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November 20, 1984

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

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

References (a): October 1, 1984 letter from T. R. Tramm to R. C. DeYoung

(b): October 19, 1984 letter from J. Nelson Grace to Cordell Reed

(c): October 19, 1984 letter T. R. Tramm to R. C. DeYoung

Dear Mr. DeYoung:

This letter provides additional information regarding the actions taken in response to the NRC's Integrated Design Inspection (IDI) at Byron. The information presented here supplements that provided in reference (a) to address the NRC comments in reference (b).

Attachment A to this letter addresses the Staff comments regarding improvements in the A-E's documentation of the use of engineering judgements and the review of FSAR changes. It explains how the S&L QA program complies with Regulatory Guide 1.64 and ANSI N45.2.11 with respect to the documentation of design activities, especially the documentation of the design basis and engineering judgements. It also describes the manner in which S&L's engineers are trained in these procedures, particularly the procedures relating to engineering judgement and design change control.

Attachment D to reference (c) partially addressed the NRC comment regarding the process of FSAR review and revision to reflect design changes. Additional actions have been taken. Since, and as a result of, the Byron IDI and IDR, project personnel are more aware of the necessity to update the FSAR to reflect the design when design changes are made. The numerous correspondence and discussions relative to the subject has reinforced their on the job training relative to updating the FSAR. The subject has also been discussed and emphasized at meeting where both project and support personnel have attended.

A001
1/1

A Project Instruction under development for post fuel load design changes will reinforce the need to update the FSAR when design changes are made, by specifically requiring that the design change be evaluated for potential FSAR revision.

The NRC also requested additional details regarding the auxiliary building flooding analyses which were summarized in Attachment B to reference (c). Attachment B to this letter contains the documentation of this analysis and identified the disposition of items identified during the reviews.

Please direct further questions regarding these matters to this office.

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

Very truly yours,

T. R. Tramm

T. R. Tramm
Nuclear Licensing Administrator

Attachments

9455N

ATTACHMENT A

I. COMPLIANCE OF THE SARGENT & LUNDY QUALITY ASSURANCE PROGRAM AND PROCEDURES WITH ANSI N45.2.11 AND REGULATORY GUIDE 1.64 WITH RESPECT TO DOCUMENTING DESIGN ACTIVITIES

The Sargent & Lundy Quality Assurance Program which is described in the Topical Report SL-TR-1A, Rev. 6, has been approved by the Nuclear Regulatory Commission as meeting the criteria of Appendix B to 10CFR Part 50. The Topical Report states that S&L is committed to meeting and implementing the applicable provisions of Regulatory Guide 1.64, Revision 2, June 1976, Quality Assurance Requirements for the Design of Nuclear Power Plants (ANSI N45.2.11, Quality Assurance Requirements for the Design of Nuclear Power Plants) except as the provisions may be modified by a commitment in an applicable SAR.

The following is a list of pertinent sections of the S&L QA Program Topical Report that provides examples of how the pertinent sections of ANSI N45.2.11 are addressed:

Pertinent Sections of ANSI N45.2.11

Section 3 - Design Input Requirements
Section 4 - Design Process
Section 5 - Interface Control
Section 6 - Design Verification
Section 7 - Document Control
Section 8 - Design Change Control

S&L QA Program (Topical Report SL-TR-1A, Rev. 6)

Section 01, page 01-3, lines 09 through 19
Section 02, page 02-2, lines 13 through 22
Section 02, page 02-4, lines 01 through 16
Section 03, page 03-1 lines 01 through 34
pages 03-02; 03-03; 03-04; 03-05; 03-06; 03-07
Section 04, page 04-1, 04-2, 04-3 and 04-4.

We are also attaching for your information Table 0.2.04-1 "List Of General Quality Assurance Procedure" from the Topical Report. The following GQ procedures address the following pertinent sections of ANSI N45.2.11:

GQ Procedure	Pertinent Section of ANSI N45.2.11					
	3	4	5	6	7	8
GQ 3.01	x	x	x		x	x
GQ 3.02	x		x		x	x
GQ 3.03	x	x	x		x	x
GQ 3.04	x	x	x	x	x	x
GQ 3.05	x	x	x		x	x
GQ 3.06	x				x	
GQ 3.07	x	x	x	x	x	x
GQ 3.08	x	x		x	x	x
GQ 3.09	x	x		x	x	x
GQ 3 10	x	x	x	x	x	x
GQ 3.11	x	x		x	x	x
GQ 3.12		x			x	
GQ 3.13	x	x	x	x	x	x
GQ 3.14		x	x			
GQ 3.15	x	x	x	x	x	x
GQ 3.16	x	x	x	x	x	x
GQ 3.17	x	x	x	x	x	x
GQ 3.18	x	x	x	x	x	x
GQ 16.03		x	x	x	x	

The S&L Quality Assurance Program provides for control of S&L design and procurement activities which affect the quality of safety-related nuclear power plant structures, systems and components. It is S&L's policy that designs be in accordance with appliable quality assurance requirements and that design activities be procedurally controlled and documented. This includes training of personnel in quality-related S&L activities.

In addition to the QA procedures, the design of structures, systems, and components is planned and controlled by S&L Department Standards, Divisional Procedures and Project Instructions. Design processes are prescribed, accomplished and documented in accordance with procedures which establish the responsibilities and interfaces of design disciplines. Design procedures for control of changes, additions or deletions in design information require documentation and approval. The appropriate engineer is charged with the responsibility for defining other design documents affected by the change,and for resolving and coordinating changes from other disciplines whose design is affected.

Sargent & Lundy uses a system of planned and periodic audits

of activities, records and facilities to verify compliance with, and to assess the effectiveness of, the various aspects of the S&L Quality Assurance Program and the implementing procedures. As part of the auditing process, samples of pertinent design documents requiring independent reviews are taken.

II. DOCUMENTATION OF DESIGN BASIS AND ENGINEERING JUDGMENT

Sargent & Lundy has addressed the need for documentation of design work as follows:

QA Procedure GQ-3.08, Design Calculations, contains requirements for the proper documentation of design basis including assumptions, formulae and steps used in the analysis. QA Procedure GQ-3.17, Design Information Transmittal has been issued to formalize the transmittal of design information between project team members in various design disciplines. The procedure covers any design input which is not already addressed in existing standards or procedures. It requires documentation of the basis for design information including identification of design input which is preliminary.

A nonconformance review program was initiated three years ago to identify trends. The Trend Review Report is issued by Quality Assurance Division every three months, identifying the nonconformances cited during the previous 12 months. This report addresses trends and recommends corrective action. In the last four Trend Review Reports, the subject, "documenting engineering judgment" was addressed. The corrective actions recommended in these reports were implemented.

The use of enginering judgment is specifically addressed by the three engineering disciplines through their respective departmental standards on calculations, SAS-22, MAS-22, and ESI-253. These standards provide the requirements for documenting engineering judgment and permit the use of engineering judgment under the following conditions.

Engineering judgment may be used when it is evident that the design meets the appropriate criteria by a substantial margin. Engineering judgment may be used in repetitive calculations for similar designs by referencing previously reviewed and approved calculations for the same project. Documentation shall include a discussion of differences

between the similar designs. The referenced calculations shall be referenced by calculation number, and revision. Engineering judgment may be used when making revisions to approved calculations if it is evident that the revision does not affect the final calculation, and if it is evident from the previously prepared calculations that design limits are below the allowables. The impact of the revision on the final design is required to be documented.

The reviewer of a calculation may use engineering judgment when making comments if it is evident that his comments do not affect the end result of the calculation. The basis for engineering judgment is required to be documented to permit verification of the logic and adequacy of the judgment.

III. Training

Three Sargent & Lundy QA Procedures address the required training of engineers engaged in the design of nuclear facilities. These are discussed below:

1. Procedure GQ-2.04 describes the training system conducted by the QA Division in the Quality Assurance Procedures. This training covers QA Procedures GQ-3.08 on calculations & GQ-3.17 on Design Information Transmittal, discussed in Section II above.

2. Procedure GQ-2.05 addresses the training to be given by each department in its standards and procedures. A discussion of this training as it affects engineeirng judgment and review of design changes is given below.

3. Procedure GQ-2.07 addresses training in Project Instructions. This training is also given by the Engineering Departments and is discussed below.

Department Training

Training in Department Standards is performed to training procedures in each engineering department.

A. Training in the Documentation of Engineering Judgment

In the Structural Engineering Division (SED), a memo has been issued to all individuals currently performing quality-related activities. This memo contained the more detailed requirements for the use of engineering judgment. Each individual receiving this memo was

instructed to document by signature that he has become familiar with and understands the revision to standard SAS-22 addressing engineering judgment. The memos are retained on file to document this training. Revisions to this standard is also discussed in the SED Supervisors Technical Meetings and summarized in the meeting notes which have broad distribution within SED.

The supervisory staff on all nuclear projects have held meetings with project personnel to review the detailed requirements governing the use of engineering judgment. Attendance sheets were signed to document attendance at these meetings.

In the Mechanical Department, a generic training program was established by Mechanical Department Standard MAS-8 issued in February 1984. This standard requires Mechanical Divisions performing quality-related activities (other than those governed by project unique procedures and instructions) to have a documented divisional training program. One aspect of the divisional program is to prepare an outline identifying the standards and procedures governing each individual's work and the need for training in these standards.

Each Mechanical Division performing quality-related work has prepared an outline as required, and MAS-22 (addressing engineering judgment) or its equivalent has been identified on that outline as one of the standards that individuals who prepare, review and approve safety-related calculations must be trained in. The actual training is now in progress and will be ongoing as new personnel are added to the list. The training consists of the Supervisor or his Designee directing the individual to read MAS-22 or its equivalent, and to discuss any questions that he may have with the Supervisor. The Supervisor also observes the work of the individual to determine that he has attained adequated knowledge of the procedure or standard. When this has been accomplished, the Supervisor documents the individual's proficiency and sends this documentation to the Divisional Training Coordinator for record purposes.

In the Electrical Department, documented training has been conducted dealing with the use of engineering judgment when preparing calculations. ESI-253 has been

circulated through the Electrical Analytical Division and the Electrical Project Engineering Division to the responsible engineers. All employees responsible for performing Junction Box Calculations have received a revised copy of EDSI-77 which incorporates the concept of engineering judgment. Engineering judgment has also been the subject of intra and interdivisional meetings to emphasize its use.

B. Training in the Review and Control of Design Changes

In addition to the Quality Assurance procedures governing changes to drawings, specifications, calculations, and Engineering Change Notices, the processing of design changes is the subject of a number of project instructions. Personnel performing design verification are trained in applicable standards and procedures. Training in design verification activities is covered by both generic and project unique training programs.

An individual is required to be retrained whenever his responsibilities change or are substantially affected by a revision to applicable standards and procedures. Records are maintained to document the successful completion of all required training. Training in Project Instructions is generally conducted in the project team meetings which are attended by representatives from cognizant divisions and departments. In these meetings, the project instruction is introduced and discussed. This is documented in the meeting notes. The attendees at this meeting are usually the lead personnel from the various divisions. It is the responsibility of these lead personnel to carry the message back to the personnel under their supervision and to instruct those personnel in the requirements of the project instruction.

SARGENT & LUNDY

TABLE 02.04-1

LIST OF GENERAL QUALITY ASSURANCE PROCEDURES

SL-18-1A

Revision 6

PROCEDURE NUMBER	PROCEDURE TITLE	10CFR50 APPENDIX B REFERENCE CRITERIA			
		PRIMARY CRITERION		SECONDARY CRITERION	
6 QAP-1.01	S&L Organization Manual	I	Organization	II	QA Program
QAP-1.02	Project Organization Structure	I	Organization	II	QA Program
6 QAP-1.03	S&L Position Descriptions	I	Organization	XVII	QA Records
QAP-1.04	Employee Experience Records and Qualification Statements	I	Organization	XVII	QA Records
QAP-2.01	S&L Quality Assurance Manual	II	QA Program	I	Organization
QAP-2.02	Distribution and Control of the S&L Quality Assurance Manual	II	QA Program	I	Organization
QAP-2.03	Review of Client Quality Assurance Program Requirements	II	QA Program	I	Organization
6 QAP-2.04	Indoctrination and Training in the S&L Quality Assurance Manual	II	QA Program	I	Organization
QAP-2.05	Technical Training	II	QA Program	--	--
QAP-2.06	Management Review of the S&L Quality Assurance Program and Procedures	II	QA Program	XVIII	Audits
6 QAP-2.07	Project Indoctrination Training	II	QA Program	V	Instructions, Procedures and Drawings
QAP-3.01	Control of Regulations, Guides, Codes and Standards	III	Design Control	IV	Procurement Document Control
QAP-3.02	Scope of Work	III	Design Control	VI	Document Control
QAP-3.03	Classification Criteria	III	Design Control	II	QA Program
QAP-3.04	Design Criteria	III	Design Control	V	Instructions, Procedures and Drawings
QAP-3.05	Design Analyses Reports (DAR's and FAR's)	III	Design Control	V	Instructions, Procedures and Drawings
				VI	Document Control
QAP-3.06	Computer & Code Programs	III	Design Control	VI	Document Control
QAP-3.07	Computer & Code Control	III	Design Control	V	Instructions, Procedures, and Drawings
				VI	Document Control
QAP-3.08	Design Calculations	III	Design Control	VI	Document Control
QAP-3.09	Purchase Design Changes	III	Design Control	VII	Control of Purchased Material, Equipment and Services
QAP-3.10	Interim and Final Design Reviews	III	Design Control	VI	Document Control
QAP-3.11	Engineering Reports	III	Design Control	VI	Document Control
QAP-3.12	Project Status Reports	III	Design Control	VI	Document Control
QAP-3.13	Engineering Change Notices	III	Design Control	VI	Document Control
QAP-3.14	Nuclear Feedback	III	Design Control	XVI	Corrective Action
QAP-3.15	Approved Procedural Deviations	III	Design Control	VI	Document Control
6 QAP-3.16	Design Functional Descriptions	III	Design Control	VI	Document Control
QAP-4.01	Procurement Specifications	IV	Procurement Document Control	III	Design Control
6 QAP-4.02	Proposed Deviations and Nonconformances	IV	Procurement Document Control	VII	Control of Purchased Material, Equipment and Services
QAP-5.01	Project Instructions	V	Instructions, Procedures, and Drawings	II	QA Program
QAP-6.01	Project Distribution List and Project File Indexes	VI	Document Control	--	--
QAP-11.01	Preoperational and Startup Test Procedures	XI	Test Control	V	Instructions, Procedures, and Drawings
QAP-16.01	Corrective Action Reports	XVI	Corrective Action	I	Organization
QAP-16.02	Significant Conditions Adverse to Quality and Stop Work Orders	XVI	Corrective Action	I	Organization
6 QAP-16.03	Design Errors and Deficiencies	III	Design Control	XVI	Corrective Action
QAP-17.01	Qualification Criteria for Quality Assurance Records	XVII	Quality Assurance Records	V	Instructions, Procedures, and Drawings
6 QAP-17.02	Quality Assurance Records Control System	XVII	Quality Assurance Records	V	Instructions, Procedures, and Drawings
QAP-18.01	Internal Audits	XVIII	Audits	I	Organization
QAP-18.02	Qualifications of Auditors	XVIII	Audits	I	Organization
QAP-18.03	External Audits of Technical Service Subcontracts	XVIII	Audits	IV	Procurement Document Control

ATTACHMENT B

Calculation Sheets Which Document The
Reviews of Auxiliary Building Flooding

9455N

SARGENT & LUNDY ENGINEERS CHICAGO	Calcs. For Confirmation of Safe Shutdown Capability After Aux Bldg Flooding	Calc. No. HELB-8
	X Safety-Related / Non-Safety-Related	Rev. 0 Date [illegible]
		Page 1 of 13

Client CECo	Prepared by [illegible]	Date 10-?-?
Project Byron / Braidwood 1 & 2	Reviewed by BT Appelson	Date 10-10-8?
Proj. No. 4311/4312-00, 4633/4634-00 Equip. No.	Approved by [illegible]	Date 10-15-8?

PURPOSE: Confirm that an adequate design approach relative to High Energy Line Break (HELB) and Moderate Energy Line Break (MELB) Auxiliary Building flooding effects and single failure for safe shutdown mechanical and electrical systems has been accomplished and meets the objectives of Standard Review Plan (SRP) Sections 3.4 and 3.6. The scope of this assessment is limited to the safe shutdown systems in the Auxiliary Building since flooding effects in other areas and effects on structures have been assessed in other Sargent & Lundy Calculations. Cross references to these calculations will be made as necessary to verify safe shutdown capability.

METHOD: Reference 1 is a calculation which indicates maximum flood levels for every area within the Auxiliary Building. Based on this calculation, design drawing reviews or field walkdowns were performed (References 2, 3 and 4) which determined all safety related components existing below these flood levels that would be adversely affected by flooding. More specifically, all safety related instrumentation and electrical components below flood level which could be affected by flooding were identified. Mechanical items

such as, but not limited to, piping, valve bodies, supports, tanks, heat exchangers and pump casings were not identified since flooding effects would not prevent these components from performing their safe shutdown functions.

The safety related items located below flood level which could be affected by flooding are listed on pages 4-8 of this calculation. The items are listed in groups that correspond to Auxiliary Building flood zones which are defined in Reference 1. The component listing identifies the safe shutdown function of each component and indicates whether that component is required for safe shutdown following any HELB or MELB initiating event in the auxiliary building. Components which would never be required for safe shutdown after one of the events listed above require no further assessment.

Components which may be required for safe shutdown following a HELB or MELB and which are located below flood level require further assessment. Each Auxiliary Building flood zone which contains component(s) described above is assessed individually to ensure that safe shutdown is attainable following the initiating event and single failure. These assessments are on pages 9-14

of this calculation. These design justifications demonstrate that safe shutdown is attainable mainly for the following reasons.

(a) Redundant and/or diverse means of achieving the safe shutdown function of the disabled equipment exist.

(b) The safe shutdown equipment disabled by flooding is not required for safe shutdown following the specific HELB or MELB event which causes the flooding.

Based on the information given on pages 4-8 only the Auxiliary Building flood zones listed below contain equipment that may be required for safe shutdown following a HELB or MELB in the A.B. and which is located below flood level. These are the only zones which the assessments on pages 9-14 are required for.

G1-1A	G1-1B
S2-8A	S2-8B
S2-13A	S2-13B
S3-10A	S3-10B
S3-13A	S3-13B
G4-1	

Form GO-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Client CECo | Project Evaluation of Safe Shutdown Capability After Aux. Bldg. Flood | Proj. No. 4322-003 | Equip. No. | Safety-Related | Non-Safety-Related

Calc. For Evaluation of Safe Shutdown Capability After Aux. Bldg. Flood | Calc. No. HELB-E | Rev. 0 | Date 10-3-85 | Page 4 of 19

Prepared by [illegible] | Date 10-3-85
Reviewed by | Date
Approved by | Date

FLOOD ZONE No.	AFFECTED EQUIPMENT	SAFETY RELATED EQUIPMENT DESCRIPTION	REQUIRED FOR AUX. BLDG. HELB OR MELB SSD (YES or NO)
G1-1A	1VA01SA	ESW Pump 1A cubicle cooler	Yes
	2VA01SA	ESW Pump 2A cubicle cooler	Yes
G1-1B	1VA01SB	ESW Pump 1B cubicle cooler	Yes
	2VA01SB	ESW Pump 2B cubicle cooler	Yes
S1-3A	1SX001A	ESW Pump 1A inlet isolation valve for pump maintenance	No
S1-3B	2SX001A	ESW Pump 2A inlet isolation valve for pump maintenance	No
S1-3C	1SX001B	ESW Pump 1B inlet isolation valve for pump maintenance	No
S1-3D	2SX001B	ESW Pump 2B inlet isolation valve for pump maintenance	No

Note: Valves 1/2SX001A/B are not required for isolation following a MELB between the valves and pumps since the upstream valves at the ESW cooling tower basin could be utilized.

S2-8A	1TS-VA003	Temp switch which supports RH pump 1A cubicle cooler	Yes
	1VA03J	Control panel which supports RH pump 1A cubicle cooler	Yes
	1VA02SA	RH pump 1A cubicle cooler	Yes
	1RH01PA-M	RH pump 1A motor	Yes
S2-8B	2TS-VA003	Temp switch which supports RH pump 2A cubicle cooler	Yes
	2VA03J	Control panel which supports RH pump 2A cubicle cooler	Yes
	2VA02SA	RH pump 2A cubicle cooler	Yes
	2RH01PA-M	RH pump 2A motor	Yes
S2-13A	1TS-VA004	Temp. switch which supports RH pump 1B cubicle cooler	Yes
	1VA04J	Control panel which supports RH pump 1B cubicle cooler	Yes
	1VA02SB	RH pump 1B cubicle cooler	Yes
	1RH01PB-M	RH pump 1B motor	Yes
S2-13B	2TS-VA004	Temp switch which supports RH pump 2B cubicle cooler	Yes
	2VA04J	Control panel which supports RH pump 2B cubicle cooler	Yes
	2VA02SB	RH pump 2B cubicle cooler	Yes
	2RH01PB-M	RH pump 2B motor	Yes

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Confirmation of Safe Shutdown Capability After Aux Bldg Flooding

X Safety-Related   Non-Safety-Related

Calc. No. 4E-E-?-   Rev. 0   Date 10-?-?-   Page 5 of 1?

Client CECo

Project Byron / Braidwood 1 & 2

Proj. No. [illegible]   Equip. No.

Prepared by [illegible]   Date 10-?-?-

Reviewed by   Date

Approved by   Date

Form GQ 3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs For: [illegible]

Client CECo

Project [illegible]

Proj. No. [illegible] Equip. No.

Safety-Related ✓ Non-Safety-Related

Calc. No. [illegible] Rev. 0 Date [illegible]

Prepared by [illegible] Date [illegible]

Reviewed by [illegible] Date

Approved by Date

Page 6 of 1[illegible]

S2-9A	1VA03SA	CS pump 1A cubicle cooler	No
	1CS010A	CS eductor valve 1A	No
S2-9B	2VA03SA	CS pump 2A cubicle cooler	No
	2CS010A	CS eductor valve 2A	No
S2-12A	1VA03SB	CS pump 1B cubicle cooler	No
	1CS010B	CS eductor valve 1B	No
	1VA06J	CS pump 1B cubicle cooler panel	No
S2-12B	2VA03SB	CS pump 2B cubicle cooler	No
	2CS010B	CS eductor valve 2B	No
	2VA06J	CS pump 2B cubicle cooler panel	No

Note: Containment spray system is only required following a containment LOCA and would not be required following a HELB or MELB in the Auxiliary Building.

S3-10A	1TS-VA010	Temp. switch for CV pump 1A cooler	Yes
	1VA10J	Control panel for CV pump 1A cooler	Yes
	1VA06SA	CV pump 1A cubicle cooler	Yes
	1CV01PA-M	CV pump 1A motor	Yes
S3-10B	2TS-VA010	Temp switch for CV pump 2A cooler	Yes
	2VA10J	Control panel for CV pump 2A cooler	Yes
	2VA06SA	CV pump 2A cubicle cooler	Yes
	2CV01PA-M	CV pump 2A motor	Yes
S3-13A	1TS-VA011	Temp switch for CV pump 1B cooler	Yes
	1VA11J	Control panel for CV pump 1B cooler	Yes
	1VA06SB	CV pump 1B cubicle cooler	Yes
	1CV01PB-M	CV pump 1B motor	Yes
S3-13B	2TS-VA011	Temp switch for CV pump 2B cooler	Yes
	2VA11J	Control panel for CV pump 2B cooler	Yes
	2VA06SB	CV pump 2B cubicle cooler	Yes
	2CV01PB-M	CV pump 2B motor	Yes

Note: Some additional misc. items which are listed in Reference 4 are also located in the zones above, however, these items are used to support their respective charging pumps. Most importantly, the worst case flood in any of the 4 CV pump cubicles could result in the loss of the charging pump in that zone.

SARGENT & LUNDY ENGINEERS CHICAGO

Client CECo
Project LaSalle Unit 1&2
Proj. No. 4331.123-00 4331.123-03 Equip. No.
Safety-Related / Non-Safety-Related

Calcs. For Confirmation of Safe Shutdown Capability After Fire in Cable Spreading Room

Prepared by [illegible] Date 10-7-87
Reviewed by [illegible] Date
Approved by Date

Calc. No. HELB-2
Rev. 0 Date 10-7-87
Page 7 of 15

Form GQ-3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO

Client: CECo
Project: Byron / Braidwood 1 & 2
Proj. No. 4311/4312-00, 4683/4684-00 Equip. No.
Calcs For: Qualification of Safe Shutdown [illegible] Electrical [illegible]
X Safety-Related ☐ Non-Safety-Related
Prepared by [illegible] Date 10-[illegible]
Reviewed by [illegible] Date
Approved by Date
Calc. No. HELB-8 Rev. 2 Date [illegible]
Page 8 of 1[illegible]

S3-9A	1VA05S	Positive displacement charging pump cubicle cooler	No
	1VA09J	PDP cubicle cooler panel	No
S3-9B	2VA05S	Positive displacement charging pump cubicle cooler	No
	2VA09J	PPP cubicle cooler panel	No
S3-8A	1RH610	RH pump 1A mini-flow line valve	No
S3-8B	2RH610	RH pump 2A mini-flow line valve	No
S3-11A	1RH611	RH pump 1B mini-flow line valve	No
S3-11B	2RH611	RH pump 2B mini-flow line valve	No

NOTE: The RH pump mini-flow valves are normally open and are only required to close in a high RHR flow condition following a LOCA. Since flooding events in the A.B. only require normal flow, these valves are not required to operate following a HELB or MELB event inside the A.B.

G4-1	OCC01E	CCW pump 0 switchgear to switch power source for pump 0	Yes
S10-2A	1JB1653A	Junction box for valve 1VQ005C	No

The following discussion explains in more detail the methodology that will be used in justifying safe shutdown equipment disabled by A.B. flooding events.

Only the zones with affected safe shutdown equipment required for HELB/MELB A.B. events will be reviewed. All affected equipment within a flooded zone is assumed to be disabled simultaneously. Based on the building configuration, flooding events are not necessarily limited to one flood zone. In cases where a single HELB or MELB causes flooding in multiple zones containing safe shutdown equipment, all the affected equipment in those multiple zones is assumed to be disabled simultaneously.

Reference 1 uses the worst case HELB/MELB to determine the maximum possible flood level in each area. The worst case break from a flood standpoint is not necessarily the worst case break from a safe shutdown standpoint. Based on the existing piping configuration, each zone with affected safe shutdown equipment will be assessed to verify that the worst case flood break is conservative from a safe shutdown standpoint.

Flood Zones G1-1A and G1-1B

The worst case flood in either of the above zones is due to an essential service water line break. The resulting flood level could disable the cubicle coolers for pumps 1A and 2A in Zone G1-1A. Similarly, the flood in Zone G1-1B could disable the cubicle coolers for pumps 1B and 2B. The separation between the two zones is a water tight separation and the flood does not affect any other zones. The essential service waters system is a dual purpose moderate energy system and therefore, per APCSB 3-1 (Reference 5) a single failure in the ESW system need not be postulated. Based on the above, two redundant pumps will be available for safe shutdown in the unflooded cubicle.

Based on examination of piping comonsite drawings for Zones G1-1A and G1-1B, no HEL's exist in these areas and the only other MEL's in these areas are fire protection lines. Reference 6 indicates that these fire protection lines do not exceed the moderate energy stress limits and therefore cracks or breaks need not be postulated.

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For: Determination of Safe Shutdown Capability After Fire, Elev. Flooding

[X] Safety-Related [ ] Non-Safety-Related

Calc. No. -ELE-1 | Rev. 0 | Date 10-9-87 | Page 11 of 15

Client CECo		Prepared by TR Butler	Date 10-9-87
Project Byron/Braidwood 1&2		Reviewed by	Date
Proj. No. 4371/4372-00 4682/4684-00	Equip. No.	Approved by	Date

Flood Zone 64-1

The worst case flood in this zone is due to a non-essential service water line break. The resulting flood level could disable the common component cooling water (CCW) pump to Units 1 and 2 (OCC01P). This pipe break also results in flooding of other zones, however, only the safe shutdown equipment in zones S2-8A, S2-8B, S2-13A and S2-13B could be disabled by the flooding. Flooding in all other safe shutdown equipment areas would not be high enough to disable any safe shutdown equipment.

Following the failure of one CCW pump due to flooding and the single failure of another, at least one CCW pump will remain functional per unit as required for safe shutdown. Concurrent flooding of the zones listed above could disable both RHR trains which are used to bring the plant from a hot standby to a cold shutdown condition. The Byron/Braidwood licensing basis is to attain safe shutdown following any accident. For non-LOCA breaks, safe shutdown is defined as hot standby (T_{AVG} greater than or equal to 350°F, zero percent rated thermal power and k_{eff} less than 0.99). Since the licensing basis is hot shutdown, it is not necessary to demonstrate capability to reach cold shutdown conditions (reactor

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coolant temperature less than or equal to 200°F, zero rated thermal power and Keff less than or equal to 0.99) using only safety related equipment. However, alternate means for achieving cold shutdown without repair or replacement of equipment are available. These means are described on page 18 of Reference 7.

No other HELB's or MELB's in Zone G4-1 are more limiting than the non-essential service water break discussed above.

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Confirmation of Safe Shutdown Capability After Aux. Bldg. Flooding		Calc. No. HELB-7
		Rev. 0 Date 10-7-92
X Safety-Related	Non-Safety-Related	Page 13 of 16

Client CECo	Prepared by WS Leutloff	Date 10-7-92
Project Byron / Braidwood 1 & 2	Reviewed by	Date
Proj. No. 4.3=14312-00 4.2=14321-00 Equip. No.	Approved by	Date

Flood Zones S2-8A, S2-8B, S2-13A, S2-13B

The worst case floods in these zones is caused by a sixteen inch RH line break in each of the respective zones. A break in any one of these zones causes concurrent flooding of both RH pump cubicles per Unit. The flooding does not affect safe shutdown equipment in any other flood zones. Based on the discussion given on pages 11 and 12 of this assessment, loss of the redundant RHR trains is acceptable for achieving hot standby conditions.

No other HELB's or MELB's in these flood zones are more limiting than the breaks discussed above.

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Client CECo

Project Cyrus / Braidwood 1&2

Proj. No. TS-111/4312-00 4633/4634-00 Equip. No.

Prepared by TCS Pontloff | Date 10-3-7-

Reviewed by MO | Date

Approved by | Date

Flood Zones S3-10A, S3-10B, S3-13A, S3-13B

The worst case floods in these zones are caused by CV centrifugal charging pump discharge line breaks within these zones. This flooding plus a single failure could cause a loss of CV system charging capability. Following this event, the plant would be maintained in a hot standby condition until charging is restored. Capability to maintain hot standby conditions and to proceed to cold shutdown is available. This capability is described in detail on pages 46 and 47 of Reference 7.

No other HELB's or MELB's in these zones are more limiting than the breaks discussed above.

SARGENT LUNDY ENGINEERS CHICAGO

Calcs For Confirmation of Safe Shutdown Capability After Aux Bldg. Flooding

X Safety-Related | Non-Safety-Related

Calc No. HELB-8 | Rev. 0 | Date 10-7-87 | Page 15 of 16

Client CECo

Project Cygna / Braidwood 1&2 (7311/4372-00)

Proj. No. 4693/4694-00 Equip No.

Prepared by MS Southoff Date 10-7-87

Reviewed by Date

Approved by Date

CONCLUSION: This assessment verified the existing plant mechanical and electrical systems design approach for HELB and MELB flooding effects in the Auxiliary Building. This assessment verified the design by showing that:

1. Safe shutdown equipment is located outside all flood zones of influence.
2. Safe shutdown equipment is not affected adversely by flooding.
3. Redundant and/or diverse means of achieving safe shutdown exist after certain equipment is damaged by flooding.
4. The safe shutdown equipment disabled by flooding is not required for safe shutdown following the specific HELB or MELB event which causes the flooding.

The worst case flooding events in one instance caused complete loss of RHR system capability and in another instance (after considering single failure) caused complete loss of CV system charging capability. Safe shutdown capability was demonstrated for each of these instances. Based on these results, the existing system designs are adequate to withstand Auxiliary Building floods.

A detailed review of the original calculation was performed.

BT Appelson

Form GO-3 08.1 Rev. 2 SL-F647 04/84

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Confirmation of Safe Shutdown Capability After Fire Aux Bldg Flooding

X Safety-Related | Non-Safety-Related

Calc. No. HELP-8

Rev. 0 | Date 10-9-84

Page 16 of 16

Client CECo

Project Cyon / Braidwood 1&2

Proj. No. 4311/4312-00 4483/4684-00 Equip. No.

Prepared by R.S. Southoff | Date 10-9-84

Reviewed by | Date

Approved by | Date

REFERENCES:

1. Sargent & Lundy Calculation 3C8-1281-001 Rev. 2 entitled "Auxiliary Building Flood Level Calculations".

2. Sargent & Lundy Design Information Transmittal No. DIT-BB-CID-0006-A dated 9-25-84.

3. Sargent & Lundy Document No. HDI-02-BB Rev. 1 entitled "Impact of Auxiliary Building Flood Levels on HVAC".

4. Sargent & Lundy Design Information Transmittal No DIT-BY-EPED-0012 dated 10-9-84

5. Branch Technical Position APCSB 3-1 entitled "Protection Against Postulated Piping Failures in Fluid Systems Outside Containment". (Section B.3.b.(3)).

6. Sargent & Lundy Interoffice Memorandum dated March 19, 1984 entitled "Moderate Energy Piping".

7. Sargent & Lundy August 1984 Report entitled "Confirmation of Design Adequacy for Jet Impingement Effects".

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SARGENT & LUNDY ENGINEERS

DESIGN INFORMATION TRANSMITTAL

☒ SAFETY-RELATED ☐ NON-SAFETY-RELATED

DIT-BY-EPED-0012-1*

Page 1 of 1

CLIENT CECo

STATION Byron UNIT(S) 1 & 2

PROJECT NO(S). 4391/2

To M. S. Leutloff - 22

J. D. Regan (Please Print) — Responsible individual

EPED — Division

J Regan — Responsible individual's signature

10-12-84 — Issue date

STATUS OF INFORMATION (this information is approved for use. Design information, approved for use, that contains assumptions or is preliminary or requires further verification (review) shall be so identified)

This information is approved for use. No further verification is required.

IDENTIFICATION OF THE SPECIFIC DESIGN INFORMATION TRANSMITTED AND PURPOSE OF ISSUE
(list any supporting documents attached to DIT by its title and revision and/or issue date)

Attachment "A" identifies all safety-related electrical equipment which is located below the flood level within the flood zone identified. The flood levels used to determine the affected equipment are those identified in the Auxiliary Building Flood Level Calculation (Calc. No. 3CB-1281-001), Rev. 1, dated 3-1-84. Only safety-related electrical equipment is listed.

*This DIT supersedes DIT-BY-EPED-0012, dated 7-19-84. The revision of the above calculation has been corrected.

BASIS FOR INFORMATION

Calc. no. N/A ____ Rev. and/or date

Report no. N/A ____ Rev. and/or date

Other I.O.M. from T. Kepes to F. G. Gogliotti, dated 4-23-84, 5-10-84 and 6-11-84.

DISTRIBUTION

CC: D. L. Leone/W. C. Cleff - 22 (1/1)
K. J. Green - 22 (1/1)

Form GO-3.17.1 Rev. 0 (5-1-84)

SARGENT & LUNDY ENGINEERS

DESIGN INFORMATION TRANSMITTAL

☒ SAFETY-RELATED ☐ NON-SAFETY-RELATED

DIT- BB-CID-0006-A

CLIENT Commonwealth Edison Company

STATION Byron/Braidwood UNIT(S) 1 & 2

PROJECT NO(S). 4331/4392/4683/4684

Page 1 of 12

To → J. Grunaman - 2

R. P. Orkfritz — Responsible individual (Please Print)

CID — Division

Responsible individual's signature

9/25/84 — Issue date

STATUS OF INFORMATION (this information is approved for use. Design information, approved for use, that contains assumptions or is preliminary or requires further verification (review) shall be so identified)

This information is approved for use.

IDENTIFICATION OF THE SPECIFIC DESIGN INFORMATION TRANSMITTED AND PURPOSE OF ISSUE
(list any supporting documents attached to DIT by its title and revision and/or issue date)

Refer to DIT-BB-CID-0006.

Revision made to page 5 which corrected instrument panel numbers on M-828-13, zone S3-13B.

BASIS FOR INFORMATION

Calc. no. N/A — Rev. and/or date

Report no. N/A — Rev. and/or date

Other NONE

DISTRIBUTION

W. C. Cleff

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DESIGN INFORMATION TRANSMITTAL

☒ SAFETY-RELATED ☐ NON-SAFETY-RELATED DIT- BB-CID-0006

CLIENT Commonwealth Edison Company Page 1 of 12

STATION Byron/Braidwood UNIT(S) 1&2 To J. Grunemann

PROJECT NO(S). 4391/4392/4683/4684

R. Orkfritz C&ID Roger Orkfritz 8/8/84

Responsible individual (Please Print) Division Responsible individual's signature Issue date

STATUS OF INFORMATION (this information is approved for use. Design information, approved for use, that contains assumptions or is preliminary or requires further verification (review) shall be so identified)

This is approved for use.

IDENTIFICATION OF THE SPECIFIC DESIGN INFORMATION TRANSMITTED AND PURPOSE OF ISSUE (list any supporting documents attached to DIT by its title and revision and/or issue date)

C&ID has reviewed the auxiliary building flood levels versus the mechanical instrument location drawings with the results attached.

There are no problems with safety-related instruments found to auxiliary flooding.

BASIS FOR INFORMATION

Calc. no. _____ _____ Report no. _____ _____

Rev. and/or date Rev. and/or date

Other _____

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W. C. Cleff

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SARGENT & LUNDY

INTEROFFICE MEMORANDUM

2947

From D. H. Flens - 31 (X3901) Date August 1, 1984

Dept./Div. Mechanical/HVAC Project No. 4391/2;4633/4-00

Spec. No.

File No.

Page No. 1

Client CECo Stn. Byron/Braidwood Unit 1 & 2

Subject HVAC Auxiliary Building Flood Level Impact Report

To: K. J. Green (1/1) - 22

cc: D. L. Leone (1/1) - 22
W. C. Cleff (1/0) - 22
J. Grundman (1/0) - 22
G. C. Jones (1/0) - 22
D. C. Soni (1/0) - 20
A. M. Bizarra (1/1) - 20
W. B. Paschal/S. N. Planjery (1/0) - 31
E. G. Hibbard (1/0) - 31

Attached is a copy of HVAC Calculation HDI-02-BB, Revision 1, dated 07-27-84, entitled "Impact of Auxiliary Building Flood Levels on HVAC," which was prepared per your request.

A list of our assumptions used in performing the evaluation is provided on page 2 of this report. A summary of our report is also provided on page 13.

If you have any questions, please contact me.

DHF:alj
Attachment

DOCUMENT ISSUE SUMMARY SHEET

Client: CECO
Project: BYRON/BRAIDWOOD
Project No.: 4391/2 & 4683/4-00
Equipment No.: ___

☑ Nuclear Safety-Related
☐ Nuclear Non-Safety-Related
☐ Fossil

Doc. No.: HDI-02-B5
Revision: 1
Responsible Division: HVAC
File Index No.: 8.1
Page 1 of 13

Title: IMPACT OF AUX. BLDG. FLOOD LEVELS ON HVAC.

Revision Number	Date	Revised Pages	Preparer	Method of Review	Reviewer/ Date	Approver/ Date
0	7/17/84	ALL	E. B. Hibbard 7/12/84	Detailed Review	[illegible] 7-16-84	[illegible] 7/17/84
1	7/27/84	Technical revisions pgs 2-7 & 13. All pgs updated dwg. revision letters.	E. B. Hibbard 7/27/84	Detailed Review	[illegible] 7-31-84	[illegible] 7/31/84