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

December 6, 1983

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Byron Generating Station Units 1 and 2
Braidwood Generating Station Units 1 and 2
Environmental Qualification of Equipment
NRC Docket Nos. 50-454, 50-455, 50-456, and 50-457

References (a): July 20, 1983, letter from B. J. Youngblood to D. L. Farrar.

(b): May 20, 1983 letter from B. J. Youngblood to D. L. Farrar.

Dear Mr. Denton:

This is to provide additional information regarding the environmental qualification of safety-related equipment at Byron and Braidwood stations. Reference (a) provided an SER on this topic and requested additional information on specific technical issues which were identified as incomplete at the July 1983 site audit at Byron. Attachment A to this letter contains Commonwealth Edison's response on all issues except mechanical equipment qualification and justification for interim operation of electrical equipment. Those responses will be provided by the end of this month.

In reference (b) the NRC requested a list of safety-related mechanical equipment located in harsh environment areas and summary information on that equipment. The requested information is being compiled and will be submitted by December 19, 1983. We understand that the NRC expects to review detailed qualification information on three items from this list to confirm the adequacy of our qualification program.

At present, it appears that environmental qualification testing of six items of electrical equipment will not be completed prior to the target fuel load date. Accordingly, our justifications for interim operation of the plant with incomplete qualification of these six items will be provided for NRC review. The justification for NSSS Limitorque valve operators will be submitted by December 15, 1983. Similar justifications for Barton switches, Crosby relief valve position indication switches, Rockwell hydrogen recombiners, Borg Warner main steam atmospheric relief valves, Model 85440, and Borg Warner damper actuators will be provided by December 30, 1983. The qualification testing of some

A046
1/1

or all of these items may actually be completed prior to fuel load of Byron 1, but these six justifications are being developed as a contingency.

Please direct further questions regarding this matter to this office.

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

Very truly yours,

T. R. Tramm

T. R. Tramm
Nuclear Licensing Administrator

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Attachment A

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ATTACHMENT A

ADDITIONAL INFORMATION REGARDING ENVIRONMENTAL QUALIFICATION OF SAFETY-RELIEF EQUIPMENT FOR BYRON AND BRAIDWOOD STATIONS

NOTE: The information presented here addresses specific sections of the NRC's SER provided in the July 20, 1983 letter from B. J. Youngblood to D. L. Farrar. The SER excerpts are identified by section number.

3.11.3.1 Completeness of Equipment Important to Safety

In order to demonstrate compliance with 10 CFR 50.49, the following information is required to be submitted by the applicant prior to granting of an operating license:

(a) a list of all non-safety-related electrical equipment located in a harsh environment whose failure under the postulated environmental conditions could prevent the satisfactory accomplishment of safety functions by the safety-related equipment. A description of the methods used to identify this equipment must also be included. The non-safety-related equipment identified must be included in the environmental qualification program.

(b) a list of additional safety-related electrical equipment which is required to function to mitigate design basis events other than LOCAs or HRLBs and which is located in the harsh environment created by the design basis event.

(c) a list of all post-accident monitoring equipment currently installed or that will be installed prior to plant operation that is specified as Category 1 and 2 in Regulatory Guide 1.97 Rev. 2 and is located in a harsh environment. The equipment identified must be included in the environmental qualification program.

Response

(a) Equipment, valve and instrument indexes were searched to identify safety related equipment. Schematics, piping and instrument details and wiring diagrams were then reviewed to determine safety related functions.

The Byron/Braidwood electrical design does not utilize any non-safety-related electrical equipment whose failure under the postulated environmental conditions could prevent a satisfactory accomplishment of safety functions by the safety-related equipment. All Byron/Braidwood electrical circuits/equipment are designated either Class 1E or Non-Class 1E. Associated cables are not utilized on Byron/Braidwood design. Class 1E components of an ESF division are physically and electrically separated from Class 1E components of the redundant ESF division as well as Non-Class 1E components that could cause loss of redundancy as the result of a design basis event affecting failure of these components. The physical and electrical separation is in accordance with the guidelines presented in IEEE 384-1974 and Regulatory Guide 1.75 (with certain exceptions as documented in Appendix A to the FSAR). The separation requirements are incorporated in the design through the project Electrical Separation Design Criteria and project procedures. For cases where the circuit design requires an interface between Class 1E and Non-Class 1E circuits, specific analyses are performed on a case by case basis to show that any postulated failures in the Non-Class 1E circuit will not prevent a Class 1E circuit from performing its safety function. These analyses are documented and maintained on file along with other design documents.

(b) As stated in the introduction to the Byron/Braidwood Equipment Environmental Qualification Report, the equipment which is identified in the report and included in the Byron/Braidwood Environmental Qualification Program is all electrical equipment required for emergency reactor shutdown, containment isolation, reactor core cooling, containment heat removal, core residual heat removal or prevention of significant release of radioactive material to the environment. The list of equipment included in the program includes not only Class 1E equiment which is required to mitigate a LOCA or HELB, but it also includes all other equipment designated as Class 1E. Qualification for all Class 1E equipment located in a harsh environment created by any design basis event will be completed prior to fuel load or a justification for interim operation will be prepared and submitted in accordance with 10 CFR 50.49.

(c) See Table A for listing of Post Accident Monitoring instruments. This equipment is included in the environmental qualilfication program. Included in this Table is equipment required by the TMI Action Plan (NUREG-0737). This equipment will be qualified prior to fuel load.

3.11.3.3.5 Aging

The aging program requirements for Byron electrical equipment are defined in Section 4, Category I of NUREG-0588. The degrading influences of temperature, radiation, vibration, and electrical and mechanical stresses should be considered and included in the aging program. Any justifications for excluding pre-aging of equipment in type testing should be established based on equipment design and application, or on state-of-the-art aging techniques. A qualified life is to be established for each equipment item. In addition to the above, a maintenance/surveillance program should be implemented to identify and prevent significant age-related degradation of electrical and mechanical equipment. The applicant has committed to follow the recommendations in Regulatory Guide 1.33, Revision 2, "Quality Assurance Program Requirements (Operation)," which endorses American National Standard ANS-3.2/ANSI N18.1976, "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants," in the FSAR. This standard defines the scope and content of a maintanence/surveillance program for safety-related equipment. Provisions for preventing or detecting age-related degradation in safety-grade equipment are specified and include a) utilizing experience with similar equipment, b) revising and updating the program as experience is gained with the equipment during the life of the plant, c) reviewing and evaluating malfunctioning equipment and obtaining adequate replacement components, and d) establishing surveillance tests and inspections based on reliability analyses, frequency and type of service, or age of the items, as appropriate.

The applicant has described generally a program based on the above but has not adequately addressed use of operating experience and surveillance as they relate to equipment qualification. This area will remain open until an adequate program description is provided. In addition, the staff will review the implementation of the program at a later date.

Response

See Attachment A Documentation of Structured History File, Retrieval and Sort Menu and Flexible Retrieval Examples. This is a detailed explanation of a segment of the CECo structured maintenance history file which addresses the mechanism Byron and Braidwood Stations propose to use, for allowing operating experience, based on equiment performance, to flag age related degradation. Through this mechanism, the appropriate measures of increased or decreased preventive maintenance activities, or design corrrections, in accordance with other established programs, can be accomplished.

3.11.3.4 Outstanding Equipment

For safety-related items not having complete qualification documentation, the applicant has provided commitments for corrective action and schedules for completion. For items not expected to have full qualification, analyses must be performed in accordance with paragraph (i) of 10CFR50.49 to ensure that the plant can be operated safely pending completion of environmental qualification. These analyses must be submitted to staff prior to granting of an operating license. Section 3.11.3.1 discusses additional equipment which may require qualification based on 10CFR50.49. These items must be identified to the staff and included in the qualification program.

Response

Justifications for interim operations will be provided for six items in December, 1983.

The applicant has made a number of commitments to replace or retest unqualified equipment prior to fuel load, as described in Section 4.2 of the environmental qualification program submittal. Prior to issuance of an operating license, the applicant must confirm that all equipment replacement and testing commitments have been fulfilled or must justify interim operation with equipment not fully qualified.

A program has been implemented at Byron Nuclear Station to verify that the equipment presently installed at the station is the same as that for which qualification has been established. A designated equipment qualification field engineer has been assigned the responsibility to verify that the installed model is the correct (qualified) model or to initiate the required actions to change out the equipment with the applicable qualified mode. All unqualified equipment will be replaced prior to fuel load. Presently over ninety percent of the unqualified equipment has been replaced.

3.11.4.1.2 Equipment Requiring Additional Information and/or Corrective Action

Appendix B identifies equipment in this category. Corrective action or deficiencies are noted by a letter relating to the legend identified below.

Response

Responses to open items are listed in the same sequence as identified in Appendix B. In some instances, Appendix B inaccurately listed the status of components requiring corrective actions. Some of those discrepancies are corrected here.

Valve Operator, Limitorque, SMB Series

1) For harsh Non-NSSS Limitorque Valve Operators Environmental Qualification is completed and contained in Binder CQD-009948.

2) Limitorque Valve Operators on NSSS that may be exposed to HELB/LOCA Environments will be replaced during the first refueling outage. Justification for their interim operation will be provided December 15, 1983.

Hydraulic Valve Operator, Borg Warner, Model No. 38971

Environmental Qualification is complete and contained in Binder CQD-009487

Hydraulic Valve Operator (MS Atmospheric Relief Valves), Model No. 85440, Borg Warner

Test results will become available in February, 1984. Justification for interim operation will be provided by December 30, 1983.

Hydraulic Valve Operator, Borg Warner Model No. 85460.

Environmental Qualification is in progress. The report will be available from Borg Warner after January 1984. Affected are valve actuators for Containment Purge Valve Actuators 1,2 VQ001A, 2A and 1,2VQ001B, 2B. The safety function of these valves and actuators is to remain closed during all phases of plant operation. The valves are opened by their respective actuators during planned reactor shutdowns to purge the containment of airborne particulates so as to allow safe personnel access within three hours.

Until the vendor environmental qualification report is received and evaulated the respective power supplies will remain disconnected by station procedure. Once the valves are closed and the electric power supply disconnected, the valves will remain closed and will not open due to any environmental event.

3.11.4.1.2 Response (Cont)

Junction Box, Borg Warner

This item was qualified as part of Hydraulic Valve Operator, Model No. 38971. Evaluation is contained in Binder CQD-009487.

Junction Box, Westinghouse, Model No. W/L 23686

This equipment consists of a 2 section power range excore neutron detector, type WL-23686 detailed on Westinghouse drawing E-2231 Rev. 13. Environmental Qualification testing was completed by Westinghouse. Equipment Qualification Data Package EQDP-ESE-8 Rev. 0 is presently under evaluation. Test results appear good and the evaluation will be completed prior to fuel load.

HVAC Control Panel, Johnson Controls

Initial Environmental Qualification testing was completed and evaluated. A number of outstanding items are presently being reevaluated or retested. Evaluation of seismic qualification of device mountings will be completed by Nov. 30, 1983. Some devices are in retest for additional radiation exposure, see listing below. Retesting and reevaluations are scheduled to be completed prior to fuel load. Based on the initial evaluation that accounted for over 97% of components no new problems are expected to arise from this additional testing.

Components undergoing additional radiation aging:

General Electric Terminal Blocks
General Electric Switchboard Wire
Gould ITE Fuse Pullout
Pyrotronics Smoke Detector
United Electric Pressure Switch
Wallace and Tierman Chlorine Detector
Weed RTD
OT-2 Switch
EZC-Light
Love Flow Controller, 548187-8115-8174
Moore Industries Differential Pressure Relay
United Electric Temperature Switch

Radiation Detector, General Atomics, RD-12

The environmental qualification is completed and is evaluated in Binder CQD-007951.

Flow Indicating Switch, Barton, 288A

The final test report is due December 31, 1983. The evaluation will be completed prior to fuel load. Justification for interim operation will be provided by December 30, 1983.

Response

Sandia test reports ADND 80-2149 RV and "A Study of Strong Synergism in Polymer Degradation" have been reviewed along with other industry reports on cable failures. There is no evidence that Byron cables will be susceptible to any significant age related degradation. Failures in industry were induced by conditions not normal to Byron Station while the Sandia testing was conducted on cables of a material composition different from the Byron cable materials. A specific maintenance/surveillance program for cables inside the containment will not be developed. Existing maintenance and surveillance programs coupled to our Structured History computer program will identify root causes of problems, including cable related anomolies.

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3.11.4.1.2 Response (Cont)

Hand Switch, Westinghouse, OT2

This is included in Johnson Controls test program listed previously.

Pressure Switch, United Electric, J-302-5164

This is included in Johnson Controls Test Program listed previously.

Level Transmitter, Barton, 764-763

These instruments were relocated above flood level.

Pressure Transmitter, Veritrak, 76PH2

Environmental Qualification testing is completed by Westinghouse and contained in Binder EQDP-ESE1B. Evaluation will be completed prior to fuel load.

RTD, RDF, 21204

Environmental Qualification and evaluation are completed and contained in Binder EQDP-ESE-6.

Pressure Transmitter, Barton - 351

Environmental Qualification and evaluation are completed and contained in Binder EQDP-ESE-21.

Flow Controller, Love, 54-8187-8115-8174

This is included in Johnson Controls test program listed previously.

Flow Transmitter, Hays, 252A

Hays Flow Transmitters were replaced with Validyne P361D-FT508 units which are now located in mild environment areas.

Differential Pressure Relay, Moore Industries, ADM Position Light, Westinghoue, EZC Temperature Switch, United Electric, C303D-103

These three items are included in Johnson Controls test program listed previously.

Current Relay Signal Converter, Masoneilan, 8005A

Environmental Qualification completed, with evaluation to be completed prior to fuel load.

Flow Transmitter, Rosemount, 1153B

Environmental Qualification and evaluation completed and contained in Binder CQD-006044.

3.11.4.1.2 Response (Cont)

Limit Switch (I/C), NAMCO, EA-180

Environmental Qualification and evaluation completed and contained in Binder CQD-010001.

Positioner, ITT, NH90, NH91

ITT NH91 and NH95 damper actuators are used at Byron Station. Environmental Qualification is completed and formal test report is due Dec. 15, 1983. Based on a preliminary review of the test data no outstanding items are expected and the evaluation should be completed prior to fuel load.

Switchboard Wire, Rockbestos, Firewall SIS

Evaluation is completed and contained in Binder CQD-01009.

Hydraulic Valve Operator, Anchor/Darling

Environmental Qualification and evaluation completed and contained in Binder CQD-009941.

Terminal Block, Marathon, 1600 Series

Marathon NUC 1600 series terminal blocks were retested and found acceptable for power and control circuitry. Instrument circuits in LOCA/HELB areas were removed from terminal blocks and spliced.

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3.11.4.1.3 Equipment Considered Acceptable or Conditionally Acceptable

Based on the staff review, the items identified in Appendix C have been determined to be acceptable, pending implementation of the maintenance/surveillance program.

Response

The General Surveillance System a computer program for initiating maintenance and surveillance activities, has been loaded into the station computer. In addition to other functions, this program will track all activites on Environmentally Qualified equipment. Information is presently being loaded into this program which will allow it to initiate E.Q. related maintenance and surveillances.

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3.11.4.2 Environmental Qualification Audit

The staff and EG&G Idaho personnel conducted an audit of the Byron plant qualification files and installed equipment on June 21-23, 1983. The following observations and conclusions were made as a result of the audit:

Issue: Not all essential equipment potentially exposed to flooding has been identified. For example, it was observed during the plant walkdown that the juction box for a valve motor operator required to operate post-LOCA was located below the flood level in containment but had therefore conduct a plant walkdown to identify all equipment and interfaces (junction boxes, splices, etc.) which are below the postulated flood levels and either relocate these items or demonstrate qualifcation for submergence. The applicant must confirm that this work has been completed prior to fuel loading.

Response

A walkdown was performed to determine all essential equipment that was located below the potential flood level. Through a formal program, all essential equipment has been relocated above flood level.

Issue: In several of the equipment reviews, it was determined that insufficient attention had been given to the acceptance criteria for qualification tests and their applicability to plant specific requirements (see discussions of Marathon terminal blocks and Conax penetrations below). The acceptance criteria for all equipment in the program should therefore be reviewed. The applicant should notify the staff when this review is completed and describe any changes in qualification status of equipment. The staff will select several items of equipment for additional review to verify that this area has been acceptably resolved.

Response

In order to make the environmental qualification data more retrievable for engineering review, and more effective for station maintenance, all qualification files for equipment located in harsh environment have been reformatted. Twenty-two of the twenty-eight non-NSSS environmental qualification binders have been re-reviewed and reformatted at this time. During the review, particular attention was given to assure that the acceptance criteria for the qualification tests enveloped the acceptance criteria required by the equipments plant specific application.

Based on retest and reevaluation of the environmental qualification of Marathon terminal blocks it was determined that terminal blocks would not be used for safety related instrumentation circuits within the containment since the acceptance criteria for the qualification test did not envelope Byron's requirements for instrument circuits.

Qualification status did not change for any additional equipment. In many cases the reevaluation of data allowed for increased qualified life by calculating the qualified life based on specific plant locations rather than a worst case environment.

Issue: A number of discrepancies existed between the qualification summary sheets supplied with the environmental qualification submittal and the information in the plant files, most of which were satisfacto- rily addressed during the audit. The summary sheets were furnished to the staff on June 17, 1982 and did not reflect the most recent qualification data. Revised and updated sheets should be made available to the staff for review.

Response

Revision of data sheets is taking considerably longer than anticipated. Information being incorporated into the data sheets already exists in the Environmental Qualification Equipment Binders. During the recent three months data in the binders was reevaluated and reformatted before being made available for entry into the data sheets. Data sheets reside inside two separate computer files where data entry is limited to the use of only one terminal per file. Revision of data sheets is optimistically scheduled for completion and transmittal by December 31, 1983. Any specific information required before this data can be obtained from existing equipment binders.

Issue: In our review of individual items of equipment during the audit, several questions could not be satisfactorily resolved. These are listed below and must be addressed by the applicant prior to licensing.

Anchor/Darling Main Steam Isolation Valve - the audit team was unable to resolve questions concerning the correct values for postulated pressure and temperature during DBA, the required operability time, and the time period after an accident during which failure may not occur. In addition, the failure modes and effects analysis and identification of valve accessories should be clarified. This file should be revised and rearranged to address these concerns and be made available for further review by the staff.

Response

Additional vendor test data was obtained to resolve the above concerns. New data, along with existing data was reevaluated and reformatted. Resulting infomation is contained in Binder CQD - 009941 which will be transmitted to E.G. and G. Idaho on November 22, 1983, for review.

Issue: Marathon 1600 Series terminal blocks - the staff reviewed this item for instrumentation applications. The acceptance criteria specified included only the ability to withstand an applied voltage and current and to not exceed a specified level of leakage current during exposure to LOCA conditions. Insulation resistance values were specified in the design specification but were not measured during LOCA exposure. In addition, the leakage current tests results indicated that insulation resistance, although not directly measured, was probably less than the value required for instrumentation circuits. The applicant stated that the test results can apply to control circuits only and has committed to retesting or replacement of terminal blocks in this application as a result of the review.

Response

This concern is resolved in response to Marathon NUC 1600 terminal blocks in part 3.11.4.1.2.

Issue: Conax electrical penetrations - the qualification file did not contain results of insulation resistance measurements during exposure to LOCA conditions, as required by IEEE 317-1976. The checklist in the file did not address this omission and accepted the existing incomplete test data as sufficient. The applicant contacted the vendor during the audit and determined that these data are available and demonstrate the acceptability of the instrumentation penetrations for this application. This information will be incorporated into the plant environmental qualification file.

Response

Additional information has been obtained from CONAX and incorporated in the respective equipment binders CQD-009952, 009824, 009498 and 009944.

Issue: The applicant also committed to providing information on surveillance to be used to monitor the condition of the penetrations during the life of the plant.

Response

After completion of Appendix J testing, CONAX penetrations surveillance will be performed in accordance with Section 3/4.6.1.2 of the technical specifications for mechanical integrity of the penetrations.

Electrical integrity of penetations are verified through periodic instrument loop calibration/surveillances or periodic performance testing of equipment in accordance with technical specification requirements.

Failure of penetrations to meet these periodic surveillance requirements results in appropriate corrective actions utilizing the CECo maintenance repair programs. This results in the ability to track the condition of plant equipment over the life of the plant as discussed in answer to question 3.11.3.3.5.

Issue: Rosemount 1153B transmitter - the applicant should confirm that the transmitter will be replaced at proper intervals.

Response

Equipment Qualification Binder CQD - 006044 has been tansmitted to Byron Station. Maintenance/surveillance data is being entered into the General Surveillance computer program described in section 3.11.4.1.3. Qualified life is incorporated in the Maintenance and Surveillance Schedule of the equipment binder.

Transmitters in zone A-8 are qualified for 21 years.
Tag numbers are:
1FT-AF011 through AF018
1FT-CS011 through CS016
2FT-CS011 through CS016

Transmitters in zone A-10 are qualified for 7 2/3 years.
Tag numbers are:
2FT-AF011 through AF018

Issue: Reliance fan motor for RCFC - the comparison of postulated chemical spray conditions versus tested conditions should be furnished to the staff for review.

Response

See Attachment B which is duplicated from Section F-1 of Binder CQD-009644. Test conditions exceeded postulated chemical spray conditions by over 200%.

Issue: Okonite and Dekorad cables - the applicant committed to provide information on surveillance techniques to be utilized for cables inside containment.

DOCUMENTATION OF STRUCTURED HISTORY FILE

RETRIEVAL AND SORT MENU

1A. E.I.D.#
1B. Unit
1C. System
1D. Equipment Number
1E. Equipment Type
2. Location
3. Function #
4. NPRDS Vendor Code
5. Manufacturer's Name
6. Model #
7. Drawing #
8. Class
9. Size
10. Maximum Occurrances (Auto. Flag)
11. Work Request #
12. Date of Completion (2 Dates)
13. Priority of W.R.
14. Department
15. Outage
16. Actual Hours
17. Foremans Code
18. Contractor Name
19. Serial #
20. P or C Indicator
21. Tool I.D.#
22. EQ
23. S.T.I.
24. Maintenance Code
25. Maintenance Cause
26. S.I.#
27. Manufacturer's Name of Part

DOCUMENTATION OF STRUCTURED HISTORY FILE

FLEXIBLE RETRIEVAL EXAMPLES

(Numbers under Examples refer to item numbers on Retrieval and Sort Menu -- Page 45)

1. List all history on #2 Reactor Feed Pump on Unit #1.

   #1A

2. List all history between January 1, 1981 and December 31, 1981 for the Mechanical Maintenance Department on the make-up demineralizer system.

   #1C #12 #14

3. What history is on work request #12345?

   #11

4. List all rotating element failures on Ingersoll Rand pumps, between January 1, 1981 and January 1, 1982.

   #5 #12 #24

5. How many times have I used stores item #222333 in a class 1E environment between January 1, 1982 and July 1, 1982?

   #8 #12 #26

6. List all history that contractor Smith Company worked on within the last year.

   #12 #18

7. List all history on manufacturer Pacific Pump model #87654112.

   #5 #6

8. List all history performed by the Electrical Maintenance Department on 3-inch motor operated valves on the heater drainage system between January 1, 1981 and December 31, 1981.

   #1C #1E #9 #12 #14

DOCUMENTATION OF STRUCTURED HISTORY FILE

FLEXIBLE RETRIEVAL EXAMPLES (Cont'd)

9. How many times have I used Asco solenoids on safety-related equipment between January 1, 1982 and July 1, 1982?

#8 #12 #27

10. What location and position is Target Rock relief valve, serial #198 in?

#19

11. List all history on Unit #1 Outage between February 1, 1982 and March 1, 1982.

#15 #12

12. List all jobs that tool #12345 was used on between January 1, 1982 and July 1, 1982.

#12 #21

DOCUMENTATION OF STRUCTURED HISTORY FILE

MAXIMUM OCCURRENCE/FREQUENCY ADDENDUM

Maximum Occurrence/Floating Frequency Examples

Initial conditions

Max. Occur. = 3
Freq. = 6 months

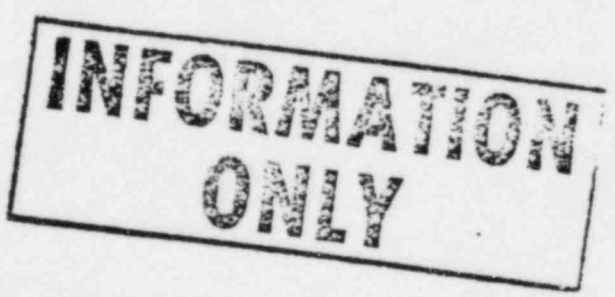
Maintain following parameters

Counter = _ _ (initially set to 0)
Action Date = _ _ _ _ _ _ (Date of current corrective action)
Pointer Date = _ _ _ _ _ _ (Set to date of first corrective action and then updated as required to maintain window period (freq.)).

Counter will be updated each time a corrective action is entered for an EID#. Any additional action will be triggered by counter reaching max. occur. value. Once reaching max. occur. value, counter will be reset as shown in examples. If conditions are changed by the user, last action date becomes the pointer date, and the counter is set to one.

Use the following corrective action dates to step through the examples:

1 - 1/05/83
2 - 2/10/83
3 - 7/06/83
4 - 7/25/83
5 - 9/30/83



Initial conditions:

Max. Occur. = 3
Freq. = 6 months
Counter = 0
Action Date = _ _ _ _ _ _
Pointer Date = _ _ _ _ _ _

DOCUMENTATION OF STRUCTURED HISTORY FILE

MAXIMUM OCCURRENCE/FREQUENCY ADDENDUM

Maximum Occurrence/Floating Frequency Examples (Cont'd)

1 - 1/5/83 Corrective action after entry

Counter = 1
Action Date = 01 05 83
Pointer Date = 01 05 83

- Compare counter to max. occur.
- Counter not equal to max. occur.
  No action required

2 - 2/10/83 Corrective action after entry

Counter = 2
Action Date = 02 10 83
Pointer Date = 01 05 83

- Compare counter to max. occur.
- Counter not equal to max. occur.
  No action required

3 - 7/06/83 Corrective action after entry

Counter = 3
Action Date = 07 06 83
Pointer Date = 01 05 83

- Counter equals max. occur.
- Compare action date to pointer date for frequency of 6 months.
- Period is greater than 6 months - no printout.
- Update pointer date to next corrective action. Pointer date = 2/10/83.
- Decrement counter from 3 to 2.

After action

Counter = 2
Action Date = 07 06 83
Pointer Date = 02 10 83

DOCUMENTATION OF STRUCTURED HISTORY FILE

MAXIMUM OCCURRENCE/FREQUENCY ADDENDUM

Maximum Occurrence/Floating Frequency Examples (Cont'd)

4 - 7/25/83 Corrective action after entry

Counter = 3
Action Date = 07 25 83
Pointer Date = 02 10 83

- Counter equals max. occur.
- Compare action date to pointer date for frequency of 6 months.
- Period is less than 6 months; print message to Maint. Dept. flagging EID#; (hard copy report generated).
- Update pointer date to last corrective action. Pointer date = 7/25/83.
- Decrement counter from 3 to 1.

After action

Counter = 1
Action Date =
Pointer Date = 07 25 83

5 - 9/30/83 Corrective action after entry

Counter = 2
Action Date = 09 30 83
Pointer Date = 07 25 83

- Compare counter to max. occur.
- Counter not equal to max. occur. No action required.

DOCUMENTATION OF STRUCTURED HISTORY FILE

MAXIMUM OCCURRENCE/FREQUENCY ADDENDUM

Maximum Occurrence/Floating Frequency Examples (Cont'd)

6 - The users will have the capability of increasing or decreasing the maximum occurrence field or floating frequency at any time. If they do so, the last action date becomes the pointer date and the action date is blank until the next corrective action, and the counter is set at one.

On 1/20/84 the user changes conditions.

Change conditions to:

Max. occur. = 5
Freq. = 12 months

Counter = 1
Action Date =
Pointer Date = 09 30 83

Attachment B

SARGENT & LUNDY ENGINEERS CHICAGO

Calcs. For Primary Containment Vent. System RCFC Fan		Calc. No.
		Rev. / Date
Safety-Related	Non-Safety-Related	Page 1 of 4

Client Commonwealth Edison	Prepared by C. Voskamp	Date 9/1/83
Project Byron / Braidwood	Reviewed by	Date
Proj. No. A3912/A6834 Equip. No. 2VP01CA, B, C, D	Approved by	Date

The attached information is contained in the Marble Hill FSAR. The Marble Hill plant is identical to Byron and Braidwood therefore the calculations apply to Byron and Braidwood as well, see attached pages.

Form GQ-3.08.1 Rev. 2

Comparison of pressure:

. The peak pressure of 50 psig is enveloped through the testing at 50 psig during the initial transients.

. The transient pressure of 20 psig is enveloped during the first 21 hour exposure to 83 psig.

. The steady state pressure of 5 psig for one year is not explicitly enveloped. There is no known way to simulate accelerated effects of pressure. However, the maximum requirement of 50 psig for three hours at the peak temperature was simulated. The blocks were then exposed to 83 psig which exceeds the maximum requirement by 66%, for a duration of 42 hours which exceeds the maximum duration (3h) by 1300%. At these tested extremes, no failures were attributed to pressure. Based on this, it is concluded that the 5 psig requirement would not be a failure mechanism.

Comparison of chemical spray:

Two areas must be examined when evaluating chemical spray. They are the ph level and the spray saturation.

During testing, the ph was maintained within the range of 8.5 to 10.5. The minimum requirement for Marble Hill is 8.5 (ref. section 6.5.2 of FSAR). Thus it is concluded that the Marble Hill requirements were met.

The spray saturation is defined as the gallons per square foot seen within the containment during the accident. The spray saturation is determined from the following:

Spray Saturation (gal/ft^2) = (spray density (gpm/ft^2)) X (Duration (in minutes))

The spray saturation from testing is determined from the following tabulated test data:

Spray Density in gpm/ft^2	Duration in minutes	Spray saturation (gal/ft^2)
0.04	180	7.2
0.04	180	7.2
0.15	2520	378
0.50	180	90
1.5	40,320	60,480
Spray saturation during testing = 60,962.4		

The spray saturation for Marble Hill is determined through references to the FSAR. The Marble Hill spray system consists of two trains A & B. Train A consists of 219 nozzles while train B is designed

with with 253 nozzles for a total of 472 nozzles (ref. FSAR 6.5.2.2). The spray system is designed to deliver 15 gpm to each nozzle (ref. FSAR 6.5.2.2). Thus the spray system is designed to deliver a total of 7080 gpm. The containment radius is 70 ft. (ref. FSAR figure 3.8.1). Thus we can calculate the Marble Hill spray density as follows:

$$\text{Spray Density} = \frac{7080 \text{ gpm}}{\text{cont. area}} = \frac{7080 \text{ gpm}}{\pi (70)^2} = 0.46 \text{ gpm/ft}^2$$

If we assume the spray to remain functional for 30 days, the Marble Hill spray saturation becomes

$$(0.46 \text{ gpm/ft}^2) \quad (43200 \text{ min}) = 19{,}872 \text{ gal/ft}^2 .$$

The test conditions exceed the Marble Hill requirements by over 200%.

We thus conclude that the Marble Hill spray conditions were enveloped.

Attachment B

ATTACHMENT to Check X-604

COMPARISON of SERVICE CONDITIONS/MARGIN DBA

TEMP: MARBLE peak TEMP: 325°F @ 3h

TESTED CONDITION: 350°F @ 4h; 7.7% MARGIN ~~TIME~~-TEMP
33% MARGIN TIME

Two peaks first peak avg 315°F but did peak at 330°F (ref. ITEM C, pg. 15 X-604)

MARBLE hill transient TEMP 225°F @ 21h.

Tested CONDITION: 320°F @ 3h
300°F @ 4h
260°F @ 14h

AVG. TEMP. 274°F, 22% MARGIN ON ~~TIME~~ TEMP

MARBLE HILL steady STATE TEMP: 150°F @ up to 1%.

Tested steady STATE TEMP: 250°F @ 1.16%; 67% MARGIN TEMP
16% MARGIN TIME

PRESS: MARBLE hill peak PRESS: 50psig @ 3h.

Tested peak press: 78psig @ 4h; 56% MARGIN ON PRESS
33% MARGIN ON TIME.

MARBLE hill transient press: 20psig @ 21h.

Tested press: 70psig @ 7h
25psig @ 14h

AVG press. 40psig; 100% MARGIN. press.

STOADY STATE press. 5psig @ up to 1%.

Tested press. 16psig @ up to 1.16%; 220% MARGIN PRESS
16% MARGIN TIME

chemical spray: MARBLE HILL = 0.46 GPM/FT² for 24h. (UNTILL SS IS reached).

test condition: .15GPM/FT² for 7d (ref. pg. 15 X-604)

MARBLE hill SATURATION = (0.46 GPM/FT²)(24h)(60min/hr)
= 662.4 G/FT²

TEST CONDITION: (.15GPM/FT)(7d)(24)(60) = 1512GAL/FT²

MARGIN = 128% on both 10.5.

Table A — R.G. 1.97, Rev. 3 & NUREG-0737

PAM INSTRUMENTS

Note: This is a listing of those local mounted instruments which are currently specified for Post Accident Monitoring service and are being or have been procurred to the equipment qualification requirements of a Category 1 or 2 component (per R.G. 1.97, Rev. 3) Unit 1 instruments are listed only. The primary element (transmitter, sensor, etc.) is listed with the implication that the balance of the instrument loop, required to support display and recording functions, is to be qulified also. However, the environment is mild since the balance of each instrument loop is located in the Aux. Electric & Main Control Rooms.

Instrument No.	Service	R.G. 1.97 Cat.	NUREG-0737 Act. Item	COL-ROW	EL.	Instr. Loc. Dwg.	Instr. Location
1PT-403	RCS WR Pressure	1	N/A	G-1	Cont. 377	M821-3	1PL75J
1PT-405	RCS WR Pressure	1	N/A	L-5	Cont. 377	M821-3	1PL66J
1TE-413A	RC Temperature WR T_{Hot}	1	N/A	D-7	Cont. 390	6/20E-1-3521	LM
1TE-423A	RC Temperature WR T_{Hot}	1	N/A	H-7	Cont. 390	6/20E-1-3522	LM
1TE-433A	RC Temperature WR T_{Hot}	1	N/A	H-6	Cont. 390	6/20E-1-3527	LM
1TE-443A	RC Temperature WR T_{Hot}	1	N/A	D-5	Cont. 390	6/20E-1-3524	LM
1TE-413B	RC Temperature WR T_{Cold}	1	N/A	D-8	Cont. 390	6/20E-1-3521	LM
1TE-423B	RC Temperature WR T_{Cold}	1	N/A	H-9	Cont. 390	6/20E-1-3522	LM
1TE-433B	RC Temperature WR T_{Cold}	1	N/A	H-4	Cont. 390	6/20E-1-3527	LM
1TE-443B	RC Temperature WR T_{Cold}	1	N/A	D-4	Cont. 390	6/20E-1-3524	LM
1LT-501	SG WR Level	1	N/A	A-8	Cont. 377	M821-1	1PL50J
1LT-502	SG WR Level	1	N/A	L-7	Cont. 377	M821-2	1PL67J
1LT-503	SG WR Level	1	N/A	G-1	Cont. 377	M821-3	1PL75J
1LT-504	SG WR Level	1	N/A	D-1	Cont. 377	M821-4	1PL52J
1LT-517	SG NR Level	1	N/A	A-6	Cont. 401	M822-4	1PL69J
1LT-518	SG NR Level	1	N/A	C-10	Cont. 412	M823-1	LM
1LT-519	SG NR Level	1	N/A	A-4	Cont. 412	M823-4	1PL57J
1LT-527	SG NR Level	1	N/A	G-1	Cont. 377	M821-3	1PL75J
1LT-528	SG NR Level	1	N/A	J-10	Cont. 412	M823-2	LM

PAM INSTRUMENTS

Instrument No.	Service	R.G. 1.97 Cat.	NUREG-0737 Act. Item	COL-ROW	EL.	Instr. Loc. Dwg.	Instr. Location
1LT-529	SG NR Level	1	N/A	G-11	Cont. 412	M823-2	1PL71J
1LT-537	SG NR Level	1	N/A	G-1	Cont. 377	M821-3	1PL75J
1LT-538	SG NR Level	1	N/A	K-7	Cont. 412	M823-2	LM
1LT-539	SG NR Level	1	N/A	G-11	Cont. 412	M823-2	1PL71J
1LT-547	SG NR Level	1	N/A	A-6	Cont. 401	M822-4	1PL69J
1LT-548	SG NR Level	1	N/A	A-8	Cont. 412	M823-1	LM
1LT-549	SG NR Level	1	N/A	A-4	Cont. 412	M823-4	1PL57J
1LT-459	Pressurizer Level	1	N/A	A-8	Cont. 377	M821-1	1PL50J
1LT-460	Pressurizer Level	1	N/A	F-10	Cont. 377	M821-1	LM
1LT-461	Pressurizer Level	1	N/A	D-1	Cont. 377	M821-4	1PL52J
1PT-934	Containment NR Pressure	1	N/A	C-1	Cont. 426	M824-4	LM
				V-12	Aux. 426	M831-11	
1PT-935	Containment NR Pressure	1	N/A	B-2	Cont. 451	M825-4	LM
				S.7-12	Aux. 451	M825-4	
1PT-936	Containment NR Pressure	1	N/A	C-1	Cont. 451	M825-4	LM
				V-12	Aux. 451	M825-4	
1PT-937	Containment NR Pressure	1	N/A	B-2	Cont. 426	M824-4	LM
				S.7-12	Aux. 426	M831-10	
1PT-PC004	Containment WR Pressure	1	II.F.1	C-1	Cont. 426	M824-4	LM
				V-12	Aux. 426	M824-4	
1PT-PC005	Containment WR Pressure	1	II.F.1	B-2	Cont. 451	M825-4	LM
				S.7-12	Aux. 451	M825-4	
1PT-514	Steamline Pressure	1	N/A	R13 & 7	377-Piping Tunnel SE Area	M833-1	LM
1PT-515	Steamline Pressure	1	N/A	R13 & 7	377-Piping Tunnel SE Area	M833-1	LM
1PT-516	Steamline Pressure	1	N/A	R-13	377-Piping Tunnel SE Area	M833-1	1PL79JB
1PT-524	Steamline Pressure	1	N/A	R20 & 7	377-Piping Tunnel SW Area	M833-2	LM
1PT-525	Steamline Pressure	1	N/A	R20	377-Piping Tunnel SW Area	M833-2	1PL77JC

Table A

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PAM INSTRUMENTS

Instrument No.	Service	R.G. 1.97 Cat.	NUREG-0737 Act. Item	COL-ROW	EL.	Instr. Loc. Dwg.	Instr. Location
1PT-526	Steamline Pressure	1	N/A	R20&7	377-Piping Tunnel SW Area	M833-2	LM
1PT-534	Steamline Pressure	1	N/A	R20&7	377-Piping Tunnel SW Area	M833-2	LM
1PT-535	Steamline Pressure	1	N/A	R20	377-Piping Tunnel SW Area	M833-2	1PL77JC
1PT-536	Steamline Pressure	1	N/A	R20&7	377-Piping Tunnel SW Area	M833-2	LM
1PT-544	Steamline Pressure	1	N/A	R13&7	377-Piping Tunnel SE Area	M833-1	LM
1PT-545	Steamline Pressure	1	N/A	R13&7	377-Piping Tunnel SE Area	M833-1	LM
1PT-546	Steamline Pressure	1	N/A	R-13	377-Piping Tunnel SE Area	M833-1	1PL79JB
1LT-930	RWST Level	1	N/A	Below RWST @21 Line	379'6"-RFLG WTR. Pipe Tunnel	M835-3	LM
1LT-931	RWST Level	1	N/A	BB-13	379'6"-RFLG WTR. Pipe Tunnel	M835-3	LM
1LT-932	RWST Level	1	N/A	BB-13	379'6"-RFLG WTR. Pipe Tunnel	M835-3	LM
1LT-933	RWST Level	1	N/A	AA-13	379'6"-RFLG WTR. Pipe Tunnel	M835-3	LM
1LT-PC006	Containment Level	1	II.F.1	C-9	Cont. 377	M821-1	LM
1LT-PC007	Containment Level	1	II.F.1	C-9	Cont. 377	M821-1	LM
1FT-AF011	Auxiliary Feedwater Flow	1	II.E.1.2	P-13	Aux. 364	M828-9	1PL84JA

Table A

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PAM INSTRUMENTS

Instrument No.	Service	R.G. 1.97 Cat.	NUREG-0737 Act. Item	COL-ROW	EL.	Instr. Loc. Dwg.	Instr. Location
1FT-AF012	Auxiliary Feedwater Flow	1	II.E.1.2	N-12	Aux. 364	M828-9	1PL84JB
1FT-AF013	Auxiliary Feedwater Flow	1	II.E.1.2	P-13	Aux. 364	M828-9	1PL84JA
1FT-AF014	Auxiliary Feedwater Flow	1	II.E.1.2	N-12	Aux. 364	M828-9	1PL84JB
1FT-AF015	Auxiliary Feedwater Flow	1	II.E.1.2	P-13	Aux. 364	M828-9	1PL84JA
1FT-AF016	Auxiliary Feedwater Flow	1	II.E.1.2	N-12	Aux. 364	M828-9	1PL84JB
1FT-AF017	Auxiliary Feedwater Flow	1	II.E.1.2	P-13	Aux. 364	M828-9	1PL84JA
1FT-AF018	Auxiliary Feedwater Flow	1	II.E.1.2	N-12	Aux. 364	M828-9	1PL84JB
1RE-AR020	Containment High Range Radiation	1	II.F.1.	F-1	Cont. 451	M825-3	LM
1RE-AR021	Containment High Range Radiation	1	II.F.1.	G-11	Cont. 451	M825-2	LM
TE01-TE-65	Core Exit Temperature	1	II.F.2.	-	Cont.	-	-
(TE's In RX Vessel, Ref. Junction Boxes in Containment		1	II.F.2.	-	Cont.	-	-
1LS-CS046A	Spray Additive Tank Level	1	N/A	U-13	Aux. 364	M828-10	LM
1LS-CS046B	Spray Additive Tank Level	1	N/A	S-12	Aux. 364	M828-10	LM
1RE-AR022A	Secondary System Radiation	1	II.F.1.	Stm. Tun.	Aux. Bldg. 385'4"	M833-1	LM
1RE-AR022B	Secondary System Radiation	1	II.F.1.	Stm. Tun.	Aux. Bldg. 385'4"	M833-2	LM
1RE-AR022C	Secondary System Radiation	1	II.F.1.	Stm. Tun.	Aux. Bldg. 385'4"	M833-2	LM
1RE-AR022D	Secondary System Radiation	1	II.F.1.	Stm. Tun.	Aux. Bldg. 385'4"	M833-1	LM
1RE-AR023A	Secondary System Radiation	1	II.F.1.	Stm. Tun.	Aux. Bldg. 385'4"	M833-1	LM
1RE-AR023B	Secondary System Radiation	1	II.F.1.	Stm. Tun.	Aux. Bldg. 385'4"	M833-2	LM
1RE-AR023C	Secondary System Radiation	1	II.F.1.	Stm. Tun.	Aux. Bldg. 385'4"	M833-2	LM
1RE-AR023D	Secondary System Radiation	1	II.F.1.	Stm. Tun.	Aux. Bldg. 385'4"	M833-1	LM
Later	Neutron Flux		(Currently in Containment Procurement for 1st Refuel Outage Installation)				
Later	Neutron Flux						

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PAM INSTRUMENTS

Instrument No.	Service	R.G. 1.97 Cat.	NUREG-0737 Act. Item	COL-ROW	EL.	Instr. Loc. Dwg.	Instr. Location
Limit Switches	Containment Isolation Valves Positions (For Valve tag's reference FSAR Table 6.2-58)	1	N/A	Mounted on Valves			
		1	N/A				
1LE-RC019	Reactor Vessel Level	2	II.F.2	In RX Vessel	Cont.	-	LM
1LE-RC020	Reactor Vessel Level	2	II.F.2	In RX Vessel	Cont.	-	LM
1PS43J/1PS47J	Containment Hydrogen Concentration	1	II.F.1	Approx. S-17	Aux. 401	M830-5	LM
1PS44J/1PS48J	Containment Hydrogen Concentration	1	II.F.1	Approx. S-17/U-18	Aux. 401	M830-5	LM
1RE-AR024A	Auxiliary Building Area Radiation	2	N/A	Stm. Tun.	Aux. 381'	M833-1	LM
1RE-AR024B	Auxiliary Building Area Radiation	2	N/A	Stm. Tun.	Aux. 381'	M833-2	LM
1RE-025A	Auxiliary Building Area Radiation	2	N/A	Approx. X-13	Aux. 369'6"	M828-12	LM
1RE-025B	Auxiliary Building Area Radiation	2	N/A	Approx. U-13	Aux. 369'6"	M828-11	LM
1RE-AR026A	Auxiliary Building Area Radiation	2	N/A	Approx. X-13	Aux. 383'0"	M829-1	LM
1RE-AR026B	Auxiliary Building Area Radiation	2	N/A	Approx. V-13	Aux. 383'0"	M829-2	LM
1RE-AR027A	Auxiliary Building Area Radiation	2	N/A	Approx. Y-13	Aux. 401'0"	M830-1	LM
1RE-AR027B	Auxiliary Building Area Radiation	2	N/A	Approx. V-13	Aux. 401'0"	M830-2	LM
1PR29J/1PR30J	Gaseous Effluent Radioactivity	2	II.F.1	Between L&M on 17	Aux. 477'	M832-34	LM
2PR29J/2PR30J	Gaseous Effluent Radioactivity	2	II.F.1	M-17/ N-17	Aux. 477'	M832-34	LM
Limit Switches	Pressurizer PORV's Position	2	II.D.3	Mounted on Valves		-	-
Limit Switches	Pressurizer Safety Relief Positions	2	II.D.3	Mounted on Valves		-	-

Table A

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PAM INSTRUMENTS

Instrument No.	Service	R.G. 1.97 Cat.	NUREG-0737 Act. Item	COL-ROW	EL.	Instr. Loc. Dwg.	Instr. Location
Limit Switches	ESW Supply to AF Valve Position	1	N/A	Mounted on Valves		-	-
1FT-CS011	Containment Spray Flow	2	N/A	V-15	Aux. 346	M827-7	1PL81JA
1FT-CS012	Containment Spray Flow	2	N/A	W-15	Aux. 346	M827-7	1PL81JB
Breaker Relay	RCFC Hi/Lo Bkr Status	2	N/A	-	-	-	At Bkr
1EI-AP054	ESF Bus Voltages	2	N/A	-	Aux. 451	Main Control Room	1PM01J
1EI-AP086	ESF Bus Voltages	2	N/A	-	Aux. 451	Main Control Room	1PM01J
1LT-PC002	Containment Floor Drain Samp Level	N/A	II.F.1	B-6	Cont. 377	M821-1	LM
1LT-PC003	Containment Floor Drain Samp Level	N/A	II.F.1	B-7	Cont. 377	M821-1	LM