Center. Data input should be limited to the Safety parameter set and key meterological and radiological release data.

Committee Position: The NDL is not considered necessary to safely operate nuclear power plants. The committee's opinion is that data systems decrease in importance with distance from the effected plant control room; i.e., priority for improvement in information systems should be control room, TSC, EOC, and lastly NDL. Therefore, considering that dedicated telephones already exist, the need for a NDL is marginal and not considered cost-effective.

Subgroup D Members

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Dave Cain-------NSAC
Bob Hamilton----GE
George Liebler--Florida Power &Light Co.
Bob Salmon------Iowa Electric Power Co.

Issues Requiring Further Discussion: (If the NDL becomes mandatory)

A. That the range, formatting and display of data should be the same as Technical Support Center and Emergency Operations Center.

B. That there be some provision for voice communication.

C. That there be capability for manual data hook-up and facsimile data transmission.

D. That effective means for signal validation/testing be provided.

E. That data be supplied on the basis of a standardized format with engineering unit conversion.

F. That provision for interactive data access not be required.

G. That data quality be supportive only of manual (hand) engineering calculations for scoping purposes.

H. That sequence of events data should not be provided.

I. That "real-time" data transmission should be correctly interpreted as near-real time, such that the safety status of the plant can be determined within a 15 minute period.

J. That bulk data requirements for detailed engineering calculations be supported on an off- ine basis; i.e., not as part of the nuclear data link syste..

K. Power supply

Recommendations of Subgroup E

Safety Parameter Integration Plan

We (NSAC) have prepared a draft implementation plan which incorporates the schedule of activities which involve the fundamental safety parameters and the different related uses of this information. At the meeting we sensed a fairly good consensus on the need and value of a simple, integrated system which can handle data acquistion and display needs of the Safety Panel; the Technical Support Center (TSC); the Emergency Operations Center (EOC); and the Nuclear Data Link (NDL). It was agreed that the priority for decisions on specification for such a system should be the Safety Panel in the interest of "helping the operator first". The other users should use the same parameters and specifications. The foregoing system description and implementation plan has been formulated with these aspects in mind.

In order to construct a meaningful implementation plan, we have found it necessary to adopt a "reference" system architecture. Thus, we have chosen what is believed to be a simple and generic approach, but recognizing that a great variety of system configurations are possible. This architecture is shown in Figure 1.

The utility of the system structure in Figure 1 is to provide a conceptual basis for discussions with the NRC. Once general agreement between industry and NRC has been reached with regards to the minimal system and a corresponding plan for its implementation, utilities and vendors would presumably be free to develop their own variations -- within the framework of basic industry-NRC understandings.

The basic plan is to tap into the system at the process computer input, rather than its output. This circumvents problems relating to the nature and extent of process computer upgrading that is necessary or perhaps desirable in light of TMI-2 but which will take considerable time. Signal inputs are limited to only those parameters which comprise the "fundamental parameter set". The scheme effectively separates what would be required as a minimum to meet NRC requirements from more elaborate operator aids and display features which could be implemented in the longer term. Some advantages and disadvantages of such a system are listed in Table 1.

A draft implementation plan and schedule for the basic system is shown in Figure 2. A principal feature is two-path program at the outset which separates the parameter selection process from hardware considerations (design criteria, concept, etc). Negotiations with the NRC must be carried out in both areas, although probably involving different Regulatory staff. In accordance with this schedule a general industry concensus and understanding with the NRC should be concluded by July 1980.

Once these preliminary activities are concluded, it is believed that a single-path program leading from the development of model procurement specifications to installation and test is appropriate. The endpoint results in the bringing "on-line" of data systems supporting the Safety Panel, the Technical Support Center, Emergency Operations Center and the Nuclear Data Link at about the same time.

The organized approach for system upgrading would seem to be a logical and efficient means for meeting NRC requirements that the Subcommittee could adopt or adapt as part of its plan of action.

Subgroup E Members

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FIGURE 1

Reference System Architecture

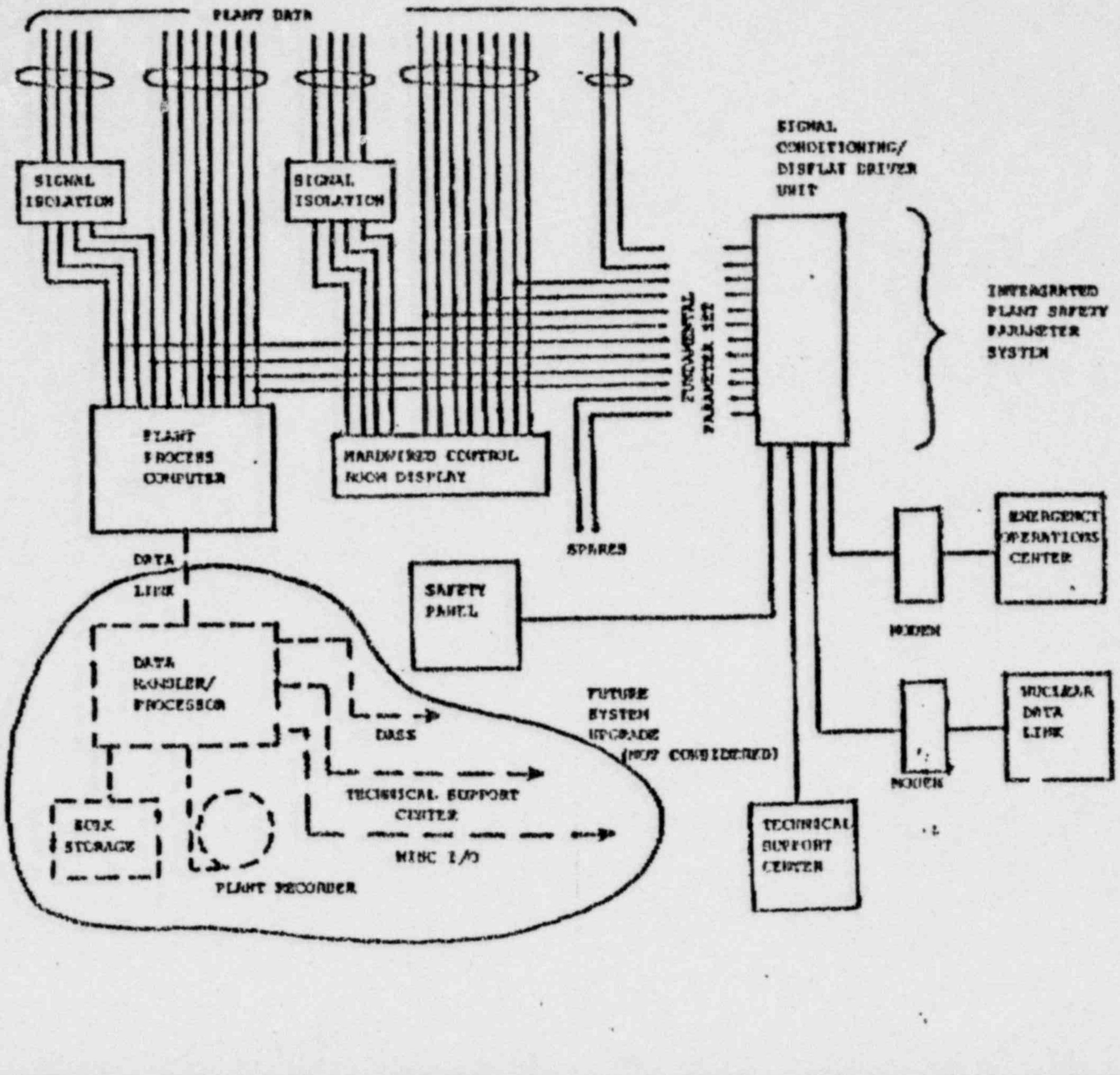
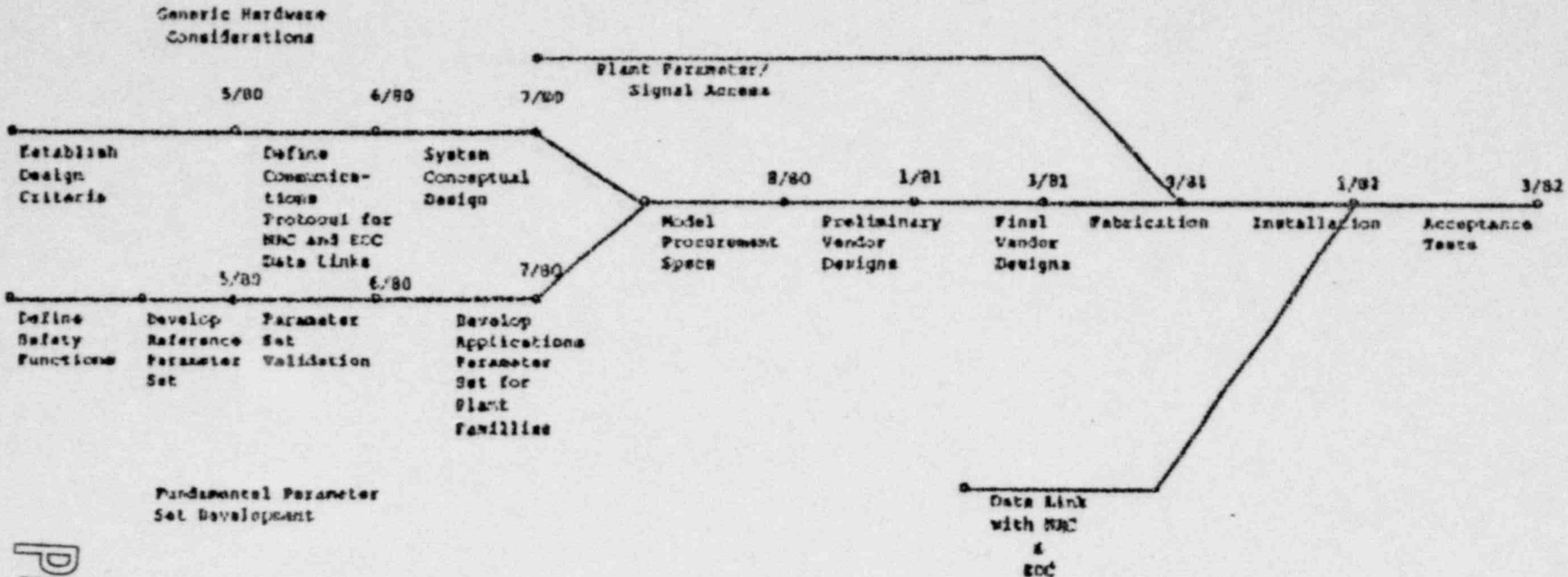


TABLE 1

Advantages	Disadvantages
Simple	Not Amendable to DASS Technologies
Limited Scope	Will not (probably) meet long term TSC requirements
Could be mostly hardwired	Inflexible
Identical Displays	
Clear Distinction Between Short and Longer Term Upgrades	
Higher Level Qualification Redundancy etc. Possbile	
Independent of Process Computer	
Greater Degree of Data Security	

FIGURE 2

Safety Panel and TSC Display Implementation
with NRC and EOC Data Links *



*Typical Target Dates for [illegible] - may need to be revised and adapted for each reactor design type.