JUL 3 0 1976

50-346

Thomas A. Ippolito, Chief, Electrical, Instrumentation and Control Systems Branch, Division of Systems Safety
THRU: Charles F. Miller, Section Leader, Electrical, Instrumentation and Control Systems Branch, Division of Systems Safety

SUMMARY OF MEETING WITH DAVIS BESSE UNIT 1 - DRAWING REVIEW OF THE REACTOR PROTECTION SYSTEM (RPS) AND THE ENGINEERED SAFETY FEATURES ACTUATION SYSTEM (ESFAS)

A meeting was held in Gaithersburg, Maryland, July 13-15, 1976, with NRC, Toledo Edison Company (Davis Besse Unit 1) and Bechtel Company (Gaithersburg) to review the final design drawings for the subject systems. In addition, representatives from Babcock and Wilcox and Consolidated Control Corporation were present to answer questions relative to their respective scope of supply (i.e., the RPS and the ESFAS). A list of attendees is attached.

The purpose of the meeting was to assure that the design has been implemented to satisfy the requirements of the applicable standards and criteria. During the course of the meeting the applicant was requested to demonstrate how the design met the criteria for channel separation. Selected input parameters to the Reactor Protection System and to the Engineered Safety Features System were traced from and including the sensor to the logic cabinets located in the control room and from the logic cabinets to and including the actuated equipment (i.e., valves, pumps, etc.). The applicant identified the location of wireways and sensor mountings between redundant channels in order to verify that safety related channels were adequately separated.

Enclosure 2 summarizes the items discussed and identifies the concerns expressed by the NRC staff.

/s/

Andrew J. Szukiewicz
Electrical, Instrumentation
and Control Systems Branch
Division of Systems Safety

Enclosures:
As Stated

cc: See Attached

DISTRIBUTION
DOCKET FILE
NRR READING FILE
EIC READING FILE
C. F. MILLER
A. J. SZUKIEWICZ
EICSB MEMBERS

OFFICE	PS:EICSB	PS:EICSB	PS:EICSB			
SURNAME	AJSzukiewicz	CFMiller	TAIppolito			
DATE	7/28/76	7/28/76	7/29/76			

Form AEC-318 (Rev. 9-53) AECM 0240 ☆ U. S. GOVERNMENT PRINTING OFFICE: 1974-526-166

8002050605

DISTRIBUTION LIST

B. C. Rusche
E. G. Case
S. Hanauer
R. Heineman
R. Fraley (16)
R. C. DeYoung
R. P. Denise
D. Skovholt
R. Maccary
D. Ross
R. L. Tedesco
I&E (3)
M. Kehnemuyi
NRC PDR
Local PDR
S. Varga (ECCS or ATWS)
Meeting Attendees
L. Engle

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JUL 29 1976

Thomas A. Ippolito, Chief, Electrical, Instrumentation and Control Systems Branch, Division of Systems Safety
THRU: Charles F. Miller, Section Leader, Electrical, Instrumentation and Control Systems Branch, Division of Systems Safety

SUMMARY OF MEETING WITH DAVIS BESSE UNIT 1 - DRAWING REVIEW OF THE REACTOR PROTECTION SYSTEM (RPS) AND THE ENGINEERED SAFETY FEATURES ACTUATION SYSTEM (ESFAS)

A meeting was held in Gaithersburg, Maryland, July 13-15, 1976, with NRC, Toledo Edison Company (Davis Besse Unit 1) and Bechtel Company (Gaithersburg) to review the final design drawings for the subject systems. In addition, representatives from Babcock and Wilcox and Consolidated Control Corporation were present to answer questions relative to their respective scope of supply (i.e., the RPS and the ESFAS). A list of attendees is attached.

The purpose of the meeting was to assure that the design has been implemented to satisfy the requirements of the applicable standards and criteria. During the course of the meeting the applicant was requested to demonstrate how the design met the criteria for channel separation. Selected input parameters to the Reactor Protection System and to the Engineered Safety Features System were traced from and including the sensor to the logic cabinets located in the control room and from the logic cabinets to and including the actuated equipment (i.e., valves, pumps, etc.). The applicant identified the location of wireways and sensor mountings between redundant channels in order to verify that safety related channels were adequately separated.

Enclosure 2 summarizes the items discussed and identifies the concerns expressed by the NRC staff.

Andrew J. Szukiewicz
Electrical, Instrumentation
and Control Systems Branch
Division of Systems Safety

Enclosures:
As Stated

cc: See Attached

ENCLOSURE 2

MEETING ATTENDEES

Toledo Edison Company

R. Bins
A. S. Topor
F. R. Miller

Bechtel

S. N. Saba
S. M. Canter
C. Schuker*
G. Stashte*
L. Wise*
J. Rerty*
D. Douds*
V. Howard*

Consolidated Control Corp.

G. Schoonbaum

Babcock and Wilcox

J. T. Fairburn*
J. E. Anderson*
L. M. Lesniak*

NRC

R. Kendall
A. J. Szukiewicz

*Denotes part time attendance

ENCLOSURE 1

1. Qualification of ESFAS isolation devices was discussed. The system design utilizes digital isolation (i.e., relays for ESFAS output isolation and opto-isolators for ESFAS interchannel isolation) and analog isolation devices (i.e., current to current isolation devices for isolation of input sensors). Consolidated Controls Corporation's representative described the test methods and procedures used to qualify the isolation devices. In general, the relays were qualified to 450 VAC, the opto-isolators were qualified to 1000 VAC, and the analog isolators were qualffied to 600 VAC. Testing was performed both on component and system level. Noise tests using Mil-Spec 19900 were conducted to determine noise susceptability of the safety channels. The applicant committed to amend the FSAR and describe the adequacy of these isolation devices in a subsequent revision.

2. ESFAS channel independence was reviewed in detail. Although non-Class 1E wiring is separated from Class 1E wiring outside the ESFAS logic cabinets, the system design allows non-Class 1E wiring to be bundled with Class 1E wiring inside the ESFAS logic cabinets. Therefore, it is not apparent that independence between redundant Class 1E circuits would not be compromised in the event of a single failure imposed on the non-safety circuits associated with the safety circuits. It is the staff's concern that a fault (i.e., grounding shorting, application of high voltage or noise) imposed on the non-Class 1E circuits associated with safety grade equipment could degrade the functional integrity of the safety channels below an acceptable level. The applicant was requested to demonstrate by test that the system as installed would maintain their functional integrity when subjected to these faults.

   The applicant identified that only the on-safety circuits associated with the safety channels that could be of concern are circuits associated with alarm inputs and computer inputs, and agreed to evaluate our concerns. Suitable test methods were discussed.

The applicant will advise the staff as to the satisfactory resolution of this concern.

3. Testability of ESFAS channels was reviewed in detail. It was determined that non-Class 1E equipment associated with the ESFAS test modules was utilized for periodic verification of ESFAS channels. The applicant was advised that the staff requires that the reliability of the test system be equivalent to that of the ESFAS in which it is located, and therefore this design feature of using non-Class 1E equipment for ESFAS testing is not acceptable. The applicant was requested to modify the design by providing a fully Class 1E test scheme. The applicant committed to review this design and conform with the staff's requirements

4. Channel identification of safety related cables in conduits was discussed. It was determined that identification of safety related conduits was only implemented at each end of the "run" and as such safety related conduit runs could not be readily identifiable along their entire length. The applicant was advised that channel identification for safety related conduit "raceways" does not conform to the requirements of IEEE Std 279-1971, Section 4.22, and is unacceptable. We require that conduit raceways be uniquely identified at discrete points along the entire length in order to visually verify that these "raceways" were installed in accordance with the required criteria. Color coding or alphanumeric channel designation is considered an acceptable identifier. The applicant agreed to evaluate the staff's requirements and provide unique identification for conduit "raceways."

5. ESFAS internal cabinet wiring was reviewed. Each ESFAS channel cabinet is physically separated from its redundant counterpart, all input and outputs enter and exit from the bottom of the cabinets, all entrances and exits are sealed with flame retardant material. Interchannel wiring is uniquely identified and routed in designated raceways and conform to the separation criteria for redundant Class 1E raceways (i.e., channel 12 which interconnects channel 1 and 2 are separated from raceways designated for channel 1 or channel 2). Interchannel wiring is isolated from its originating source via

optical isolators. The applicant agreed to amend the FSAR and describe in detail the separation criteria for interchannel wiring. Subject to satisfactory documentation we conclude that the design for interchannel wiring is acceptable.

6. During our review the applicant was requested to demonstrate how the separation criteria described in the FSAR for the ESFAS was implemented. Separation and independence for the following sensor inputs from their field installed location to the protection channel was traced and verified.

   a. Redundant containment radiation sensors (RIS 2004 and RIS 2005)
   b. Redundant Reactor Coolant Pressure (RC2B4 and RC2A4)
   c. Redundant Containment Vessel Pressure (PT2000 and PT 2001)
   d. Redundant Borated Storage Tank Level (LT 1525A and LT 1525B)

   In addition, separation criteria was verified from the protection system to the following actuated devices.

   a. Redundant High Pressure injection pumps and valves,
   b. Redundant Low Pressure injection pumps and valves, and
   c. Redundant Containment Spray pumps and valves.

   Also the power supply to the sensors and actuated devices was verified to be separate and independent.

   The following Bechtel cable raceway drawings were used for verification of the cable separation for the above parameters.

E 319, Revision 8	E 414, Revision 13
E 335, Revision 17	E 365, Revision 9
E 336, Revision 14	E 319, Revision 8
E 347, Revision 13	E 330, Revision 6
E 348, Revision 13	E 331, Revision 5
E 349, Sheet 1, Revision 13	E 332, Revision 17
E 350, Revision 16	E 334, Revision 4
E 356, Sheet 1	E 335, Revision 17
E 363, Revision 4	E 336, Revision 14
E 366, Revision 12	E 337, Revision 7
E 369, Revision 13	E 338, Revision 19

E 347, Revision 13	E 350, Reivision 16
E 348, Revision 12	E 356, Sheet 1, Revision 9
E 349, Sheet 2, Revision 1	E 356, Sheet 12, Revision 1
E 349, Sheet 1, Revision 13	E 412, Revision 14

Based on the review of the ESFAS system and the above referenced drawings we conclude that the design as implemented provide a satisfactory degree of separation and independence and is acceptable (except as noted in items 2, 3, and 4) subject to the verification of this design during our site visit.

7. All sensor inputs to the ESFAS and RPS logic cabinets are continuously monitored and indicated on the main control board or in the logic cabinets located in the control room to facilitate verification of their operability. Sensors used for ESFAS are not shared with the RPS.

8. The applicant was requested to submit the panel layout drawings series M-580 and series M-581 and drawing E 353 as part of the final drawing package of the FSAR.

9. Qualification of RPS isolation devices was discussed. Representatives from Babcock and Wilcox Co. described general test methods and procedures used to qualify the isolation devices. In general, two types of isolation devices are used in the RPS design, analog isolation devices (buffer amplifiers) and digital isolation devices (relays). Component tests were conducted by subjecting the isolation devices to shorts, grounds, open circuits, and application of high voltage and low voltage (up to 50 VAC) noise susceptibility.

   Since the design of the RPS is functionally similar to the ESFAS design where non-Class 1E wiring is bundled together with Class 1E wiring inside the RPS logic cabinets, the applicant was also requested to demonstrate by test that the functional integrity of the RPS would not be degraded in the event of a single failure (see item 2 of this report).

   The applicant will advise the staff as to the satisfactory resolution of this concern.

10. Separation and independence for the following RPS sensor inputs from their field installed location to the protection channels was traced and verified:

    a. Redundant Power Range (flux sensors((channel 1 and 3)
    b. Redundant Pump Speed sensors (channel 1 and 3)
    c. Redundant Reactor Coolant Temperature sensors (channel 1 and 3)

    In addition, the separation criteria was verified from the RPS channels to the undervoltage coils of the control rod drive power supply breakers.

    The following Bechtel cable raceway drawings were used for verification of the cable separation for the above parameters:

    E 319, Revision 8
    E 330, Revision 6
    E 331, Revision 5
    E 332, Revision 17
    E 334, Revision 4
    E 335, Revision 17
    E 336, Revision 13
    E 337, Revision 7
    E 338, Revision 19
    E 343, Revision 9
    E 344, Revision 5
    E 345, Revision 8
    E 346, Revision 12
    E 347, Revision 14
    E 348, Revision 13
    E 349, Sheet 2, Revision 1
    E 349, Sheet 1, Revision 13
    E 350, Revision 16
    E 356, Sheet 1, ---
    E 356, Sheet 12, Revision 1
    E 363, Revision 4
    E 365, Revision 9
    E 366, Revision 12
    E 369, Revision 13
    E 412, ---

11. The applicant was requested to submit the final design drawing for the modified Reactor Trip System, and amend the FSAR to describe the as build design. The modified design incorporates four reactor trip breakers (instead of two presently described in the FSAR) and the trip logic at the breakers is a 1-out-of-2-taken-twice. We have reviewed the proposed design and conclude that it is acceptable subject only to the satisfactory documentation of this design in the FSAR.

12. The applicant was requested and agreed to submit the final schematic diagram of the control rod drive power supply trip breakers as part of the FSAR docket (i.e., drawing 7749-14-555-341).

13. We have reviewed the inputs to the Integrated Control System that are derived from the RPS system (i.e., average power signal, Reactor Coolant loop (A)B flow, Reactor coolant pressure).We conclude that subject to the satisfactory verification of the adequacy of the isolation devices used, this design for the Davis Besse 1 plant is acceptable.