Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

June 19, 1984

Mr. R. C. DeYoung
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Byron Generating Station Units 1 and 2
Independent Design Inspection
NRC Inspection Report Nos. 50-454/83-32
NRC Docket Nos. 50-454 and 50-455

References (a): December 30, 1983 letter from Cordell Reed to R. C. DeYoung.

(b): March 23, 1984 letter from J. Nelson Grace to Cordell Reed.

(c): May 14, 1984 letter from J. Nelson Grace to Cordell Reed.

Dear Mr. DeYoung:

This letter supplies additional information regarding Commonwealth Edison's responses to the findings, unresolved items, observations and general concerns which were identified during the Byron integrated design inspection.

Attachment A to this letter contains responses to the NRC questions contained in references (b) and (c) regarding issues not associated with pipe break analyses. The pipe break issues will be addressed in a separate letter in the near future.

Please address further questions regarding this matter to this office.

One signed original and fifteen copies of this letter and the enclosure are provided for NRC review.

Very truly yours,

for Cordell Reed
Vice President

bs

cc: J.G. Keppler - w/Attachment

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8818N

Attachment A

BYRON IDI RESPONSES

Table of Contents

Section I

Response to NRC Letter Dated March 23, 1984

General Item:

"Systematic review and corrective action program to assure that the necessary calculations in the mechanical systems discipline are identified, performed and updated as needed to support the current design.

Your response stated that all safety-related calculations in the Project Management Division calculation books were being reviewed in accordance with an approved instruction to determine that they were technically adequate to support the current Byron/Braidwood design and to determine if the format conformed to the applicable version of Procedure GQ 3.08. You also stated that no hardware changes had resulted from these reviews, which were about 80% complete. You are requested to provide the following additional information about this review program when completed:

1. Describe the provisions in the review program to determine that all necessary calculations in this discipline have been identified and performed. Indicate the number of new calculations, if any, that were performed.

2. Indicate the number of calculations, if any, where:

   (a) Hardware changes were made

   (b) Reanalysis was performed

   (c) Updated information was incorporated or documentation was improved

   (d) Incomplete calculations had been approved

   (e) Additional action was taken to correct root causes or generic deficiencies

In addition, with respect to the overall project, your response noted that Commonwealth Edison quality assurance audits have included design calculations and that problems identified in those audits were pursued to determine root causes and seek out generic deficiencies. You are requested to provide the following information with respect to previous Commonwealth Edison audits of Sargent & Lundy design calculations:

1. The number of calculations audited

2. The number of calculations, if any, where:

(a) Hardware changes were made

(b) Reanalysis was performed

(c) Updated information was incorporated or documentation was improved

(d) Incomplete calculations had been approved

(e) Additional action was taken to correct root causes or generic deficiencies."

RESPONSE

The review of all safety-related calculations in the Project Management Division (PMD) calculation books, performed by the Byron project engineers, as described in the responses submitted with the December 30, 1983 letter, has been completed. This review was initiated to address the stated IDI concerns about the adequacy of the calculations previously performed by Sargent & Lundy Byron project PMD engineers. The results of this review indicated that the current design was adequately supported by these calculations.

As stated in this request for additional information, the objectives of this review were to verify that the existing calculations met the standards and instructions in effect at the time the calculations were performed, and to verify that these calculations were technically adequate. This review program did not include any specific provisions to determine that all necessary calculations by Byron PMD engineers had been identified and performed. However, the following two considerations should resolve this particular issue:

1. The safety-related calculations in the Byron PMD calculation books represent the calculations that were determined to be the necessary and sufficient calculations required by the Project Manager and/or Mechanical Project Engineer, as required by Sargent & Lundy Quality Assurance Procedure GQ-3.08. To address the concern, the Mechanical Project Management Engineers initiated a survey to confirm that the necessary PMD calculations have been performed. Two additional calculations resulted from the survey. These calculations were performed to provide documentation for the size of the diesel oil day tank and the diesel oil storage tank. These calculations represent the compilation of the formally documented calculations performed by PMD engineers during the course of the project. As such, we believe that all necessary calculations were performed.

2. In order to provide additional assurance that Sargent & Lundy has adequately addressed this issue, Commonwealth Edison Company (CECo) has retained the services of Bechtel Power Corporation to perform an Independent Design Review (IDR) of three systems on the Byron/Braidwood plants. This systematic review will include an evaluation of the design adequacy and the design process on these systems, and will ensure that the output documents (e.g., calculations) meet the licensing commitments and safety-related design requirements.

The following tabulation summarizes the results of Sargent & Lundy's review of the existing PMD calculations:

Category	No. Of Calculations
a) Hardware changes were made	0
b) Reanalysis was performed	0
c) Updated information was incorporated or documentation was improved	73
d) Incomplete calculations had been approved	0
e) Additional action was taken to correct root causes or generic deficiencies	0
f) No changes to original calculations	39
Total Calculations Reviewed	112

The following clarifications to the categories presented above need to be made. Category (b) was defined as those instances where an existing calculation was found to be technically deficient or was not conservative relative to the existing design, and therefore, required a detailed analysis to verify the adequacy of the plant design. No calculations were determined to be included in this category. Category (c) was defined as those instances where the existing calculation was technically adequate and supported the current design; however, revisions to the calculation format, list of references, updated information, or other related areas were made in order to improve the documentation aspects of the calculation. In no instance did these changes result in a design change or hardware change.

3. In the above letter from the NRC, Commonwealth Edison was requested to respond and supply information regarding the number of calculations for the Byron Project which were examined during Commonwealth Edison Quality Assurance Department audits of Sargent & Lundy. Edison audits of design calculations began in early 1979; and during the period February 1979 through January 1984, Edison Quality Assurance conducted 22 audits of Sargent & Lundy which examined work pertaining to the Byron Project. During 12 of the 22 audits, approximately 325 calculations for the Byron/Braidwood project were reviewed. It should be noted that, for the most part, calculations are applicable to both projects; however, some calculations were unique to either Byron or Braidwood. All of the calculations were processed by the same team of Sargent & Lundy personnel because the Byron/Braidwood stations are designed under a single project group.

   A summary of the corrective actions resulting from the above audits is as follows (using the same definitions as in Item 2 above):

   a) No calculations were found to have problems which resulted in hardware changes.

   b) One calculation resulted in reanalysis.

   c) 16 calculations were noted where updated information was incorporated or documentation was improved. A breakdown of the 16 calculations is as follows: 14 required documented calculations to be originated to support the design, 1 resulted in a Design Criteria change, and lastly, 1 calculation was updated to show the correct load value.

   d) No cases were noted where incomplete calculations had been approved.

   e) As a result of the 17 calculational deficiencies referred to in 3(b) and 3(c) above, Sargent & Lundy performed extensive reviews for two of the deficiencies. The action taken to prevent recurrence included revisions to procedures.

Finding 2-1: Diesel Engine Air Intake

> "You are requested to provide for our review a copy of the documented walkdown which concluded that there are no additional non-safety-related components that will impair the function of the intake line."

RESPONSE

A copy of the documented walkdown (dated 11-15-83) is enclosed.

ATTACHMENT TO FINDING 2-1

UNIT 1 AUXILIARY FEEDWATER DIESEL AIR INTAKE LOCATION REVIEW

LINE NO.:

1D0B1A14, Piping Subsystem 1D025

MATERIAL:

A-106 GrB; 0.375 inch wall

ROUTING:

The air intake line runs a short distance in the Auxiliary Building and penetrates "L" line wall into the Turbine Building at EL 391'-10". The line turns upward immediately and penetrates level 401. At level 401 the line extends upward for approximately 6 feet with two 90° elbows and a debris screen welded onto the end of the pipe. Intake air for the Auxiliary feedwater diesel is taken from the Turbine Building air volume. The total length of intake pipe is approximately 30 feet.

PIPE SUPPORT:

The pipe is seismically supported in the Auxiliary and Turbine Buildings by an anchor provided at "L" line wall. One pipe support located in the Turbine Building is provided for support of the debris screen and double elbows.

TURBINE BUILDING INTERACTION:

Below El 401: The intake line runs vertically from El 391'-10" to level 401 and is located 2'-10" from the edge of "L" line wall. This area is free of larger components and no hazard to pipe integrity exists. The pipe is physically above most nearby components.

Above El 401: The intake line ends approximately 2'-10" from "L" line wall. In plan, the pipe is located West of the CO_2 storage tank and North of the Turbine Building elevator shaft. All piping within eight feet of the intake line is 6" or less in diameter.

The nearest larger diameter pipe is 10G21C24. This 0G line is located above the floor with centerline at El 413'-3". In plan the 0G line is located approximately eight feet East of the intake line. The elevator shaft structure would provide ample protection to shield the intake line from a swinging 0G line.

Two cable trays run vertically overhead but would not be capable of jeopardizing the integrity of the intake air line.

ATTACHMENT TO FINDING 2-1

(Cont'd)

CONCLUSION:

The Auxiliary feedwater pump diesel intake air line is a reasonably short run of pipe. The air intake pipe is routed to provide a minimum exposure to non-safety related components capable of damaging it. The air intake location is acceptable.

UNIT 2:

The Unit 2 air intake location is similar to Unit 1, however the installation status is incomplete at this time. An inspection of area indicated a similar piping and equipment arrangement.

REFERENCES:

1. Piping analytical drawing 1D025, sheets 1 and 2, Rev. 1
2. Composite drawing M-330, Rev. T
3. Photographs taken 11-15-83.

Prepared James Austin 11-15-83

Reviewed 11-15-83

Approved Dennis Demons 11-15-83

Finding 2-3: Basis for Time Delay

> "You are requested to describe the basis for determining that the hydraulic transient, considering worst case conditions such as minimum technical specifications condensate storage tank level, high condensate water temperature, simultaneous pump start and runout flows, does not result in pump trip or undesirable addition of relatively impure ESW system water to the steam generators."

RESPONSE

The auxiliary feedwater system preoperational test (2.3.10) included a section to determine whether a hydraulic transient on a simultaneous pump start would result in a sudden decrease in system pressure causing either a pump trip or the opening of the essential service water supply valves. The test was conducted under the following conditions:

a. Condensate storage tank level was verified to be at 197,500 gallons. (The test procedure requires the condensate storage tank level to be at the minimum technical specification level of 200,000 gallons, ± 25,000 gallons.)

b. Suction pressures initially recorded,

c. AFW pumps started individually and suction pressures recorded, and

d. AFW pumps started simultaneously and suction pressures recorded.

The maximum suction pressure transient recorded was a 10.2 psi drop in pressure for the motor-driven pump during the simultaneous start (initial suction pressure approximately 20 psig); however, the suction pressure stabilized around 17 psig. The setpoint for switchover to essential service water is approximately 14.1 psia (1.22 in. Hg. vac.). The ambient water temperature was not recorded since this parameter does not have any effect on the results as the difference in water vapor pressure between 40°F and 100°F is negligible. The pumps were not operated at a runout condition since runout orifices are installed in each auxiliary feedwater supply line to prevent this situation from occurring.

Based on the test results, it has been sucessfully verified that a simultaneous pump start does not induce a hydraulic transient that will either open the essential service water supply valves or trip the pump due to a sudden loss of suction pressure. The test also verified that a time delay on the pump trip circuit is not required.

Finding 2-13: Design Criteria Updating

> "We recognize your statement that the design criteria are intended to guide design efforts in the initial phases of design. However, we do not understand how development of a status list, by itself, will provide an effective safeguard to assure that personnel performing safety-related activities will not be mislead by obsolete information, particularly in view of the following:
>
> 1. The design criteria appear to be important and useful documents with widespread distribution, including availability to the plant staff and design engineers.
> 2. They are controlled design documents and this creates a tendency to assume they are kept correct and current.
> 3. Since they are generally not being updated, many will contain obsolete and potentially misleading information.
>
> Accordingly, you are requested to describe your plans for additional measures, such as stamping all copies, to assure that personnel performing safety-related activities are not mislead by obsolete information."

RESPONSE

Based on a review of the 30 Byron/Braidwood safety-related design criteria documents, the March 23, 1984 status report classified each design criteria under one of the following categories:

		Number of Design Criteria
Design -	The design criteria is correct, reflects the current engineering design, and can be used as a design document.	18
Information -	The design criteria is not 100 percent correct. It does, however, provide a design basis for reference but cannot be used as a design document.	12
Obsolete -	The design criteria does not reflect the current design and cannot be used as a design document.	0
	TOTAL	30

While we still believe that the identification of the document status through a status list is adequate, those design criteria classified as "information" (or if categorized as "obsolete" in the future) will be appropriately identified on each page and redistributed in accordance with the project distribution list. We believe we have addressed all of your concerns in regard to this item.

Finding 2-18: Flooding Analysis

"For the RHR heat exchanger cubicles (Item B in your response), you are requested to provide the load due to the maximum flooding level, the design live load for the floor and the ultimate capacity of the floor."

RESPONSE

In the RHR heat exchanger cubicles, the maximum flooding level is 101 inches, which results in a dead load of 0.525 KSF. The occupational live load used was 0.05 KSF and the total factored uniform design load for the SSE level load combination, of which the flooding is a part, is W_{SSE} = 4.91 KSF. The allowable ultimate capacity of the floor, based on the strength design method in ACI 318-71, is 6.65 KSF. Therefore, the floors in question have ample capacity for accommodating the flooding load.

Finding 3-2: Functionality Criteria

"Your response indicated that Class 1, 2, and 3 stresses are being utilized to evaluate for functionality. However, it is not clear how the analyst decides whether or not the Class 1, 2, or 3 stress results from PIPSYS are acceptable per the functionality requirements when certain stress indices and stress intensification factors (specified in Tables 1 and 2 of the General Electric report) are higher than those listed in the Winter 1979 Addenda of the ASME Code which is the basis for the PIPSYS calculations. You are requested to explain further how these decisions are made."

RESPONSE

The following is a detailed discussion to illustrate that the qualification methods used by Sargent & Lundy to satisfy functional capability requirements are acceptable. This is true regardless of which addenda of the code is utilized for stress indices or stress intensification factors.

I. DIFFERENCES IN CLASS 1 STRESS INDICES:

A comparison of the stress indices (Table F3-2.1 attached) illustrates that the stress indices specified in Winter 1979 Addenda of the code (basis for PIPSYS) are equal to, or more conservative than, those specified in Table 1 of the General Electric report (NEDO-21985) except for the B_1 and B_2 indices for branch connections and butt welding tees.

As stated in our original response of December 30, 1983, a portion of the Class 2 and 3 piping is evaluated for functional capability using Class 1 analysis rules as delineated in Section 2.2e of NEDO-21985. (Namely: Eq. 9 of NB-3600.) For all cases where this approach was utilized, the allowable stress limit was considered to be 1.5 S_y. The other two methods which can be used for evaluating Class 2 and 3 piping for functional capability are the scanning method and detailed hand calculations per NEDO-21985. All three qualification methods are outlined in EMD TP-2, Rev. 4 (EMD-046032), as stated in our original response.

General Electric report (NEDO-21985) allows the use of 2.0 S_y as the allowable stress limit for the calculated stresses for the branch connections and butt welding tees using the higher values of B_1 and B_2 indices.

The ratio of allowable stress limit recommended by the General Electric report (NEDO-21985) to the allowable stress limit used by Sargent & Lundy $\left[\frac{2.0\ S_y}{1.5\ S_y}\right]$ is equal to 1.33.

The ratio of B_1 indices $\frac{B_1 \text{ (S78)}}{B_1 \text{ (W79)}}$ and B_2 indices $\frac{B_2 \text{ (S78)}}{B_2 \text{ (W79)}}$

for the worst case, is also equal to 1.33. Therefore, the use of 1.5 S_y, by the analyst, as the allowable stress limit will assure functional capability, in accordance with our licensing commitment regardless of which addenda of the code is utilized for the stress indices.

II. DIFFERENCES IN CLASS 2 & 3 STRESS INTENSIFICATION FACTORS

A comparison of the stress intensification factors (Table F3.2-2 attached) illustrates that the stress intensification factors specified in Winter 1979 Addenda of the code (Basis for PIPSYS) are equal to or more conservative than those specified in Table 2 of the General Electric report (NEDO-21985) except for welding elbows or pipe bends and welding tees.

As stated in our original response of December 30, 1983, most of the Class 2 and 3 piping is evaluated for functional capability using the stress scanning method, which is a very conservative approach. This means that the Service Level C PIPSYS stresses are scanned to assure that they do not exceed the Service Level B allowable stress limits. (Namely 1.2 S_h). The other two methods which can be used for evaluating Class 2 and 3 piping for functional capability are the detailed hand calculations per NEDO-21985 or Class 1 analysis rules. These qualification methods are outlined in EMD TP-2, Rev. 4 (EMD-046032), as stated in our original response.

The General Electric report (NEDO-21985) allows the use of 1.5 S_y as the allowable stress limit for calculated stresses for all piping components.

The most conservative ratio of allowable stress limit recommended by the General Electric report (NEDO-21985) to the allowable stress limit used by Sargent & Lundy

$\left[\frac{1.5\ S_y}{1.2\ S_h}\right]^*$ is equal to 2.0. This ratio addresses the most conservative assumptions of material properties. The ratio of the stress intensification factors for welding

elbows and pipe bends $\left[\frac{\frac{1.3}{h^{2/3}} \quad \text{(S78)}}{0.75 \times \frac{0.9}{h^{2/3}} \quad \text{(W79)}}\right]$ is 1.93

---

*S_h is the allowable stress limit at 557° F. S_y is the yield stress value at 557° F. The ratio was determined for the worst case.

and the ratio of the stress intensification factors for welding tees $\frac{.90i \quad (S78)}{.75i \quad (W79)}$ is 1.28.

Therefore, the use of the stress scanning method will assure functional capability in accordance with our licensing commitment regardless of which addenda of the code is utilized for the stress indices.

We believe that we have addressed all of your concerns in regard to this item.

TABLE F3.2-1

COMPARISON OF CLASS 1 STRESS INDICES BETWEEN THE 1979 WINTER ADDENDUM OF THE 1977 ASME CODE AND THE 1978 SUMMER ADDENDUM OF THE 1977 ASME CODE

FITTING	1979 WINTER ADDENDUM OF 1977 ASME CODE (BASIS FOR PIPSYS)	1978 SUMMER ADDENDUM OF 1977 ASME CODE (BASIS FOR NEDO-21985)
Straight Pipe	$B_1 = 0.5$ $B_2 = 1.0$	$B_1 = 0.5$ $B_2 = 1.0$
Curved Pipe or Butt Welding Elbows	$B_1 = 0.5$ $B_2 = \frac{1.46}{h^{2/3}}$	$B_1 = 0.5$ max $B_2 = \frac{1.3}{h^{2/3}}$ max ≥ 1.0
Branch Connections	$B_1 = 0.5$	$B_1 = 0.5$ unless B_{2r} or $B_{2b} = \frac{4}{3}$ then $B_1 = 0.67$
	$B_{2r} = 0.75C_{2r} \geq 1.0$	$B_{2r} = 0.75C_{2r} \geq \frac{4}{3}$
	$C_{2r} = 0.8\left(\frac{R_m}{T_r}\right)^{2/3}\left(\frac{r'_m}{R_m}\right) \geq 1.0$	$C_{2r} = 0.8\left(\frac{R_m}{T_r}\right)^{2/3}\left(\frac{r'_m}{R_m}\right) \geq 1.0$
	$B_{2b} = 0.5\ C_{2b} \geq 1.0$	$B_{2b} = 0.5\ C_{2b} \geq \frac{4}{3}$
	$C_{2b} = 3\left(\frac{R_m}{T_r}\right)^{2/3}\left(\frac{r'_m}{R_m}\right)^{1/2}\left(\frac{T'_b}{T_r}\right)\left(\frac{r'_m}{r_p}\right) \geq 1.5$	$C_{2b} = 3\left(\frac{R_m}{T_r}\right)^{2/3}\left(\frac{r'_m}{R_m}\right)^{1/2}\left(\frac{T'_b}{T_r}\right)\left(\frac{r'_m}{r_p}\right) \geq 1.5$
Butt Welding Tees	$B_1 = 0.5$	$B_1 = 0.5$ unless B_{2r} or $B_{2b} = \frac{4}{3}$ then $B_1 = 0.67$
	$B_{2b} = 0.4\left(\frac{R_m}{T_r}\right)^{2/3} \geq 1.0$	$B_{2b} = 0.4\left(\frac{R_m}{T_r}\right)^{2/3} \geq \frac{4}{3}$
	$B_{2r} = 0.75\left(\frac{R_m}{T_r}\right)^{2/3} \geq 1.0$	$B_{2r} = 0.5\left(\frac{R_m}{T_r}\right)^{2/3} \geq \frac{4}{3}$
Butt Welding Reducers	$B_1 = 1.0$ $B_2 = 1.0$	$B_1 = 1.0$ $B_2 = 1.0$
Girth Fillet Weld to Socket Weld Fittings, etc.	$B_1 = 0.75$ $B_2 = 1.5$	$B_1 = 0.5$ $B_2 = 1.0$

TABLE F3.2-2

COMPARISON OF CLASS 2 AND 3 STRESS INTENSIFICATION FACTORS BETWEEN THE 1978 WINTER ADDENDUM OF THE 1977 ASME CODE AND THE 1978 SUMMER ADDENDUM OF THE 1977 ASME CODE

FITTING	1978 WINTER ADDENDUM OF 1977 ASME CODE (BASIS FOR PIPSYS)*	1978 SUMMER ADDENDUM OF 1977 ASME CODE (BASIS FOR NEDO-21985)*
Straight Pipe Butt Weld	1.0	1.0
Welding Elbow or Pipe Bend	$0.75 \left(\frac{0.9}{h^{2/3}}\right)$	$\frac{1.3}{h^{2/3}}$
RFT	0.75i	0.75i
UFT	0.75i	0.75i
WDT	0.75i	0.90i
Fillet Weld Joint, Brazed Joint, Etc.	0.75(2.1) = 1.58	1.0
Reducer	0.75i	0.75i

*All Values Must be ≥ 1.0

Finding 3-6: Pipe Support Added Mass

> "Your response stated that one example cited in the report did not, in fact, violate your criteria with respect to added mass and the other example exceeded the criteria by an insignificant amount (53 lb vs. 52 lb criterion). However, your response did not address the overall concern. You are requested to confirm on a systematic basis that your procedures for added mass are being uniformly followed or, if not, there is no significant effect on the analysis results."

RESPONSE

A criteria for inclusion of the support added masses in piping analysis does exist as stated in our previous response. Deviations from the existing criteria will not adversely affect the validity of the analysis results based on the inherent conservatism in the total design process.

This has been demonstrated by conducting a technical evaluation of previously completed piping analyses. The sample for this evaluation was determined utilizing the military standard statistical sampling scheme (MIL-STD-105D). The evaluation has been completed and was documented on June 15, 1984.

Furthermore, to ensure uniform application in the use of support added masses in the future, a retraining program is being established. Detailed classroom and hands-on instruction are being conducted with emphasis placed in this area.

Finding 3-7: Overlap of Plate

"You are requested to provide a copy of the following documents for our review:

1. FCR F-9079

2. The backup calculation

3. Revision C to Support Drawing 1AF03009R"

RESPONSE

A copy of each of the requested documents is contained in the attachments, and each of these is discussed below:

1. Attachment A, FCR F-9079:

   Byron FCR F-9079 (dated 4-16-81) was written against Revision B of support drawing 1AF03009R to have a 1/4-inch overlap on its embedded plate. This FCR was picked up on Revision C of the drawing and issued on 12-23-81. Subsequently, this FCR was closed out on 1-9-82 as shown on Part D of the first page of the FCR.

2. Attachment B, Structural Division Calculation:

   A copy of Calculation No. 13.1.2, Pages 521, 522, and 523, is enclosed.

   Page 521 is the approval page of the calculation for Drawing 1AF03009R, Revision C, which incorporates FCR F-9079. This page contains the preparer's and reviewer's signatures and dates, and also shows approver's signature and date (top right side of page).

   Page 522 shows that design load has been changed per Revision C of the drawing from 1753 pounds to 1056 pounds and the review method has been identified (see "Remarks" column and notation for "Remarks" column).

   Page 523 is for backup calculations for the expansion anchor plates and bolt as indicated on Page 522. The supporting calculation for Revision C is shown on lower portion of this calculation sheet with Revision C indication in a box. The calculations shown on upper portions of this sheet are for previous revisions.

3. Attachment C, Drawing 1AF03009R, Revision C:

   Drawing 1AF03009R was revised per FCR F-9079 and to reflect the formal analysis loads.

ATTACHMENT A TO RESPONSE TO FINDING 3-7

FCR F-9079

VB

CC- HUNTER - DEL

Commonwealth Edison Company
Field Change Request

FCR NO. F-90
DATE: 4-16-81

PART A] REQUEST CLASS: ☒ Initial Construction ☐ Plant Modification ☐ Major ☒ Minor

PROJECT: BYRON STATION UNIT 1 & 2

P.O. NO: 207010 Scope of P.O. MECHANICAL ERECTION

SYSTEM: AUX FEEDWATER Component: HANGER

Doc/Dwg No: 1AF03009 Rev. B Doc/Dwg. Title: SUPPORT

Description of Change Request: REVISE AND INSTALL PER AB 2889

Reason for Change Request: TO FIT AS BUILT PIPE LOCATION

Does This FCR Result From A NCR ☐ Yes ☒ No
If Yes Give NCR No. ______ Date: ______

Request Originated By: ☐ Construction ☒ Other
If Other Give Name of Organization: HUNTER
Prepared By: D.STANGEL Date: 4-16-81
Engineering Disposition: ☐ SITE ☐ PROJ. ☒ S&L ☐ NONE
Request Approved By: ______ Date: 4-21-81
SITE CONSTR. SUPT., MAINT. ASSIST. SUPT. OR DESIGNEE
Logged By: ______ Date: 4/24/81
CONSTRUCTION DEPT. OR MAINT. DEPT.

ADVANCED VERBAL CONCURRENCE - TELEPHONE VERIFICATION:
Telecon By: V DeRosia & R Sampson Date: 4-17-81
Resolution or Approvals: Approved
Recorded By: John DeRosia Date: 4-17-81

PART B] ENGR'G. DISPOSITION: ☐ Approved ☐ Approved with Comment ☐ Rejected
Engr'g. Comment/Instruction:

For Information Only

Engr'g. Approval: ______ Date: ______

PART C] A-E DISPOSITION: ☒ Approved ☐ Approved With Comment ☐ Rejected
A-E Comment/Instruction:

A-E Approval: RH Kalnoski Date: 12-1-81

Part D] AFFECTED DESIGN DOCUMENTS REVISED AS LISTED: 1AF03009(C)

- LIST HERE OR ATTACH LIST OF REVISED DOCUMENTS -

DESIGN DOCUMENTS ISSUED BY: RH Kalnoski Date: 1-9-82

PART E] FINAL DISPOSITION:
REVIEWED BY REQUESTOR: ______ Date: ______
CONSTRUCTION OR MAINTENANCE
APPROVED BY: ______ Date: ______
SITE CONSTR. SUPT. OR MAINT. ASSIST. SUPT., OR DESIGNEES
COMPLETION VERIFIED BY: ______ Date: ______
SITE QA SUPT. OR STA. QA OR DESIGNEE

00-9256 12-80

Q.P. Form 3-2.1
(Rev.

Part F

FIELD CHANGE REQUEST
Contractor Notification

To: Hunter

Action to or taken: INSTALL Per REQUEST

AB 2889

Routing

Construction Supt. or Designee for Signature.

Const. Clerk to route as follows:
- Copy part F to contractor
- Copy all parts to Q.A. and Project Sta. Const.
- Route orig. to P.E. Mgr. or SNED Mgr. or A-E with transmittal letter for appropriate engineering disposition (See part A).
- Copy to P.E. Mgr. or SNED Mgr. or A-E where orig. is not transmitted.

For Information Only

9-17-81

C.E.Co. Field Engineer Date

Q.P. Form 3-2.2
Page 2 of 2
(Rev. 3)

HUNTER CORPORATION

COMPONENT SUPPORT/C.E.A. DISCREPANCY REPORT

NO. AB-2889 LOCATION AUX BLDG. UNIT 1 AREA 2

COMPLETE THIS SECTION FOR PIPING SUPPORT DISCREPANCIES

COPY SUPPORT DWG. NO. 1AE03009R REV. 1/B QUALITY CLASS C

INE 1SXB7AB-8" CONST. COPY PIPING DWG. NO. SX-55 REV. 3

INTERFACE DWGS. ______

LOOR ELEVATION BELOW SUPPORT 383'

EMARKS: ASBUILT PER F.C.R. Delete Prev. HEPS

COMPLETE THIS SECTION FOR C.E.A. DISCREPANCIES

ROBLEM: ☐ RE-BAR HIT ☐ NUT WON'T TIGHTEN ☐ C.E.A. WON'T SET ☐ C.E.A. ABANDONED ☐ HOLE ABANDON

.E.A. ELEVATION ______ C.E.A. SIZE ______ long x ______ diameter

IMENSIONS AND DIRECTIONS FROM NEAREST COLUMN LINES ______

ONCRETE SURFACE ☐ CEILING ☐ BEAM SIDE ☐ BEAM BOTTOM ☐ COLUMN ☐ FLOOR ☐ WALL

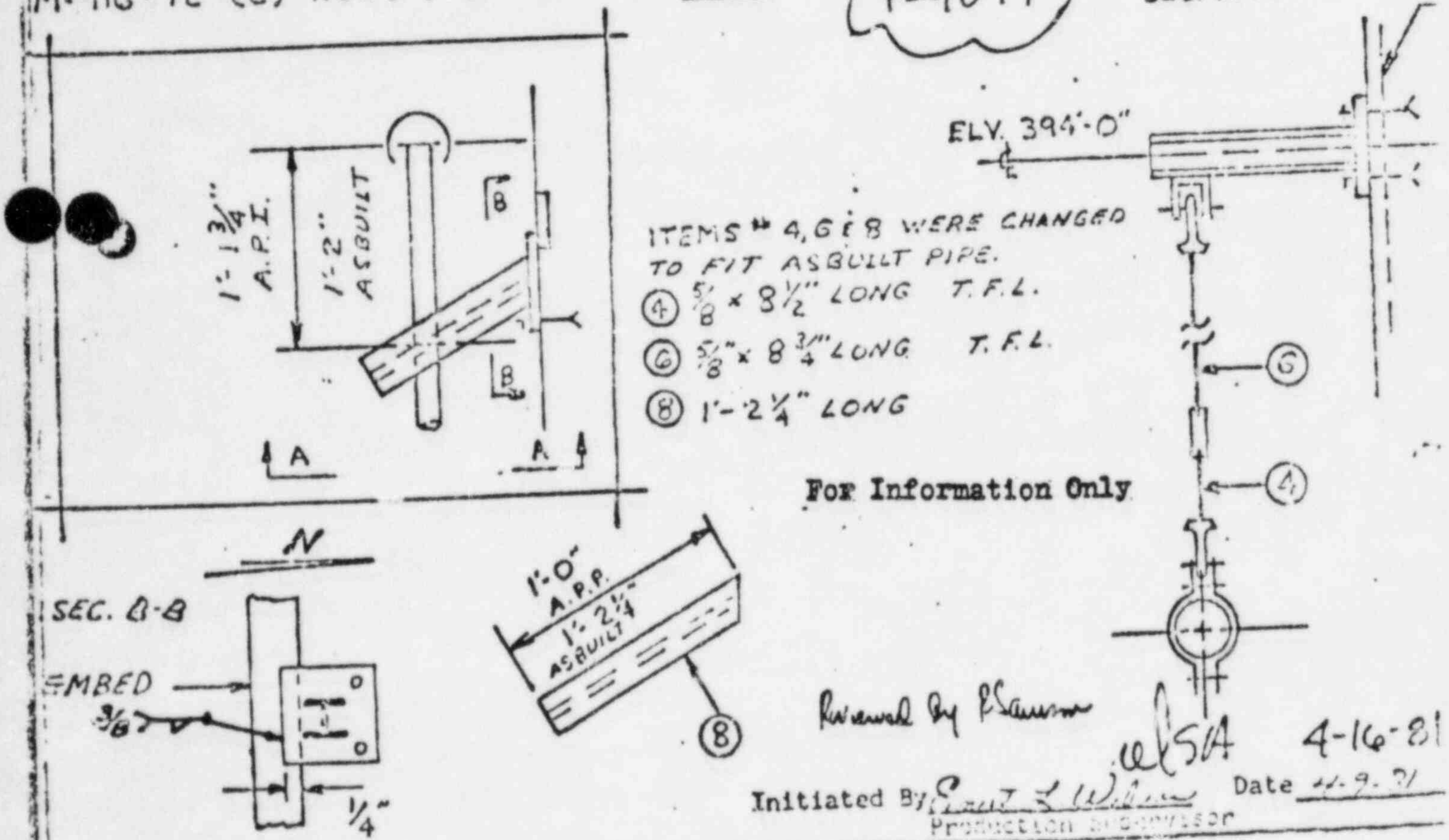
☐ HOLE IS MARKED WITH D.R. NO. ☐ ABANDONED HOLES GROUTED

EMARKS:

M-91G-12-(C)-REV.3-(±3 TOL.)

SKETCH

F-9079



ITEMS # 4, 6 & 8 WERE CHANGED TO FIT ASBUILT PIPE.

④ 5/8 × 8 1/2" LONG T.F.L.

⑥ 5/8" × 8 3/4" LONG T.F.L.

⑧ 1'-2 1/4" LONG

For Information Only

Reviewed by P Sawson

4-16-81

Initiated By Ernest L Wilson Date 4-9-81
Production Supervisor

ENGINEERING DISPOSITION

RESOLUTION TO COMPONENT SUPPORT DISCREPANCY ACCOMPLISHED THRU: ☐ DESIGN DWG. REV. ☐ CECO F.C.R

NO. ______ R.F.A. NO. 6925 REMARKS: ______

By ______ Date ______

NOTE: 1. SEND ONE COPY OF C.E.A. DISCREPANCIES TO CECO SCD STRUCTURAL DEPARTMENT.

ATTACHMENT B TO RESPONSE TO FINDING 3-7

Supporting Calculation for Revision C of
Component Support Drawing No. M-1AF03009R

SARGENT LUNDY
ENGINEERS
CHICAGO

Calcs. For MECHANICAL COMPONENT		Calc. No. 13.1.2
SUPPORT NUMBER: M-1AF03009R		Rev. 2 | Date
X Safety-Related	☐ Non-Safety-Related	Page 521 of

Client COMMONWEALTH EDISON COMPANY	Prepared by SEE BELOW	Date
Project BYRON/BRAIDWOOD UNIT 1	Reviewed by	Date
Proj. No. 4391-00/4683-00 Equip. No.	Approved by DFReed	Date 12/21/81

BB I REV SR

MECHANICAL COMPONENT SUPPORT DOCUMENTATION SHEET 2

SD&DD REVIEW RECORD FOR

MECH. COMPONENT SUPPORT DRAWING # M-1AF03009R

DWG.REV.	STATUS	PREPARED BY	DATE	REVIEWED BY	DATE
C	3	M Pinto	12/15/81		12-18-81

NOTATION FOR "STATUS" COLUMN

"1" - PREVIOUS SD&DD COMMENTS INCORPORATED: DOCUMENTATION SHEET 1 SHOWN FOR DRAWING REV. _____ REMAINS UNCHANGED

"2" - THIS DRAWING REVISION DOES NOT EFFECT DOCUMENTATION SHEET 1 FOR DRAWING REV. _____.

"3" - THIS DRAWING REVISION EFFECTS DOCUMENTATION SHEET 1 FOR DRAWING REV. B. CHANGES IN DOCUMENTATION ARE SHOWN NEXT TO SCRATCHED OUT INPUTS.

"4" - OTHER: EXPLAIN:

Form GO 4.3.1 Rev. 1

SARGENT & LUNDY
ENGINEERS
CHICAGO

Calcs For MECHANICAL COMPONENT		Calc. No. 3.1.2	
SUPPORT NUMBER: M-1AF03008R REV. E 1/2		Rev. 0	Date
X Safety-Related	☐ Non-Safety-Related	Page 522 of	

Client COMMONWEALTH EDISON CO.	Prepared by [illegible]	Date 8/15/80
Project BYRON/BRAIDWOOD UNIT 1	Reviewed by B.E. Burns	Date 8-21-80
Proj. No. 4391-00, 4683-00	Approved by	Date

BB I SR

MECHANICAL COMPONENT SUPPORT DOCUMENTATION SHEET

CONTROLLING DESIGN LOAD: ☒ BY/BR ☐ MARBLE HILL

DESIGN LOAD: ~~1402x1.25 = 1753#~~ 704x1.5 = 1056#

LOAD TYPE: ☒ DESIGN, ☐ OPERATING, ☐ HYDRO, ☐ EMERGENCY, ☐ OTHER; ______

REV. C

ITEMS REVIEWED	SECTION OF REVIEW MANUAL USED	REMARKS
☒ NON-VENDOR CATALOG COMPONENT SUPPORT ELEMENT	5.0	A
☐ STIFFENERS		
☒ CONNECTION OF NON-VENDOR CATALOG SUPPORT ELEMENTS	5.0	A
☐ WELDS OF COMPONENT SUPPORT ATTACHMENTS		
☒ EXPANSION ANCHOR PLATES		C
☐ OTHER:		

NOTATION FOR "REMARKS" COLUMN

"A" - Review Manual utilized with no supplemental hand calculations

"B" - Review Manual utilized with supplemental hand calculations which follow

"C" - Non-Standard: hand calculations follow

Form GQ-3.08.1 Rev. 2

SARGENT LUNDY ENGINEERS CHICAGO	Calcs. For MECHANICAL COMPONENT SUPPORT NUMBER: M-1AF030038 REV. B SHT 2 of 2	Calc. No. 13.1.2
	☒ Safety-Related ☐ Non-Safety-Related	Rev. 0 Date Page 523 of

Client	COMMONWEALTH EDISON CO.	Prepared by P. S. Sinnal	Date 8/15/80
Project	BYRON/BRAIDWOOD UNIT 1	Reviewed by B.E. Burns	Date 8-21-80
Proj. No.	4391-00, 4683-00	Approved by	Date

BB I SR

ITEM ⑨ & ⑩

$P_{V_1} = 2103 + 5 \times \overset{28.9}{\cancel{449}} = \overset{2248}{\cancel{2313}}$ ✓ #

$P_{V_2} = 5(13) = 65^{\#}$

$P_{H_1} = 2(28.9) = 57.8^{\#}$

$P_{H_2} = 2(13) = 26^{\#}$

FORCE DUE TO MOMENT $= \dfrac{\overset{2.248}{\cancel{2.313}} \times 8.83 + \overset{.058}{\cancel{.289}} \times 8.83 + .065 \times 6 + .026 \times 6}{2 \times 9} \times 1.0$

$= \overset{1.17}{\cancel{1.21}}^{K}$

FORCE DUE TO SHEAR FRICTION $= \dfrac{2.488}{4 \times .7} = 0.89^{K}$

NET FORCE $= \overset{2.06}{\cancel{2.1}}^{K} \not< 2.09^{K}$.

REV. C

we h.S.F 1.25 ∴ OK

CHECK ANCHOR BOLTS.

$P_{support} = 68^{\#}$ $P_y = (5 \times 68) + (704 \times 1.5) = 1396^{\#}$

$P_x = P_z = 2 \times 68 = 136^{\#}$

$M_y = (136 \times 3.75) + (136 \times 7.5) = 1.530$ in-k

$M_{z'} = 1396 \times 8.39 = 11.712$ in-k.

$T = \dfrac{1.530}{2 \times 10.5} + \dfrac{11.712}{9 \times 2} + \dfrac{.136}{4} + \dfrac{1.396 + .136}{2 \times .7} = 2.16^{k}/\text{bolt} < 3.9\ ^{k}/\text{bolt}$ ok.

Since bolts are weaker weld is Ok.

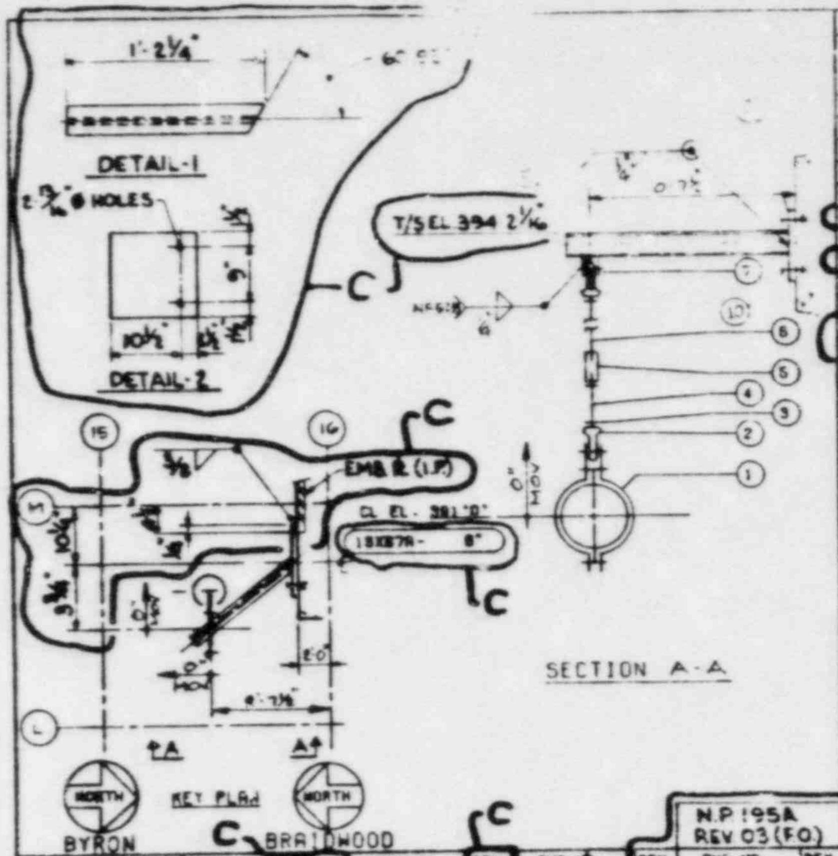
check Anchor Plate:

$M = 2.16 \times \dfrac{10.5}{2} \times 2 = 22.68$ in-k

$f_b = \dfrac{22.68}{\dfrac{12(.75)^2}{6}} = 20.16^{ksi} < 27$ ksi OK.

ATTACHMENT C TO RESPONSE TO FINDING 3-7

Support Drawing M-1AF03009R,
Revision C



C

BILL OF MATERIAL

ITEM	QTY	FIG. NO. OR PART NO.	DESCRIPTION	
	1	——	COMPONENT SUPPORT ASSEM.	
1	1	295	8" PIPE CLAMP (13.1)	
2	2	290	5/8" EYE NUT (1.2)	
3	3	——	5/8" HEX NUT, SA-307 GR.B (.3	
4	1	140	5/8" X 8½" W/TFL (0.74)	
5	1	230	5/8" TURNBUCKLE (1.0)	
6	1	253	5/8" X 5¼" W/5¼" BE (0.76)	
7	1	66	5/8" STEEL ATTACHMENT WITH LOAD PIN (1.5)	
8	1	——	W4×13, (SA-36) 1'-2¼" LG. SEE DETAIL 1 (15.44)	X P.R.
9	1	—	¾"×7"×12" C.PLATE SA36 OR SA 516 GR 65, SEE DETAIL 2 ([illegible])	X P.R.
10	2	—	¾" φ CONC. ANCHOR PER FORM E- [illegible] (1.8A)	P.R.
		——	BUNDLE & TAG PC-09	

C C C C

TOTAL SUPPORT ASSEMBLY WT 67.52

WELD NO.	WELD PROCEDURE	EXAMINATION PROCEDURE

N.P 195A
REV 03 (F.O.)

C C C

REFERENCE DRAWINGS	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.	DWG. NO.	REV.
	M-856	L	S-690	AL	GE C 3082	K		
	M-544-95	M	A-827	AB	M-131	M		

LOADS (LB) DESIGN	OPERATING	HYDRST TEST	EMERGENCY	FAULTED
704	420		828	

DRAWING RELEASE RECORD

REV.	DATE RLSE	PREPARED	REVIEWED	APPROVED	FILM
A	3-28-79	[illegible]	[illegible]	[illegible]	✓
B	7-8-80	[illegible]	[illegible]	[illegible]	
C	12-23-81	[illegible]	[illegible]	[illegible]	

EMD REVIEW

C EMD 034501

SUPPORT CLASS C

PURPOSE

F-2771 UNAFFECTED, L-2771 FOR FABRICATION, F-2739 FOR RECORD, L-2739 FOR CONSTRUCTION, PERFORMAL ANALYSIS

FCR F-9079 BY AS-BUILT

WILLIAM CARL CLEFF 62 31871

P.E. SEAL

BYRON/BRAIDWOOD STATION
UNIT-1
COMMONWEALTH EDISON COMPANY
CHICAGO, ILLINOIS

NUCLEAR SAFETY RELATED

NO SCALE		SUPPORT NO.	REV.
PROJECT NO. 4391-00 4685-00	SARGENT & LUNDY ENGINEERS CHICAGO	M-1AF03U09R	C
		SHEET 1 OF 1	

Finding 3-16: U-bolt Analysis

> "You are requested to describe the criteria employed for U-bolt design and confirm that they have been uniformly applied."

RESPONSE

The U-bolt review procedure is defined in the Westinghouse Byron Pipe Support Design Reference Manual, Byron 1 and 2 (Revision 0, dated 11-22-83), and is summarized below.

The criteria for evaluating U-bolts, for pipe sizes up to 2 inches, is based on results of tests on U-bolt samples. The vendor allowables, as published in applicable load capacity data sheets, have been shown to be conservative by results of failure tests for sizes of 1/2 inch to 2 inches for tension and side loads. Westinghouse has reviewed these test results and established allowable U-bolt loads by applying factors of safety to the test results. Safety factors of 4.0 (normal/upset) and 2.0 (faulted) are used to define test-based allowables. This test data was collected for ITT Grinnell Figure 137H U-bolts. Since the Byron Project uses both the ITT Grinnell U-bolts and Elcen Figure 68A U-bolts, a comparison was made of U-bolts for various pipe sizes and shows the Elcen U-bolt to be identical in both material and bolt dimensions. The test data is therefore equally applicable to the Elcen U-bolt. For U-bolts for pipe sizes greater than 2 inches, the manufacturer's load capacity data sheets are the basis for the acceptance criteria.

The acceptance criteria for U-bolts for piping 2 inches and smaller, is based on test data. It is Westinghouse policy for the Byron Project to select U-bolts in the design phase using the vendor supplied load capacity data sheets. Allowables based on the test results discussed above may be used in the as-built reconciliation phase.

Westinghouse reviewed pipe support calculations to verify that the criteria was correctly applied. This review covers analyses that apply to 62% of the 820 U-bolts in the Unit 1 containment and applicable scope in the auxiliary building. In all cases, the reviewed U-bolts met the specified criteria.

Finding 4-1: Transverse Wall Load Criteria

"For the original Byron design, you are requested to describe how the design of peripheral walls, perpendicular to the transverse load, actually considered the loads coming on to the outside of the walls from wind and tornado (wind and differential pressure).

For a given wall loaded with a transverse wind load, describe how the transverse load at the center of a wall between two supporting orthogonal walls (shear walls) is carried out through the wall to the orthogonal walls which carry the shear force as in-plane shear in a normal shear wall concept. Describe how Sargent & Lundy determined the load capacity of the peripheral wall loaded transversely and converted these forces to stresses and then to reinforcing areas, if required. Describe how these same loads are addressed in the final load check. The use of diagrams to illustrate the details is recommended."

RESPONSE

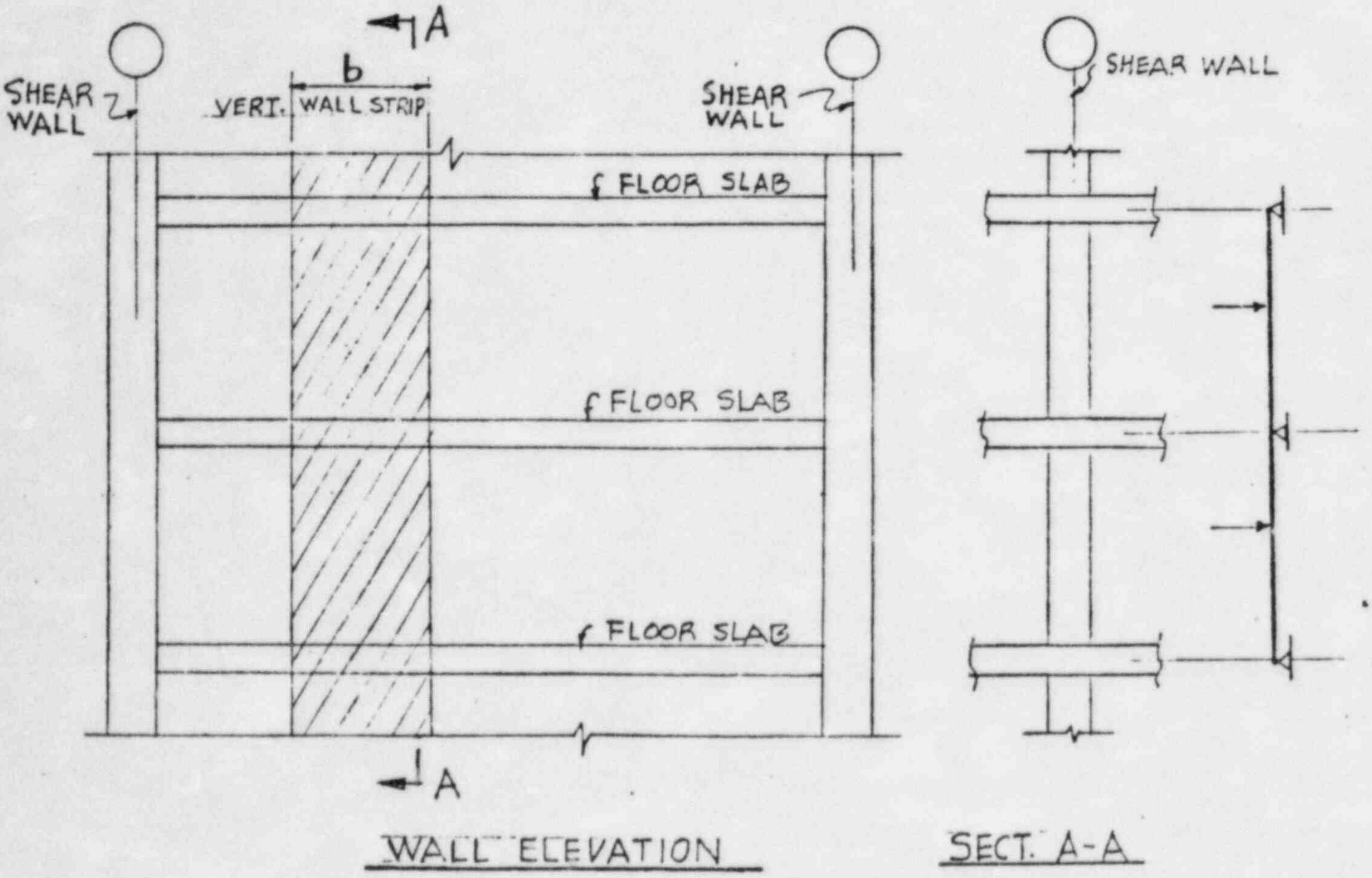
As noted in Subsection 11.6.2.3 of the Structural Project Design Criteria DC-ST-03 B/B (IDI Reference 4.31), the tornado loads in Safety Category I structures were obtained by static analysis utilizing the DYNAS lumped mass model. Various positions of the tornado were investigated to determine the maximum shear wall forces; and, for each position, the location and magnitude of the resultant tornado surface pressure was determined and transferred at the mass center at each elevation. The maximum shear wall forces thus obtained were compared to those forces due to seismic loading and the walls were designed for the most critical loading combination. Seismic load governed over wind and tornado in the shear wall design.

For a wall loaded with a given transverse load, the wall was analyzed using a "strip method" (i.e., the most critically loaded strip of the wall was isolated and treated as a "wall strip" which spans either vertically or horizontally and is supported at the intermediate floor slabs or adjacent walls as applicable, see Figures F4.1-1 and F4.1-2). In those cases where a vertical strip was used, the transverse load was applied to the wall strip and transferred to the supporting intermediate slabs. The load is then transferred through the slabs to the orthogonal shear walls and down to the foundation. In those cases where a horizontal strip was used, the transverse load applied to the shear wall was transferred directly to the supporting orthogonal walls.

For the case of transverse wind and tornado loading on walls, the controlling condition was tornado pressure plus a tornado-generated missile. The original wall design included an analysis which demonstrated that any peripheral wall was adequate to absorb this load and transfer it via a controlling strip to the lateral load resisting system.

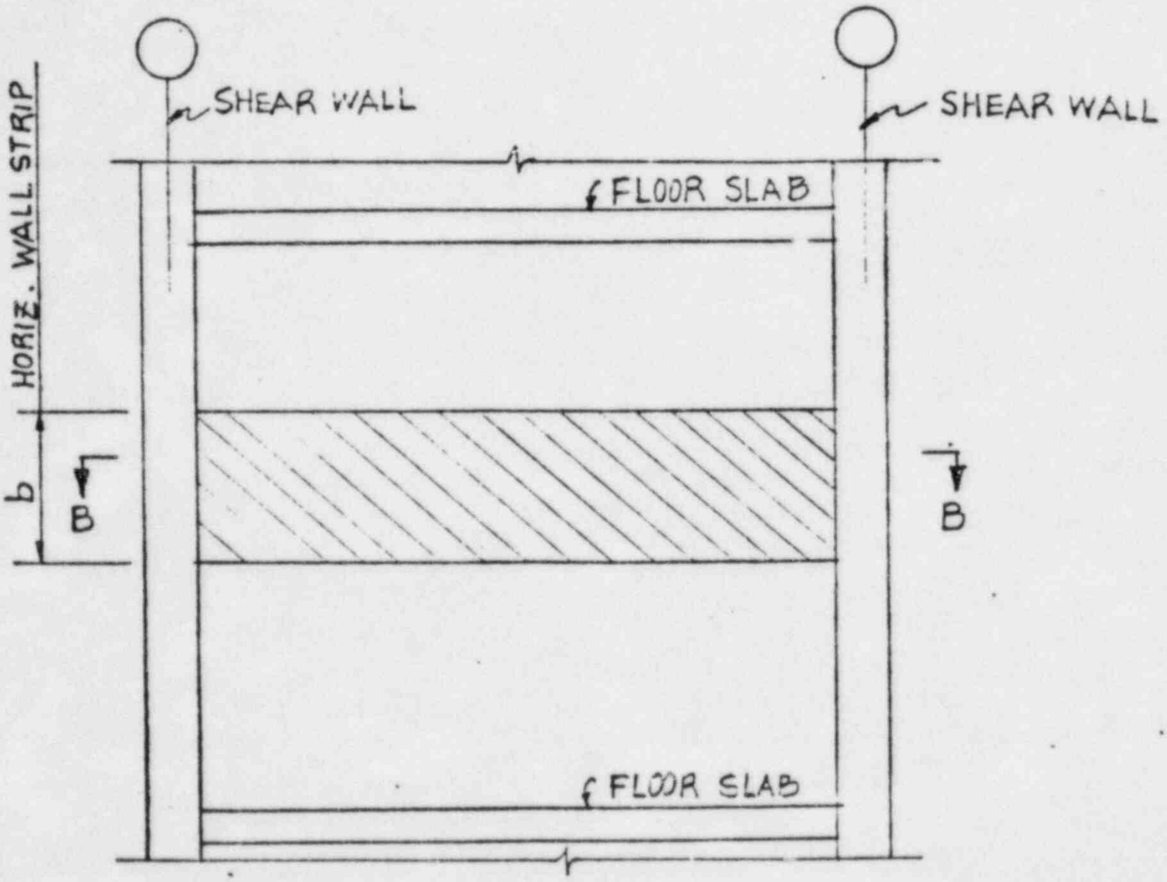
The transverse flexural steel area required for each wall strip was calculated using the flexural strength provisions of Chapter 10 of ACI 318-71. The transverse shear friction steel area required was calculated using the shear-friction provisions of Chapter 11 of ACI 318-71. Transverse loads are addressed in a similar manner in the final load check.

FIGURE F4.1-1

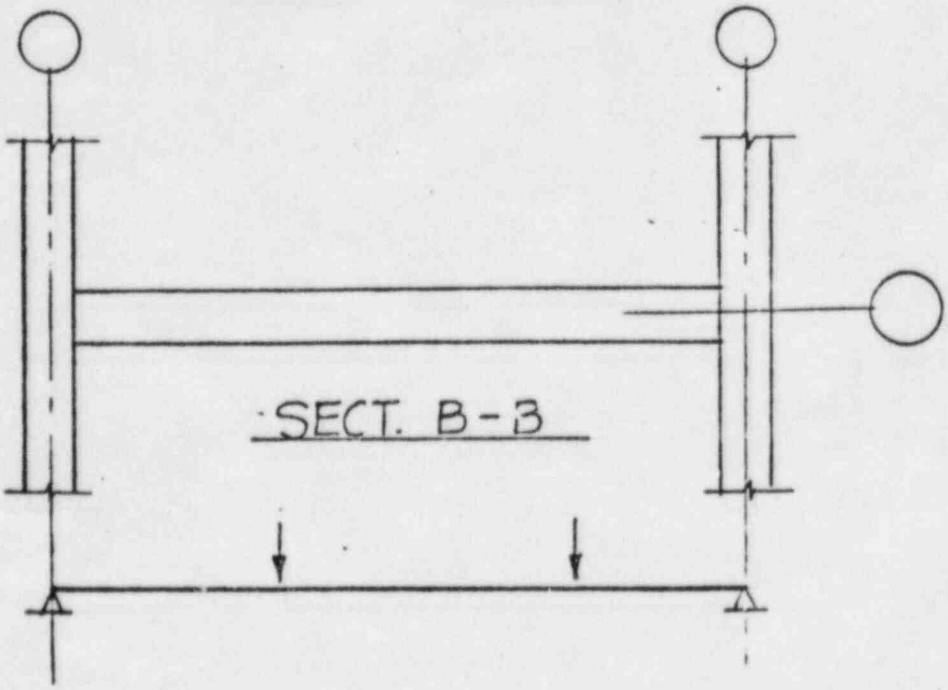


WALL STRIP: SPAN VERTICALLY

FIGURE F4.1-2



WALL ELEVATION



WALL STRIP: SPAN HORIZONTALLY

Finding 4-2: Shear Friction Method

> "Our understanding of your response is as follows:
>
> In the design of walls, the transverse shear stresses were computed from the transverse loads such as dynamic soils and water pressure, wind loads, tornado effects and horizontal seismic and compared to a value of V_c such as determined by Section 11.4 of ACI 318-71. If the actual shear stress was less than or equal to the allowable, no ties were added. If the actual shear stress was greater than the allowable stress, ties were added to carry the stress exceeding that carried by the concrete such as required in Section 11.6 of ACI 318-71.
>
> In either case, when the vertical reinforcement was sized, the value of the actual transverse shear was combined with the in-plane shear and the resultant used as the total shear to be carried. The area of steel was computed from the resultant shear value by using the shear-friction concept.
>
> The result is that in all cases, there is a margin in the vertical reinforcement relative to carrying in-plane shear loads.
>
> You are requested to verify that this understanding is correct or, if it is not, describe how the actual design was executed. You are also requested to provide the details of how the transverse shear was combined with in-plane shear. The use of diagrams to illustrate details is recommended."

RESPONSE

Your understanding of our response is correct relative to the treatment of transverse shear stress, but differs somewhat relative to the method used for sizing vertical reinforcement.

In the design of the walls, the transverse shear stresses were computed from the transverse loads and compared to a value of v_c determined using Chapter 11 of ACI 318-71. If the actual shear stress was less than or equal to the allowable, no ties were added. If the actual shear stress was greater than the allowable stress, ties were added to carry the stress exceeding that carried by the concrete.

In the design of the vertical reinforcement, however, the steel area required for transverse shear loads was added directly to the steel area required for in-plane shear loads. Both the transverse shear steel area and in-plane shear steel area were determined using the shear friction concept.

Finding 6-3: Bases for Setpoints
Finding 6-7: Setpoint Accuracy Requirements
Finding 6-8: Basis for Reset Value

"IEEE 279-1971, which is invoked by 10 CFR 50.55a(h) requires 'A specific protection system design basis shall be provided .... The design basis shall document as a minimum .... (2) the generating station variables .... required to be monitored in order to provide protective actions .... (4) prudent operational limits for each variable .... (5) the margin .... between each operational limit and the level considered to mark the onset of unsafe conditions .... (6) the levels that, when reached, require protective actions, (7) the range of transient and steady state conditions .... throughout which the system must perform, (8) the malfunctions .... for which provisions must be incorporated to retain necessary protective actions and (9) minimum performance requirements including .... response times .... accuracies .... ranges .... of the magnitude and rate of change of sensed variables ....'

Our understanding of the intent of your responses is as follows:

1. For all safety-related instruments in the Sargent & Lundy scope, you will assure that documented bases have been provided as required by IEEE 279.

2. For cases judged to be complex, you will assure that calculations have been provided to support the selection of setpoints.

You are requested to indicate whether or not this understanding of your intent is correct. If it is not, please explain what is different in your intent."

RESPONSE

I. The instrument data sheets for safety-related instruments document the bulk of the design basis information and, in conjunction with other information denoted below, comply with our interpretation of IEEE-279 as follows (item numbers correspond to referenced sections above):

(2) The generating station variables that are required to be monitored in order to provide protective actions are determined during the design and review process of a particular system as documented on the system's Piping and Instrument Diagrams (P&ID), Control and Instrument Diagrams (CID) and the Logic Diagrams (LD). The documentation for this activity is thus contained on the P&ID's, CID's, and LD's as well as the instrument index and the instrument data sheets. (See attached

example of an instrument data sheet, refer to encircled Item 2 in boldface type).

(4) The operational limits for each variable are documented on the Instrument Data Sheet. (See attached instrument data sheet, refer to encircled Item 4).

(5) The margin, with appropriate interpretive information, between each operational limit and the level considered to mark the onset of unsafe conditions are determined from existing calculations, design drawings and/or vendor supplied component design data. The margin on the data sheet is the relationship between the instrument's range and the setpoint. (See attached instrument data sheet, refer to encircled Item 5).

(6) The levels that, when reached, will require protective actions are determined using the design input discussed in Item (2) above and documented on the data sheet. (See attached data sheet, refer to encircled Item 6).

(7) The range of transient and steady state conditions of the power supply and the environment during normal, abnormal, and accident circumstances throughout which the system must perform are contained in the procurement specification which is referenced on the data sheet. In addition, the data sheet calls for seismic and/or Class 1E qualifications, all of which are documented in the EQ binders. (See attached instrument data sheet, refer to encircled Item 7).

(8) Malfunctions, accidents, or other unusual events (for example, fire, explosion, missiles, lightning, flood, earthquake, wind, etc.) which could physically damage protection system components or could cause environmental changes leading to functional degradation of system performance, and for which provisions must be incorporated to retain necessary protective action, are reviewed at the time a particular condition is identified (see also Item (7) above and encircled Item 7 on instrument data sheet, for environmental conditions). For example, cubicle flooding was reviewed and the review of these flood levels (as related to instrumentation) was incorporated into the flooding calculation.

(9) The required instrument accuracy of an instrument is determined from an engineering assessment of information contained in the system calculations, design drawings and/or vendor supplied component design data. The setpoint accuracy required is then used in the review of vendor catalog information to establish

the instrument selection. The selected instruments are documented on the instrument data sheet by manufacturer and model number using vendor standard designs which envelop the system operating requirements. (See attached instrument data sheet, refer to encircled Item 9). Past experience has shown that response times and ranges of the magnitudes and rates of change of sensed variables have had little effect on the instrument selection. Therefore, these parameters are not reviewed unless a specific application is needed.

II. Complex setpoints for safety-related Sargent & Lundy instruments have been identified via a documented memo and calculations exist for these instruments.

ATTACHMENT TO RESPONSE TO FINDING 6-3, 6-7, 6-8

Example of
Instrument Data Sheet

FORM ME-3.3.21 (7-78) APPROVED BY [illegible] DEPT. MGR.

INSTRUMENT NO.	(2)1PSL-AF051		(2)1PSL-AF055		
SERVICE	Aux FW Pump (2)1A Suct		Aux FW Pump (2)1B Suct		2
FLUID	WATER		→		
PRESS.MAX. / TEMP. MAX.	100PSIG	100 °F	→		
PRESS. NORM.	20-25 PSIG		→		4
MEAS. ELEM. TYPE/MAT'L.	Diaphragm	Teflon	→		
RATING	225PSIG		→		
PRESS. RANGE	30" Hg - 20PSI		→		4&5
SWITCH TYPE / RATING	SNAP	Note 1	→		
CONTACTS QTY./TYPE	Note 2	SPDT	→		
DIFF. ADJUST	FIXED		→		
OP.OR CL. INC.-DEC.@PRESS	CL - Inc Vacuum	①1.22"Hg vac ②4.48"Hg vac	Note 4		5&6
RESET@PRESS.	MFR. STD		→		
HOUSING TYPE (ELEC.)	NEMA 4		→		
MOUNTING TYPE	SURFACE		→		
ACCESSORIES	Note 3		→		9
MANUFACTURER	UNITED ELECTRIC		→		
MODEL NO.	J302-552		→		
NUCLEAR PLANT DATA SAF. CL. / SEIS. CAT.	—	I	—	I	7
QA	—		—		
ELECT. CLASS	1E		1E		
FURN. SPEC./INSTALL.SPEC.	F/L-2906	F/L-2906	→		

EXAMPLE

REMARKS

Note 1

0.55 A Inductive
@ 125 VDC

(10 Amp DC switch,
Switch MT4R)

Note 2

One SPDT Switch For Each Function With Switches To Be Individually Adjustable.

Switch Functions:
① Open Suct. Valves
② Trip Pump

Note 3

Furnish With Bracket Suitable For Seismic Mounting.

Note 4

① CL-Inc Vacuum @ 1.22" Hg Vac
③ OP-Inc Vacuum @ 4.48" Hg Vac

RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED
E	6-24-83				RELEASED	For RECORDS			
C	4-12-82				RELEASED	For Records F/L-2906			
D	6-25-82				REV-RELEASED	For RECORDS			

7

PRESSURE SWITCHES

NUCLEAR SAFETY-RELATED

SARGENT & LUNDY
CHICAGO

BYRON/BRAIDWOOD STATIONS
UNIT 1&2
COMMONWEALTH EDISON COMPANY

DATA SHEET NO.
PS180

BPD

Unresolved Item 2-1: Diesel Engine Exhaust Pipe

> "You are requested to describe the basis for determining that tornado missiles will not crimp the auxiliary feedwater pump diesel engine exhaust stack completely closed. Include a discussion of the potential for damaging the hinged cap in such a way as to incapacitate the pump."

RESPONSE

Sargent & Lundy performed an analysis to determine the effect of tornado missiles impacting the auxiliary feedwater pump diesel exhaust stack. Tornado missiles defined as Spectrum II missiles in Section 3.5.1.4 of NUREG-0800 were postulated. The calculations demonstrate that crimping the exhaust pipe due to a tornado missile impact results in a maximum 60% reduction in flow area at the roof interface. Missile impact on the 1/8-inch thick aluminum weather cap will not affect the flow area since the cap will either be destroyed or blown out of the stack by the exhaust pressure. The 60% reduction in flow area of the exhaust stack at the roof interface will not incapacitate the auxiliary feedwater pump diesel.

Unresolved Item 4-2: Top Reinforcing for Slabs

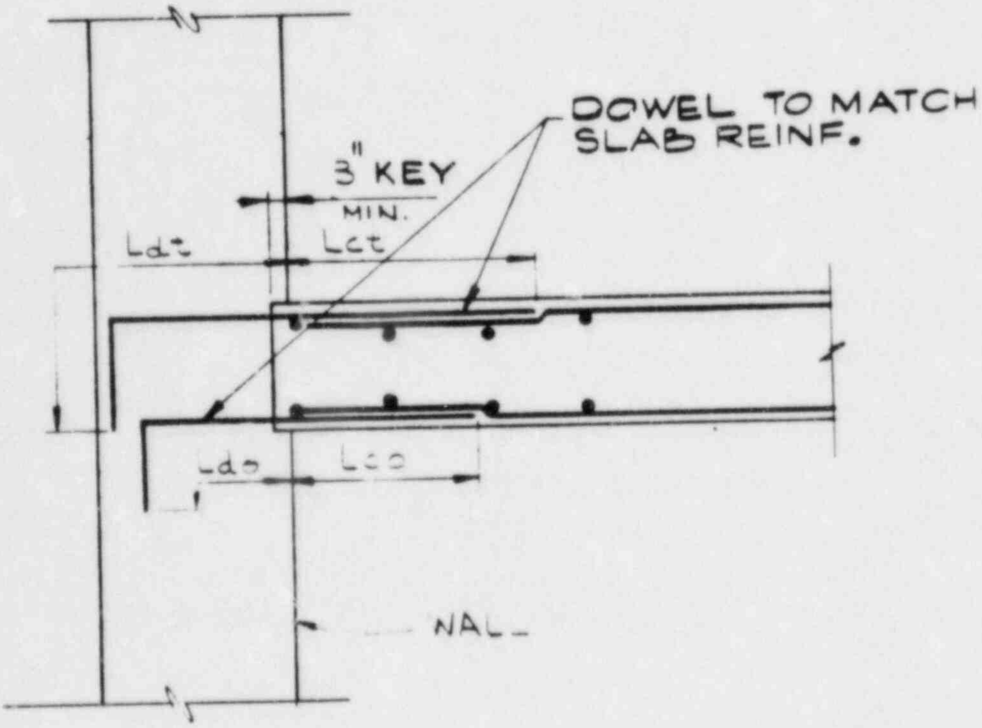
> "The design procedure outlined in the response, if applied for all slab designs on the Byron project, would yield conservative steel areas (bottom steel) for midspan positive moments. You are requested to indicate whether this concept was used throughout the plant. Indicate if the procedure described in the original answer for supplying negative steel (top steel) at each slab boundary was used throughout the project and if so what portion of the maximum moment for a simply supported case was provided in negative moment capacity at the boundaries. Indicate, by providing detailed references to written documents, how these project-wide concepts (if used) were provided to individual designers in the way of instructions or procedures. If no project-wide concept was applied, indicate what technique was used in providing slab reinforcing based on varying boundary conditions."

RESPONSE

As noted in our original response, negative moment steel equal to that at the continuous support was provided at the junction to the wall of slab 4AB53. This is a conservative design approach which was used for all slabs supported by walls. This typical detailing is shown as Slab Support Types 5 and 6 (see Figures U4.2-1 and U4.2-2) on Structural Drawing S-473 which was included in project Specification F/L 2722 and initially released to the appropriate contractors on August 7, 1974.

These standard details are specified for construction at all slab-to-wall junctions and, because they are standard details, no other reinforcing arrangements could have been used. Thus, their use is a project-wide concept and did not depend on the judgment of the individual designer involved.

FIGURE U4.2-1*



SLAB SUPPORT TYPE-5

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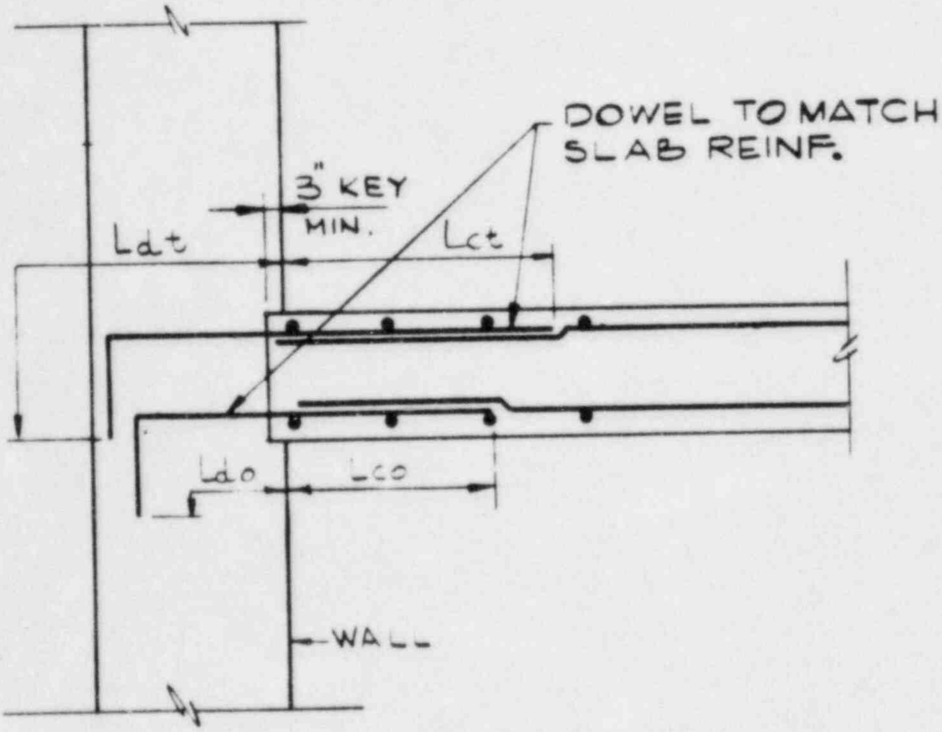
*Taken from S&L Drawing S-473.

FIGURE U4.2-2*



SLAB SUPPORT TYPE-6

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*Taken from S&L Drawing S-473.

Unresolved Item 6-2: Pressure Switch Qualification

> "When review of the pressure switch qualification data is complete, you are requested to provide a description of the basis for acceptance. If qualification by similarity with the tested switch is used, describe the rationale for using similarity."

RESPONSE

The qualification program for pressure switches 1PSL-AF051 and 1PSL-AF055 is described in the following discussion.

The original pressure switch specified for this application was United Electric Model J-302-S156, which is a metal bellows type sensor. Later, due to operating requirements, this switch was changed to Model J-302-552, which is a teflon diaphragm type sensor. Since the test program for Model J-302-S156 was in progress, it was decided to continue the test and evaluate the acceptability of the report upon receipt.

Since the time of the IDI, the report has been received, reviewed, and found to be unacceptable for qualification of Model J-302-552. Due to internal mechanism differences between the two switch models, seismic testing of Model J-302-552 is required and in progress.

Since the switches are located in a mild environment, the environmental qualification will be by a combination of similarity between the tested and supplied switch models for parts that are identical, and a material analysis for parts that are different.

Section II

Response to NRC Letter Dated May 14, 1984

Finding 2-1: Diesel Engine Air Intake

> "Our March 23, 1984 letter requested a copy of the documented walkdown which concluded that there are no additional non-safety-related components that will impair the function of the intake line. Please indicate how the turbine building crane was assessed relative to potential failure during a seismic event and consequential damage to the diesel intake line, unless this is covered in the documented walkdown."

RESPONSE

The turbine building crane was not included in the subject walkdown since only the non-safety-related equipment in the immediate vicinity of the auxiliary feedwater diesel air intake line was reviewed. The diesel air intake line is located at grade elevation 401 feet while the turbine building crane is located above the main operating floor (at approximately elevation 500 feet). The turbine building crane rail girders are designed to withstand SSE loads. The bridge is normally parked at the south end of the turbine building during power operation, corresponding to a horizontal distance of nearly 300 feet from the diesel air intake line. In the unlikely event that the bridge fails during an SSE, the auxiliary feedwater diesel air intake line will not be affected.

Finding 2-4: Time Delay on Logic Diagram

"(1) What system ensures that logic diagrams will be revised when the associated schematic diagram is revised?

(2) Please indicate the systems associated with each drawing referenced in FCR Nc. F21,265."

RESPONSE

(1) Project Instruction PI-BB-58, "Incorporation of Electrical Schematic Control Diagram Changes Into Control Logic Diagrams," has been written to formalize the engineering practice described in the previous response to this finding. This instruction requires that changes to schematics are reviewed against the logic diagrams and, if applicable, requires that logic diagrams are revised. In addition, Sargent & Lundy is conducting a review of the logic diagrams against the schematics. This review is scheduled to be completed in mid-July 1984.

(2) The following drawings are referenced in FCR-21265 with the respective systems requiring revisions:

1-4030 OG01	OG (Off-Gas)
1-4062B	WO (Chilled Water)
1-4062C	WO (Chilled Water)
1-4062E	Bill of Material
1-4062G	WO (Chilled Water)
1-4062H	WO (Chilled Water)
1-4600E	FW (Main Feedwater)
1-4030 SX01	SX (Essential Service Water)
1-4611B	AP (Auxiliary Power 480 V and above)
2-4045B	EH and TG (Turbine EHC and Turbine Generator Auxiliaries)

Finding 2-8: Missing Calculation For Containment Spary

> We believe that the FSAR statements are design bases and are licensing commitments. Our letter dated March 23, 1984 (page 1 of enclosure) requested you to describe the provisions in your review porgram (of Project Management Division's calculations) to determine that all necessary calculations have been identified and performed. Please indicate how you ensured that necessary calculations were identified and performed relative to FSAR statements.

RESPONSE

We concur with the IDI Team that the FSAR statements represent licensing commitments. The Independent Design Review will address the issue concerning calculations, as described in our response to the General Item of NRC letter dated March 23, 1984. (The response to the General Item is contained in Section I of this attachment.)

Finding 6-12: Equipment Status Display Criteria

> "Please inform us of the date that we can review the final design of the Equipment Status Display System."

RESPONSE

The "Documentation Package for Equipment Status Display System; Byron and Braidwood Nuclear Power Stations - Units 1 and 2," is now complete and available for review. This document contains final design information for the ESD system.

Unresolved Item 3-1: Rod Hangers and Pipe Rest Supports

"The following outline is provided to clarify the team's intent:

1. Use of infinite support stiffness met the licensing commitment in the sense that there was no specific commitment to use realistic stiffness in piping analyses.

2. Our sample problem indicated that calculated piping stresses varied somewhat when realistic stiffnesses were employed, but not enough to matter with respect to the piping stress.

3. Our sample problem indicated that calculated seismic support loads varied when realistic stiffnesses were employed. The maximum increase in a support load was 70 percent. This result is shown in Table 2 of the EG&G report at Sargent & Lundy Node 98A:

   609 lb - EG&G calculated SSE load using reasonable stiffness

   358 lb - S&L calculated SSE load using infinite stiffness

   251 lb - 70 percent increase over the S&L calculated load

   (a) In the sample problem, this type of variation was not considered to matter with respect to support strength in view of the large margins typically provided.

   (b) However, we were concerned about your up-lift check procedures for non-linear supports such as pipe rests and rod hangers. When the seismic loads exceeded the dead weight and thermal loads further checking was performed to assure that unloading did not cause problems, e.g., checking of pounding action and of increased loads on adjacent supports. Our concern was as follows:

      (i) If reasonable support stiffnesses were used, the predicted seismic loads would be substantially greater in some cases.

      (ii) Some non-linear supports which were not originally predicted to unload and thus were not checked would be expected to unload.

(iii) We, therefore, intended to suggest that you check additional non-linear supports for unloading - for example, those where seismic loads exceed about half of deadweight and thermal loads.

You are requested to describe your plans to assure that seismic unloading of non-linear supports, where that can be expected, will not cause overstress due to pounding or increased loads on adjacent supports."

RESPONSE

Piping analysis is a design tool for providing a basis for selection of support hardware and evaluation of piping stresses. The EG&G analysis method considers pipe support stiffness values whereas the Sargent & Lundy analysis method considers pipe support to be infinitely rigid.

Both EG&G and Sargent & Lundy methodologies are acceptable means for analyzing a piping system. Large margins and considerable conservatisms do exist in both approaches. These are demonstrated and discussed in detail in technical literature such as NUREG/CR-3526, "Impact of Changes in Damping and Spectrum Peak Broadening on the Seismic Response of Piping Systems.' In addition, it is not reasonable to take extreme differences resulting from the two methodologies and review the results of one analysis method (EG&G) against the other (S&L) and to suggest that the uplift limits should be increased for rod hangers and rest type supports.

Sargent & Lundy's support modeling practice was discussed in detail with the staff of the NRC Mechanical Engineering Branch on August 19, 1983 and it was found to be acceptable.

Attached for your reference are two memos by the NRC Mechanical Engineering Branch and the Division of Licensing which state that the approach used by Sargent & Lundy is acceptable.

Reference 1, "Memorandum from D. G. Eisenhut" states:

> "Based on our review of the Sargent & Lundy design practices, the staff concludes that the method used by Sargent & Lundy for the modelling of the pipe supports in the piping design analyses together with the engineering rationale presented in some detail in the attachment provides an adequate basis for the calculation of piping stresses and support loads."

Reference 2, "Memorandum from D. Terao" states:

> "It is the staff's belief that S&L's design practice of modelling supports as infinitely rigid is acceptable when used with sound engineering judgement."

We believe that we have addressed your concerns in regard to this item.

ATTACHMENT IN RESPONSE TO UNRESOLVED ITEM 3-1

1. NRC Memo from D. G. Eisenhut to R. L. Bangart, dated October 31, 1983.
2. NRC Memo from D. Terao to R. J. Bosnak, dated September 19, 1983.