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S.O.	CALC NO. CAE-05-01	FILE NO.	GROUP EQT

REPORT NO. CAE-05-01

PUMP AND VALVE OPERABILITY
SUMMARY FOR
BYRON UNITS 1 + 2
CAE/CBE

WESTINGHOUSE ELECTRIC CORPORATION
P.O. BOX 355
PITTSBURGH, PA 15230

PREPARED BY Mark Kamenic 6/10/83
MARK KAMENIC

VERIFIED BY [signature] 6-10-83
John M. Snider

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WESTINGHOUSE NUCLEAR TECHNOLOGY DIVISION

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WESTINGHOUSE NUCLEAR TECHNOLOGY DIVISION

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1.0 INTRODUCTION

THIS REPORT SUMMARIZES ALL PUMP AND VALVE OPERABILITY QUALIFICATION PERFORMED UNDER THE STANDARD WESTINGHOUSE PUMP AND VALVE OPERABILITY PROGRAM THAT IS APPLICABLE TO THE CAE/CBE PROJECTS.

REG GUIDE 1.48, "DESIGN LIMITS AND LOADING COMBINATION FOR SEISMIC CATAGORY 1 FLUID SYSTEM COMPONENTS" REQUIRES THAT ASSURANCE OF OPERABILITY BE ILLUSTRATED FOR PUMPS AND VALVES WHEN SUBJECTED TO FAULTED CONDITION LOADINGS. WESTINGHOUSE HAS CHOSEN TO ADDRESS THIS REQUIREMENT BY USING A COMBINATION OF TESTING AND ANALYSIS TO SHOW THAT DEFORMATIONS RESULTING FROM THE FAULTED CONDITION EVENT DO NOT PRECLUDE OPERABILITY.

DETAILS OF SPECIFIC TESTS AND ANALYSES PERFORMED FOR BOTH PUMPS AND VALVES ARE EXPLAINED IN DETAIL IN SECTION 3.9N.3.2 OF THE BYRON/BRAIDWOOD FINAL SAFETY ANALYSIS REPORT (FSAR). THE INTENT OF THIS SUMMARY IS TO PROVIDE A REFERENCE TO THOSE QUALIFICATION REPORTS AND DOCUMENTS APPLICABLE TO THE CAE/CBE PROJECTS.

THIS REPORT IS APPLICABLE ONLY TO THOSE PUMPS AND VALVES RECOGNIZED AS BEING ACTIVE.

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2.0 SUMMARY

A LIST OF ACTIVE VALVES AND THEIR RESPECTIVE OPERABILITY QUALIFICATION REPORTS/DOCUMENTATION ARE IN TABLE 2.1. STATIC DEFLECTION TESTS WERE PERFORMED AS PART OF THE VALVE QUALIFICATION. NOT EVERY VALVE ID WAS TESTED. THOSE VALVES TESTED WERE CHOSEN AS BEING REPRESENTATIVE OF A FAMILY OF VALVES. TABLE 2.1 INDICATES WHICH TESTED VALVE COVERS EACH SPECIFIC ID. BECAUSE OF THEIR LOW PROFILE, STATIC DEFLECTION TESTING IS NOT PERFORMED ON ACTIVE CHECK VALVES.

THE ACTIVE PUMPS AND THEIR RESPECTIVE SEISMIC QUALIFICATION REPORTS/DOCUMENTATION ARE LISTED IN TABLE 2.2.

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TABLE 2.1

SYSTEM	LOCATION	W IL	SEISMIC REPORT NO.	STATIC DEFLECTION TEST COVERED BY	DEFLECTION TEST REPORT NO.	DRAWING NO.
RCS	8025	3/4TA78RL	7310-95300	3/4TA78RL	4.1.338	E-167329
↓	8026	↓	↓	↓	↓	↓
↓	8028	3DA92R	1163	4DA92R	W-210	SD-C-100598
↓	8033	3/4DA92R	↓		↓	SD-C-102364
CVCS	LCV 112B,C	4GM72FB	4981	4GM88	4995	115E426
↓	LCV 112D,E	8GM72FB	↓	12GM88	↓	115E431
↓	8100	2TM78FN	DR-1028	2TM78FN	SR-6397	E73-020-R
↓	8104	↓	↓	↓	↓	↓
↓	8105	3GM78FN	4981	4GM88	4995	115E422
↓	8106	↓	↓	↓	↓	↓
↓	8110	2TM78FN	DR-1028	2TM78FN	SR-6397	E73-020-R
↓	8111	↓	↓	↓	↓	↓
↓	8112	2TM78FNH	↓	↓	↓	E73-024-R
↓	8152	3IA76RE	7310-95280	3IA88RG	4.4.496	D-166026
↓	8160	↓	↓	↓	↓	↓
↓	8355A,B,C,D	2TM78FN	DR-1028	2TM78FN	SR-6397	E73-020-R
SIS	8801A,B	4GM78FN	4981	4GM88	4995	115E425
↓	8802A,B	↓	↓	↓	↓	↓
↓	8804A,B	8GM74FE	↓	12GM88	↓	115E433 116E40
↓	8806	8GM72FB	↓	↓	↓	115E432
↓	8807A,B	6GM72FB	↓	4GM88	↓	115E430
↓	8808A,B,C,D	10GM88FNH	↓	12GM88	↓	116E66
↓	8809A,B	8GM78FN	↓	↓	↓	115E42[illegible]

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TABLE 2.1

SYSTEM	LOCATION	W ID	SEISMIC REPORT NO.	STATIC DEFLECTION TEST COVERED BY	DEFLECTION TEST REPORT NO.	DRAWING NO.
SIS	8812 A,B	12GM78FE	4981	12GM88	4995	115E438
↓	8813	2TM78FN	DE-1028	2TM78FN	SR-6397	E73-022-R
↓	8814	1½TM78FN	↓	↓	↓	E73-018-R
↓	8821 A,B	4GM77FH	4981	4GM88	4995	115E424
↓	8835	4GM78FN	↓	↓	↓	115E425
↓	8840	12GM78FN	↓	↓	↓	115E436
↓	8843	¾IA78RE	7310-95280	1IA78RE	4.4.496	D-165956
↓	8871	↓	↓	↓	↓	D-166121
↓	8880	1IA68RES	↓	↓	↓	D-165993
↓	8888	¾IA78RE	↓	↓	↓	D-166121
↓	8920	1½TM78FN	DE-1028	2TM78FN	SR-6397	E73-018-R
↓	8923 A,B	6GM72FB	4981	4GM88	4995	115E430
↓	8924	↓	↓	↓	↓	↓
↓	8964	¾IA78RE	7310-95280	1IA78RE	4.4.496	D-166121
WPS	LCV 1003	3DA92R	1163	4DA92R	W-210	SD-C-108252
↓	9157	1DA92R	↓	2DA92R	↓	SD-C-102872
↓	9159A,B	¾DA92R	↓	↓	↓	SD-C-102864
↓	9160A,B	1DA92R	↓	↓	↓	SD-C-102872
↓	9170	3DA92R	↓	4IA92R	↓	SD-C-106252
RHR	FCV 610	3GM78FN	4981	4GM88	4995	115E422
	FCV 611	↓	↓	↓	↓	115E624
	8701A,B	12GM88FEH	↓	12GM88	↓	1166E41
	8702A,B	↓	↓	↓	↓	1166E41 115E624

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TITLE: BYRON PUMP AND VALVE OPERABILITY SUMMARY

PROJECT: CAE/CBE | AUTHOR: MARK KAMENIC | DATE: 6/9/8? | CHK'D. BY: J.M.S | DATE: 6/10/8? | CHK'D. BY | DATE

S.O. | CALC NO: CAE-02-01 | FILE NO | GROUP: EQT

TABLE 2.1

SYSTEM	LOCATION	WID	SEISMIC REPORT NO.	STATIC DEFLECTION TEST COVERED BY	DEFLECTION TEST REPORT NO.	DRAWING NO.
RHR	8716 A,B	86-N74FE	4981	12GM88	4995	115E623
CCWS	9437A,B	31A62RG	7310-95280	31A89RG	4.4.496	D-165944
SS	9354 A,B	3/4 8TA78RL	7310-95300	3/4 8TA78RL	4.1.338	E-167329
↓	9355 A,B	↓	↓	↓	↓	↓
↓	9356A,B	↓	↓	↓	↓	↓
↓	9357A,B	↓	↓	↓	↓	↓
FW	510	16FA37RG	FQP-15-2	16FA37R	FQP-15-2	54A7543
↓	520	↓	↓	↓	↓	↓
↓	530	↓	↓	↓	↓	↓
↓	540	↓	↓	↓	↓	↓
↓	510A	4FA37RG	FQP-15-1	4FA37RG	FQP-15-1	54A7546
↓	520A	↓	↓	↓	↓	↓
↓	530A	↓	↓	↓	↓	↓
↓	540A	↓	↓	↓	↓	↓
CVCS	8473	2C58	KSAR-2C	N/A	N/A	W-D-9911-(3)
↓	8487	↓	↓	↓	↓	↓
↓	8113	3/4 C78	KSAR-1C	↓	↓	W-D-9956-(2)
↓	8348	2C78	KSAR-2C	↓	↓	W-D-9911-(2)
↓	8367A,B,C,D	2C88	↓	↓	↓	W-D-9911-(1)
↓	8368 A,B,C,D	2C78	↓	↓	↓	W-D-9911-(2)
↓	8312A,B,C,D	2C8B	↓	↓	↓	W-D-9911-(1)
↓	8377	2C98	↓	↓	↓	↓
↓	8378A,B	3C58	[illegible] REV. 1	↓	↓	934D202

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TITLE: SEISMIC PUMP AND VALVE OPERABILITY SUMMARY
PROJECT: CAE/CEE
AUTHOR: Vuk Kamenic DATE: 6/9/82
CHK'D BY: J.M.S. DATE: 6/10/82
CALC NO: CAE-CC-01
FILE NO:
GROUP: EGT
S.O.

REV. NO. | REV. DATE | AUTHOR | DATE | CHK'D. BY | DATE | CHK'D. BY | DATE

TABLE 2.1

SYSTEM	LOCATION	W ID	SEISMIC REPORT NO.	STATIC DEFLECTION TEST COVERED BY	DEFLECTION TEST REPORT NO.	DRAWING NO.
CVCS	8379A,B	3C88	4868 REV.1	N/A	N/A	934D202
↓	8381	3C78	↓	↓	↓	↓
↓	8442	2C78	KSAR-2C	↓	↓	W-D-9911-(2)
↓	8481A,B	4C78	4868 REV.1	↓	↓	934 D204
↓	8497	3C78	↓	↓	↓	934 D 202
↓	8546	8C72	↓	↓	↓	934 D 193
CCS	9464	12C32	DC-1049 REV.1	N/A	N/A	73424
↓	9463A,B	↓	↓	↓	↓	↓
↓	9436	6C32	↓	↓	↓	78122-2
↓	9518	3/4C68	KSAR-1C	↓	↓	W-D-10012-(2)
↓	9534	↓	↓	↓	↓	↓
SFPCS	8793	10C52	4868 REV.1	N/A	N/A	934D194
RCS	8010A,B,C	6GV88MCB	EC-155 REV.1	6GV88MCB	3759	DS-C-5696A
↓	8046	3C72	4868 REV.1	N/A	N/A	934D188
↓	8047	3/4C72	KSAR-1C	↓	↓	W-D-9956-(2)
SIS	8815	3C88	4868 REV.1			934D202
↓	8818A,B,C,D	6C88	↓			5056D55
↓	8819A,B,C,D	2C88	KSAR-2C			W-D-9911-(1)
↓	8841A,B	8C88	4868 REV.1			5056D56
↓	8905A,B,C,D	2C88	KSAR-2C			W-D-9911-(1)
↓	8119A,B	1 1/2C[illegible]	↓			W-D-7958-(2)
↓	8922A,B	4C77	4868 REV.1			934D199
↓	8926	3C72	↓	↓	↓	934D193

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CAE/CBE	MARK KAMENIC 6/9/93	J.M.S. 6/10/93	

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TABLE 2.1

SYSTEM	LOCATION	V.L.T.	SEISMIC REPORT NO.	STATIC DEFLECTION TEST COVERED BY	DEFLECTION TEST REPORT NO.	DRAWING NO.
SIS	8140A,B	1C78	KSAR-00779-C-PDY REV.1	N/A	N/A	W-D-9913-(2)
	8148A,B,C,D	10C88	4848 REV.1	↓	↓	934D207
	8149A,B,C,D	6C88	↓			556D55
	8956A,B,C,D	10C88				934D207
	8958A,B	12C74				934D197
	8968	1C66	KSAR-00779-C-PDY REV.1			W-D-9914X01-(2)

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CAE/CBE	MARL KAMENIC 6/9/83	J.M.S. 6-10-83	
S.O.	CALC NO.	FILE NO.	GROUP
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TABLE 2.3

SYSTEM	SPIN	DESCRIPTION	MOTOR SEISMIC REPORT	PUMP SEISMIC REPORT	DRAWING
CVCS	APCH01	CVCS CHARGING PUMPS	75-F-32351	K-313-1 REV 4	310-B49224
	APCH02		↓	↓	↓
CVCS	APBA01	BORIC ACID	82-D-55567	ME-225	N717682 #1
	APBA02	TRANSFER PUMPS	↓	↓	↓
SI	APSI01	SAFETY INJ. PUMPS	74-F-32374	K-363 + K-396 REV 3	
	APSI02		↓		
CCWS	APCC01	COMPONENT COOLING WATER PUMPS	74-F-47535	ME-210	N233595 #1
	APCC02		↓	↓	↓
	APCC03		↓	↓	↓
	APCC04		↓	↓	↓
RHR	APRH01	RHR PUMPS	74-F-12691	ME-174	C-8X20WDF86X1BE
	APRH02		↓		↓
SFS	APSF01	SPENT FUEL PIT PUMPS	LATER	ME-219	N238596 #1
	APSF02		↓	↓	↓

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PVORT Draft SER
Generic Item 3

Aging considerations have been incorporated into the qualification program for Class 1E electrical equipment and instrumentation in plant harsh environment areas. Qualification testing complies with the sequential testing requirements of IEEE-323-1974. The description of this program has been supplied to the NRC. Evidence showing compliance with the sequential test requirements has been provided during the EQ audit.

A separate program for the environmental qualification of mechanical equipment has not been required by Byron. However, Commonwealth Edison has developed a program to insure that aging of mechanical components will not adversely affect the availability of safety related mechanical equipment. This program incorporates maintenance and surveillance and is further discussed in SQRT Generic Item #6.

3120b

PVORT Draft SER
Generic Item 4

At this time, over 90% of the system pre-operational test procedures have been written and approved for testing at Byron. All active pumps are included in the pre-operational test program and the Preservice Testing Program Plan for Pumps. Parameters measured include inlet pressure, differential pressure, flowrate, vibration, lubrication level, and bearing temperature where appropriate. Pump performance is evaluated against test acceptance criteria developed from system Design Criteria and FSAR Safety Limits. The pre-operational tests and the Preservice Testing Program will demonstrate that the active pumps will function as installed and perform their required safety function within the overall system design.

Virtually all active valves are stroked to demonstrate their operability during system pre-operational testing and in the Preservice Testing Program Plan for Valves. Tests on valves include seat leakage tests, full stroke tests, check valve exercise tests, relief valve setpoint checks, fail safe tests, position indication checks, and part stroke tests. In addition, valves are timed where required, to verify movement to their safe position within prescribed time limits.

Beyond system pre-operational testing and preservice testing of pumps and valves, inservice testing of pumps and valves as required by ASME Section XI is performed on a periodic basis to demonstrate the continued operability of active pumps and valves. A complete description of the Preservice/Inservice Testing Program Plan for Pumps and Valves is included in the November 4, 1982 letter from T.R. Tramm to H.R. Denton.

PVORT Draft SER
Generic Item 5

Commonwealth Edison record keeping systems are maintained in accordance with 10CFR50 Appendix B. A filing system has been established to enable station personnel to retrieve qualification documentation when needed.

For Non-NSSS equipment, engineering documentation (seismic qualification reports, etc.) is transferred from Sargent & Lundy files to the station. The qualification documentation is organized by Sargent & Lundy procurement specification number and is filed accordingly by the central files office of the station. Documentation is retrievable by the S&L procurement specification number and the equipment piece number. The subject documentation is currently being transferred to the station.

With regard to NSSS equipment, qualification documentation is maintained in a central file location by Westinghouse in Pittsburgh. This documentation is retrievable by valve location number for valves, and SPIN and project number for pumps and all other mechanical equipment. Complete qualification documentation for NSSS Class 1E equipment is retrievable by reference to WCAP-8587 and WCAP-8687.

PVORT Draft SER
Generic Item 6

Pump and Valve Operability Assurance Program

As described in Section 3.9.3.2 of the Byron/Braidwood FSAR, an operability assurance program has been established to assure active pumps and valves will perform their intended safety function during the life of the plant under postulated plant conditions. Active mechanical equipment is that Seismic Category I equipment which must perform a mechanical motion during the course of shutting down the plant or mitigating the consequences of an accident. Active pumps and valves are listed in Tables 3.9-15 and 3.9-16 of the FSAR, respectively.

Testing, analysis, a combination of testing and analysis, or previous operating history are acceptable design methods for assuring operability of components for all expected combinations of loadings. Vendor in-shop tests or analyses, pre-operational tests, hot functional tests, static deflection tests, and periodic inservice surveillance form the basis for this program. In the case of vendor in-shop tests or analyses, acceptance criteria for operability are provided in the component procurement specification. The procurement specification specifies seismic qualification criteria, pipe reaction end loads (including weight, thermal and seismic loads), environmental conditions, design transients, system operation requirements, special test requirements, and other considerations which are important in the overall design of the components. Stress limits are listed in FSAR Table 3.9-10 for active valves and Table 3.9-8 for active pumps. The note for these tables reads "The stress limits specified for active pumps (and valves) are more restrictive than ASME III limits to provide assurance that operability will not be impaired for any operating condition."

Verification that the vendor has complied with all design requirements set forth in the component procurement specification assures operability of the component for its intended safety function. Conformance to current seismic qualification and environmental qualification parameters is verified by independent programs.

The philosophy employed by CECo reflects that of Paragraph 1.a.(10) of Standard Review Plan 3.10, Revision 2. This paragraph states that if dynamic testing of a pump or valve assembly proves to be impractical, static testing of the assembly is acceptable provided nozzle loads and dynamic amplification effects are addressed and the component is operated during and after the applied loads. For large size and high pressure valves it is often impractical, if not impossible, to perform dynamic, full flow testing. Test facilities do not have adequate capacities for the large, high pressure valves. For those valves for which dynamic full flow testing is possible, the additional benefits gained over static testing do not justify the cost.

Byron/Braidwood Station personnel will develop and implement preoperational and hot functional test procedures prior to plant operation. Inservice Surveillance conforming to ASME Code, Section XI requirements will be conducted periodically to assess operational readiness of pumps and valves during their service life.
3120b

All vendors supplying active components maintain an approved Quality Assurance Program commensurate with the requirements set forth in 10CFR50, Appendix B. The vendor's Quality Assurance Program provides for effective implementation of procedures, instructions, or reviews to ensure that all testing and analyses are accomplished in compliance with the specification and applicable codes and standards.

Pump Operability

Active pumps are qualified for operability by first being subjected to vendor in-shop tests as required by the component procurement specification.

The in-shop mechanical tests include hydrostatic tests of pressure retaining parts and pump performance tests. Hydrostatic test procedures and reports conform to ASME Code Section III requirements. Performance tests are completed in accordance with Hydraulic Institute Standards. Generally, the pumps are run at design flow and head, shutoff head, 120% of design flow, and two intermediate points to verify performance characteristics. NPSH requirements are determined by test for each pump from 0 to 120% of design flow. Verification that running clearances are adequate and that vibration and noise levels are within acceptable limits is recorded during performance tests.

All Class 1E equipment associated with active pumps meet the qualification requirements of IEEE 323-1974.

Valve Operability

Active valves are qualified for operability by first being subjected to vendor in-shop tests as required by the component procurement specification and then in many cases through static deflection tests. The in-shop mechanical tests include shell hydrostatic or pneumatic tests to ASME Code Section III requirements, backseat and main seat leakage tests, disc hydrostatic tests, and functional tests to verify that the valve will open and close within the specified time limits when subjected to the design differential pressure. Where functional tests to verify opening and closing capabilities are not practical, analysis is used to assure operability. Where required, impact testing is performed in accordance with ASME Code Section III. The static deflection test that is performed involves applying a load or loads equivalent to the resultant of the three-dimensional SSE accelerations to the center of gravity of the assembly extended structure. While in the deflection position, the valves are cycled to show that any internal rubbing or bending will not occur to the point that the valve is not able to respond upon demand and open or close within the specified time. As before, during in-shop mechanical tests, the maximum differential pressure to which the valve is designed is applied.

Valve Operability (Continued)

In developing the methodology for performing static deflection tests, the need to apply nozzle loads was evaluated and determined not to be necessary. The basis for excluding nozzle loads is that the valve body is designed to requirements which are more conservative than requirements for attached piping. This would result in yielding of the pipe rather than the valve. Also assurance that deformation due to nozzle loads will not occur is gained by specifying maximum nozzle loads to the piping designer.

The static deflection testing performed under the operability assurance program is in many ways more severe than the dynamic testing addressed by SRP 3.10. Since the static load is applied at or above the extended structure center of gravity, the resulting loads, moments, and deflections are greater than if the loading was distributed. This static testing causes deflections and any associated internal rubbing to be continuous as opposed to intermittent deflections that would result from dynamic testing. At no point is there any relaxation that would aid operability.

For valves designed to be rigid, dynamic amplification effects do not affect the loads applied to the valve during the static deflection test or the qualification acceleration level. In those cases where valves are not rigid, dynamic amplification effects are taken into account in calculating the loads to be used in the static deflection test and the qualification acceleration level for the valve. A further discussion of loads and accelerations used in the static deflection tests is provided in FSAR Section 3.9.3.2.

Active valves are seismically qualified by tests or analyses per the requirements of IEEE 344-1975. All Class 1E equipment associated with active valves meets the sequential testing requirement of IEEE 323-1974. For motor operated valves, analyses are performed to verify compatability of operator torque output versus valve torque requirements.

In summary, in-shop mechanical, cold hydro and hot functional tests assure that pumps and valves will operate under normal conditions. The static deflection tests and combination of test and analysis assure that active pumps and valves will operate under all intended service conditions.

SARGENT & LUNDY

INTER-OFFICE MEMORANDUM

005567

From T. R. Eisenbart - 24, x2172 TRE Date December 27, 1982

Project No. 4391/2 & 4683/4

Dept./Div. Electrical/Project Engineering Spec. No F/L-2819

File No. 4391/25C

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Client Commonwealth Edison Co. Stn Byron/Braidwood Unit 1 & 2

Subject Qualification Documentation for Station Batteries

To: K. Adlon - 30

Attached find the Qualification Documentation submitted by Gould Incorporated for the 125VDC Station Batteries supplied for Byron/ Braidwood.

(Spec. F/L-2819)

TRE:sh

Gould Inc., Industrial Battery Division
2050 Cabot Boulevard West, Langhorne, Pa. 19047
Telephone (215) 752-0555

CABLE: GOULNATBAT LANGHORNE, PA.
TWX: GOULD LAHN. 510-667-2056
GOULD LANG. 510-667-2066

TE

003567

GOULD
Electronics & Electrical Products

December 14, 1982

Sargent and Lundy Engineers
55 East Monroe Street
Chicago, IL 60603

Attn: ~~J.S. Mowbray~~ T. Eisenbart

Re: Byron/Braidwood
Sargent and Lundy Spec. No. Y-2819
Commonwealth Edison P.O. No. 194757, 758
GNB Batteries Inc./Gould S.O. KE 5145, 5147, 5149, 5186

Subject: Environmental Qualification Report (EQR)
Lead Acid Storage Batteries
IEEE 344/323/535

Dear Mr. ~~Mowbray:~~ Eisenbart

Enclosed please find one (1) copy of our EQR and one (1) copy of Wyle Laboratories' Test Report, Volumes I and II to support the qualification of our NCX Batteries for the Byron/Braidwood Stations. Additional copies will be made available upon notice of approval.

Very truly yours,

Howard D Rubin

Howard Rubin
Product Manager
Utility Batteries and Chargers

HR:dh

cc: Mr. J. Murray - BBEL DO#5413

133 83 C I B A

SARGENT & LUNDY

322 MAY 25 1983

Project File Index No. 32-005567

INTER-OFFICE MEMORANDUM

COD FILE C05567

From G. K. Roy - 30 - X2713

Dept./Div. Mechanical/Component Qualification

Date January 20, 1983
Project No. 4391,2/4683,4-00
Spec. No. F/L-2819
File No. CQD-005567
Page No. 1 of 1

Client CECo Stn. Byron/Braidwood Unit 1&2

Subject Review of Seismic Report for Storage Battery & Battery Racks (1&2DC01EA,EB; 1&2DC02EA,EB)

To: J. S. Paniaguas - 30

CC: W. C. Cleff - 22
K. L. Adlon - 30
T. Eisenbart - 24
AEM/APD/RDR/GKR - 30
CQD File - 30

This file has been microfilmed & returned to the Project Engineer

Safety Related / Send to Q.A.

References: 1) Gould Inc. Seismic Report on Storage Battery, Report No. GB-3454, Rev. #11-Z, dated November 19, 1982.

2) Seismic Qualification Test Report on Storage Battery prepared by Wyle Laboratories, Test Report No. 44681-2.

The above referenced reports satisfy the seismic requirements outlined in Specification F/L-2819, and have been accepted.

GKR:sas

GKRoy
KLA

PROJECT NAME: BYRON/BRAIDWOOD 1&2	PROJECT NO.: 4391, 2/4683A -00	FILE NO.: CQD-005567 REVISION NO.: 00

SPEC. NO.: F/L-2819

☒ BOP ☐ NSSS

Reviewed By: (signature) Date: 01-19-83

Review Approved By: (signature) Date: 1-20-83

COMPONENT NAME: Storage Battery

VENDOR/MANUFACTURER: Gould Inc.

COMPONENT NO./MODEL NO.: 1&2DC01 EA, EB/1&2 DC02 EA, EB

VENDOR'S REPORT NO. AND DATE: Gould Inc. Report no: GB-3454 dt. 11/19/82

Wyle Lab's Report no: 44681-2

A. CONCLUSION OF REVIEW

☒ Accepted ☐ Rejected

Comments:

B. CLASSIFICATION AND FUNCTION

1. Classification

☒ Nuclear Safety-Related, Active

☐ Nuclear Safety-Related, Passive

☐ Non-Nuclear Safety-Related

2. The component function is

3. Operability Requirements (Active Components Only)

This component is required to operate:

☒ During and after postulated dynamic and accident events

☐ Only after postulated dynamic and accident events

Form MAS-CQD-2.4 Approved by (signature) Dept. Mgr.
Rev. Orig. (11-11-82)

MECHANICAL DEPARTMENT STANDARD

CHECKLIST FOR DYNAMIC QUALIFICATION OF MECHANICAL AND ELECTRICAL EQUIPMENT

FOR OFFICE USE ONLY - NOT TO BE SENT OUTSIDE OF SARGENT & LUNDY

SARGENT & LUNDY ENGINEERS

PROJECT NO.: 4391,2/4683,4-00 | FILE NO.: CQD- 005567 REV.: 00

C. Location and Mounting

1. Location

Building: Auxiliary Building

Elevation: 451'-0"

2. Field Mounting Condition

☐ Panel/Pipe/HVAC Duct: ______

☒ ~~Wall~~/Floor

☒ Other: Storage Battery mounted on Racks and Racks mounted on floor.

3. Mounting Attachment

☒ Bolting Number: 20, Size: 1/2" ϕ

Material: A-36 (A-307)

☐ Welding Welding Type: ______

Leg: ______, Length: ______, Pitch: ______

☐ Other: ______

D. METHOD OF QUALIFICATION

☒ Static Analysis ☒ Test ☐ Dynamic Analysis

☐ Other: ______

E. VIBRATION INPUT

1. Dynamic Loads Considered

☒ Seismic

☐ Hydrodynamic

☐ Seismic and Hydrodynamic

☐ Other: ______

2. Required Frequency Range: ______

3. Required Input

☐ Response Spectra

a) Required response spectra (attach graphs, identify): ______

Form MAS-CQD-2.4
Rev. Orig. (11-11-82)

b) Method of combining required response spectra:

☐ Absolute Sum

☐ SRSS

☐ Not applicable

c) Damping Upset/Service Level B ____________

Emergency/Service Level C
Faulted / Service Level D } ____________

d) Basis for Damping: ____________

☐ Seismic Coefficients (Required acceleration in each direction)

Upset/Service Level B H_1 ______, H_2 ______, V ______

Emergency/Service Level C
Faulted / Service Level D } H_1 ______, H_2 ______, V ______

4. Is support amplification considered?

☐ Yes ☐ No ☐ Not Applicable

Comments: ____________

5. Is fatigue considered?

☐ Yes ☐ No ☐ Not applicable

Comments: ____________

F. QUALIFICATION BY TESTING

1. Does the Vendor's report indicate that the component is identical to that to be installed?

☐ Yes

☐ No - justify similarity: ____________

2. Mounting

a) Mounting Method:

☐ Bolting Number: ______, Size: ______

Material: ______

☐ Welding Welding Type: ______

Leg: ______, Length: ______, Pitch: ______

Form MAS-CQD-2.4
Rev. Orig. (11-11-82)

☐ Other: ______

b) Does the Vendor's report indicate that the laboratory mounting simulates the actual service mounting?

☒ Yes

☐ No - explain differences: ______

3. Input Motion

☐ Single-Axis

☐ Multi-Axis

☐ Other: ______

Comments: ______

4. Test Method

☐ Sine dwell (single frequency):

a) Frequency range: ______

b) Dwells at: ______ (Hz)

c) Number of tests in each orientation:

Upset/Service Level B ______ Emergency/Service Level C, Faulted/Service Level D ______

d) Duration: ______

e) Input acceleration in each direction:

Upset/Service Level B H_1 ______, H_2 ______, V ______

Emergency/Service Level C, Faulted/Service Level D H_1 ______, H_2 ______, V ______

f) How is cross coupling and modal participation accounted for?

☐ Sine beat (single frequency):

a) Frequency range: ______

b) Number of tests in each orientation:

Upset/Service Level B ______, Emergency/Service Level C, Faulted/Service Level D ______

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c) Number of beats: ________, Number of cycles per beat: ________

d) Beats at: ________ (Hz)

e) Input acceleration in each direction:

Upset/Service Level B H_1 ________, H_2 ________, V ________

Emergency/Service Level C, Faulted / Service Level D: H_1 ________, H_2 ________, V ________

f) How is cross coupling and modal participation accounted for?

☒ Random motion (multi frequency):

a) Frequency range: 1 to 40 Hz.

b) Number of tests in each orientation:

Upset/Service Level B 5, Emergency/Service Level C, Faulted / Service Level D: 1

c) Duration: 30 Secs.

d) Does Test Response Spectra (TRS) envelop the Required Response Spectra (RRS)?

☒ Yes - Provide RRS and TRS as attachment

☐ No - Explain:

5. Dynamic Characteristics

☒ Natural frequencies: (Racks) H_1 35.6 Hz, H_2 35.6 Hz, V 55.12 Hz

☐ Natural frequencies not determined.

6. Additional Loads

Are normal operating loads considered?

☐ Not applicable

☒ Yes

☐ No - explain:

Form MAS-CQD-2.4
Rev. Orig. (11-11-82)

7. Monitoring

a) Is the component functionally monitored?

☒ Yes ☐ No ☐ Not applicable

b) Is component's operability verified?

☐ Yes ☐ No ☐ Not applicable

8. Does the test meet the requirements of IEEE 344 19 75 ?

☒ Yes

☐ No-explain: ______

G. QUALIFICATION BY ANALYSIS

1. Type of Analysis

☒ Static Analysis

☒ Simplified Dynamic Analysis

☐ Modal Analysis

☐ Time History Analysis

☐ Other: ______

2. Analytical Model

☐ Finite Element

☐ Other: ______

3. Method of Analysis

☐ Computer-Aided Calculation

a) Programs used: ______

b) Have the programs been validated?

☐ Yes ☐ No

☒ Hand Calculation

Form MAS-CQD-2.4
Rev. Orig. (11-11-82)

4. Operating Loads

Are the operating loads considered in the analysis?

- [ ] Not applicable
- [x] Yes
- [ ] No - explain: ______

5. Static/Simplified Dynamic Analysis

a) Acceleration coefficients:

Upset/Service Level B — H_1 1.75, H_2 1.75, V 3.20

Emergency/Service Level C, Faulted / Service Level D — H_1 2.40, H_2 2.40, V 5.50

b) Are dynamic loads applied in the horizontal and vertical directions simultaneously?

- [x] Yes
- [ ] No-explain: ______

6. Modal Analysis

a) Identify Response Spectra used: ______

b) Damping factor used: ______

c) Number of significant modes considered: ______

d) Natural period/frequency of each: ______

e) Method of combining modal responses:

- [ ] Absolute Sum
- [ ] Square root of sum of the squares (SRSS)
- [ ] In compliance with NRC Regulatory Guide 1.92, Rev. ______, Date ______
- [ ] Other: ______

Form MAS-CQD-2.4
Rev. Orig. (11-11-82)

7. Time History Analysis

8. Results

a) Stress evaluation at critical locations:

LOCATION	LOAD COMBINATION	DYNAMIC STRESS	TOTAL STRESS PSI	ALLOWABLE STRESS PSI
Main Stringer	Dead Load + seismic		23543 (OBE)	23760 (OBE)
Anchor Bolts	D.L + Seism		12,332	20,000

Form MAS-CQD-2.4
Rev. Orig. (11-11-82)

PROJECT NO.: 4391,2/4683,4-00	FILE NO.: CQD- 005567 REV.: 00

b) Deflection evaluation at critical locations(Active Components only):

LOCATION	CALCULATED DEFLECTION	ALLOWABLE DEFLECTION

H. COMMENTS

Battery was qualified by Test and the Battery Racks was qualified by Analysis.

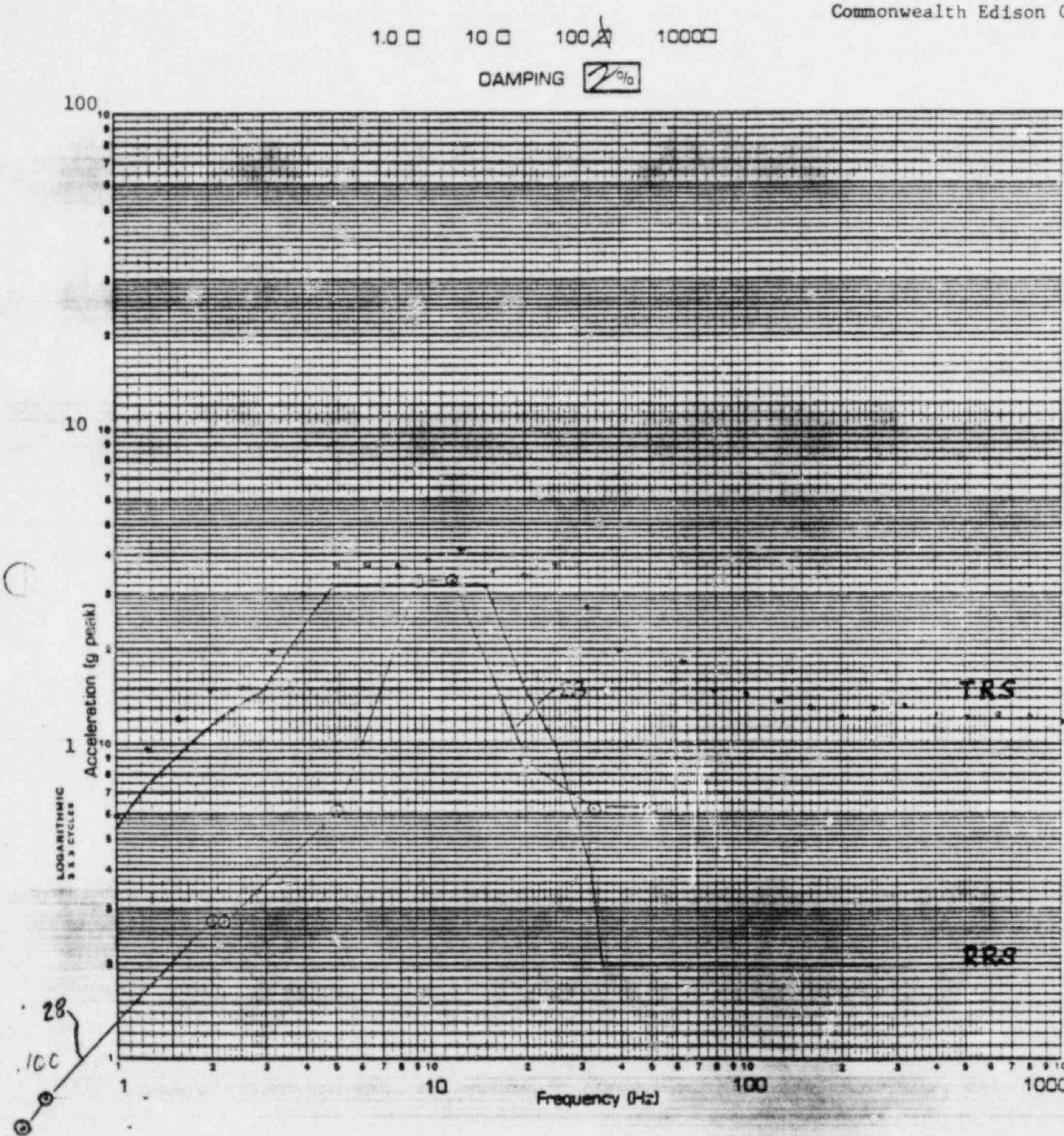
Form MAS-CQD-2.4
Rev. Orig. (11-11-82)

FULL SCALE SHOCK SPECTRUM (g Peak)

Legend

- • TRS
- ⊙ Byron/Braidwood RRS

Byron/Braidwood Station
Commonwealth Edison Co



SPECIMEN ____

AXIS FB|V

LOCATION NO. VCA

TEST RUN NO. 8

Fig. 8.1

Comparison of TRS vs RRS Vertical OBE
Front-to-Back/Vertical 2% Damping

Legend

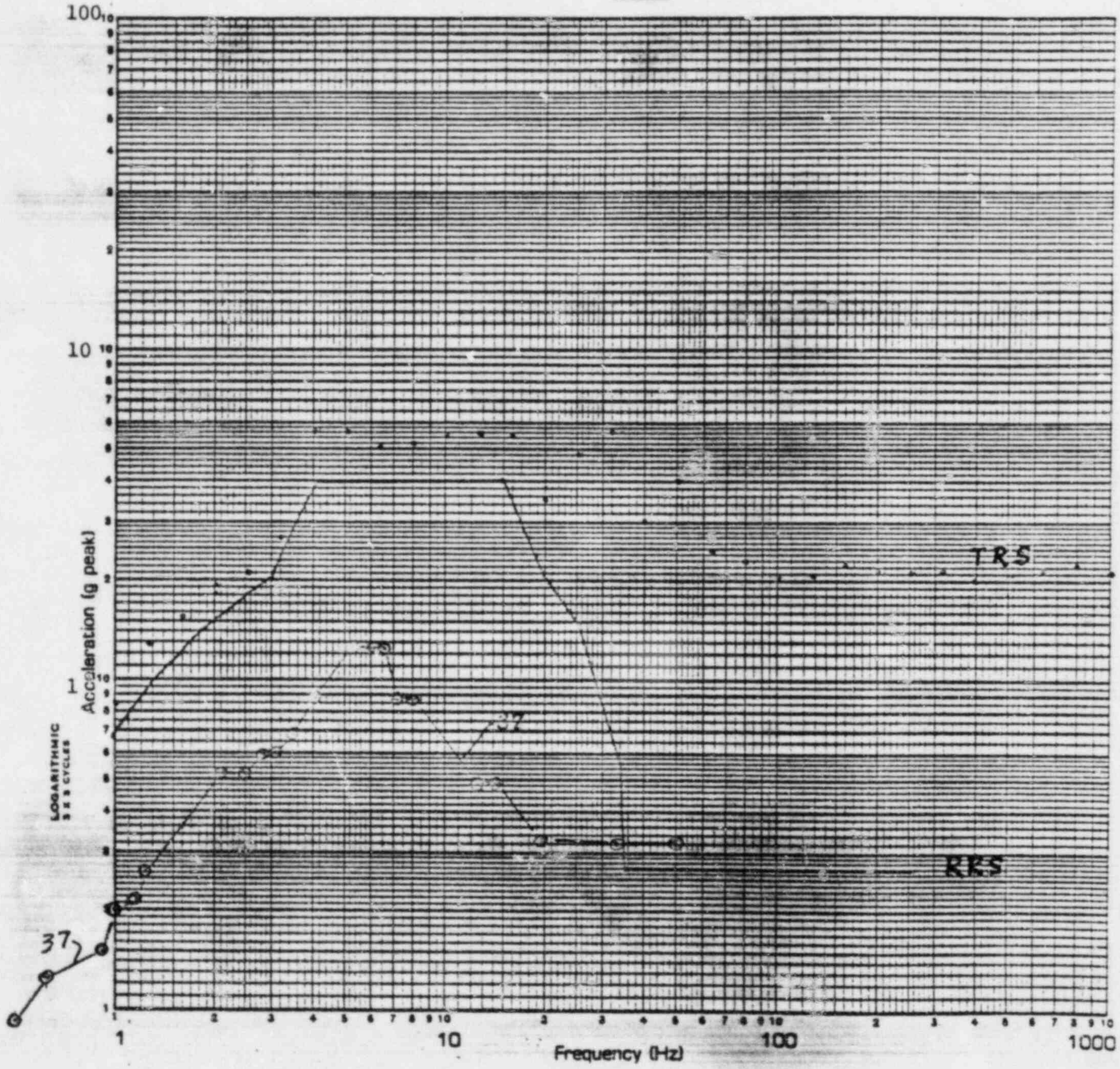
• TRS
⊙ Byron/Braidwood RRS

Byron/Braidwood Station
Commonwealth Edison Co.

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000☐

DAMPING 2%



SPECIMEN —

AXIS FB/V

LOCATION NO. HCA

TEST RUN NO. 8

Fig. 8.2

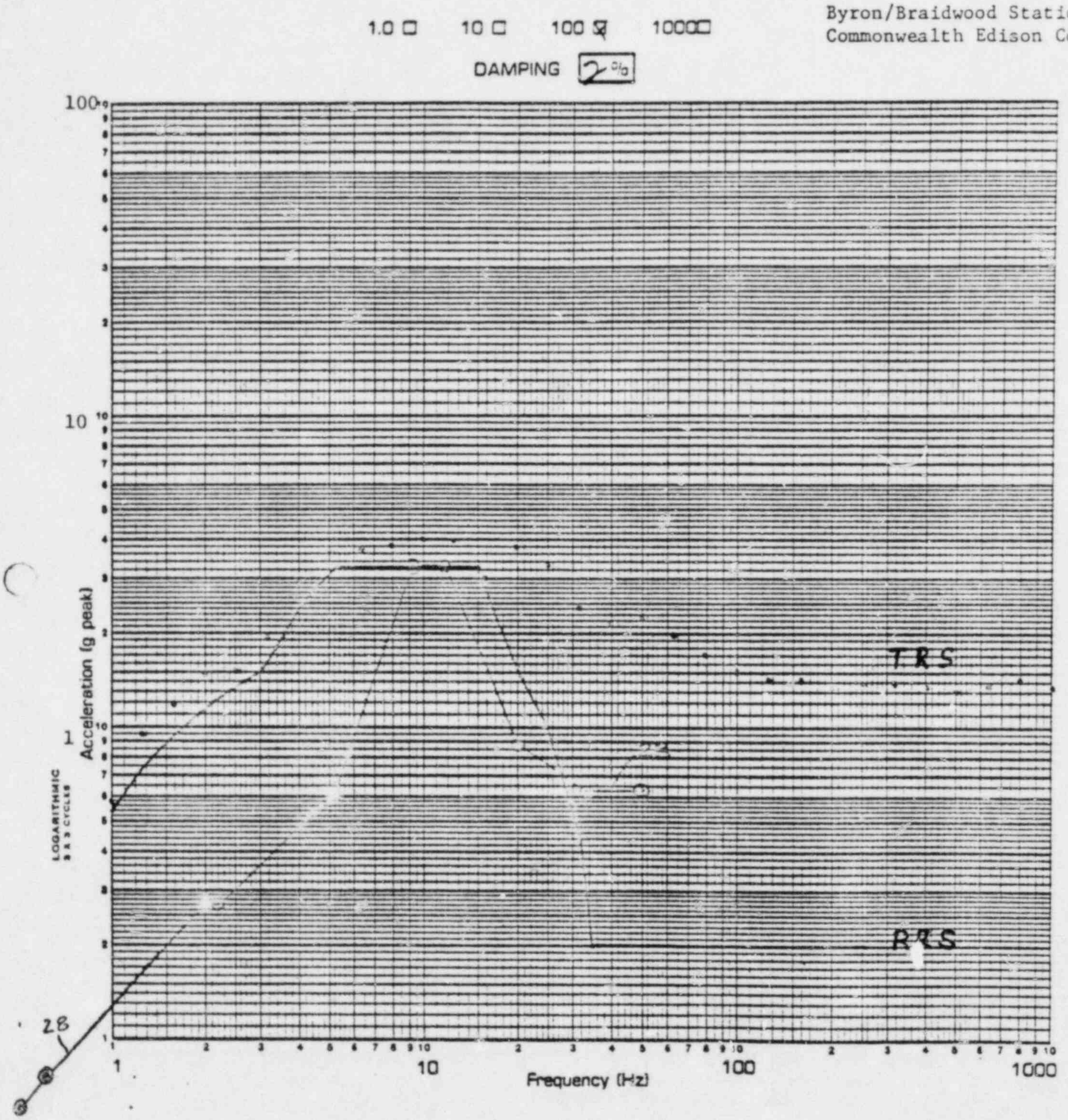
Comparison of TRS vs RRS Horizontal OBE
Front-to-Back/Vertical 2% Damping

Legend

• TRS
⊙ Byron/Braidwood RRS

Byron/Braidwood Station
Commonwealth Edison Co.

FULL SCALE SHOCK SPECTRUM (g Peak)



SPECIMEN —
AXIS SS/V
LOCATION NO. VCA
TEST RUN NO. 15

Fig. 8.3

Comparison of TRS vs RRS Vertical OBE
Side-to-Side/Vertical 2% Damping

Page No. III-453
Report No. 44681-2

FULL SCALE SHOCK SPECTRUM (g Peak)

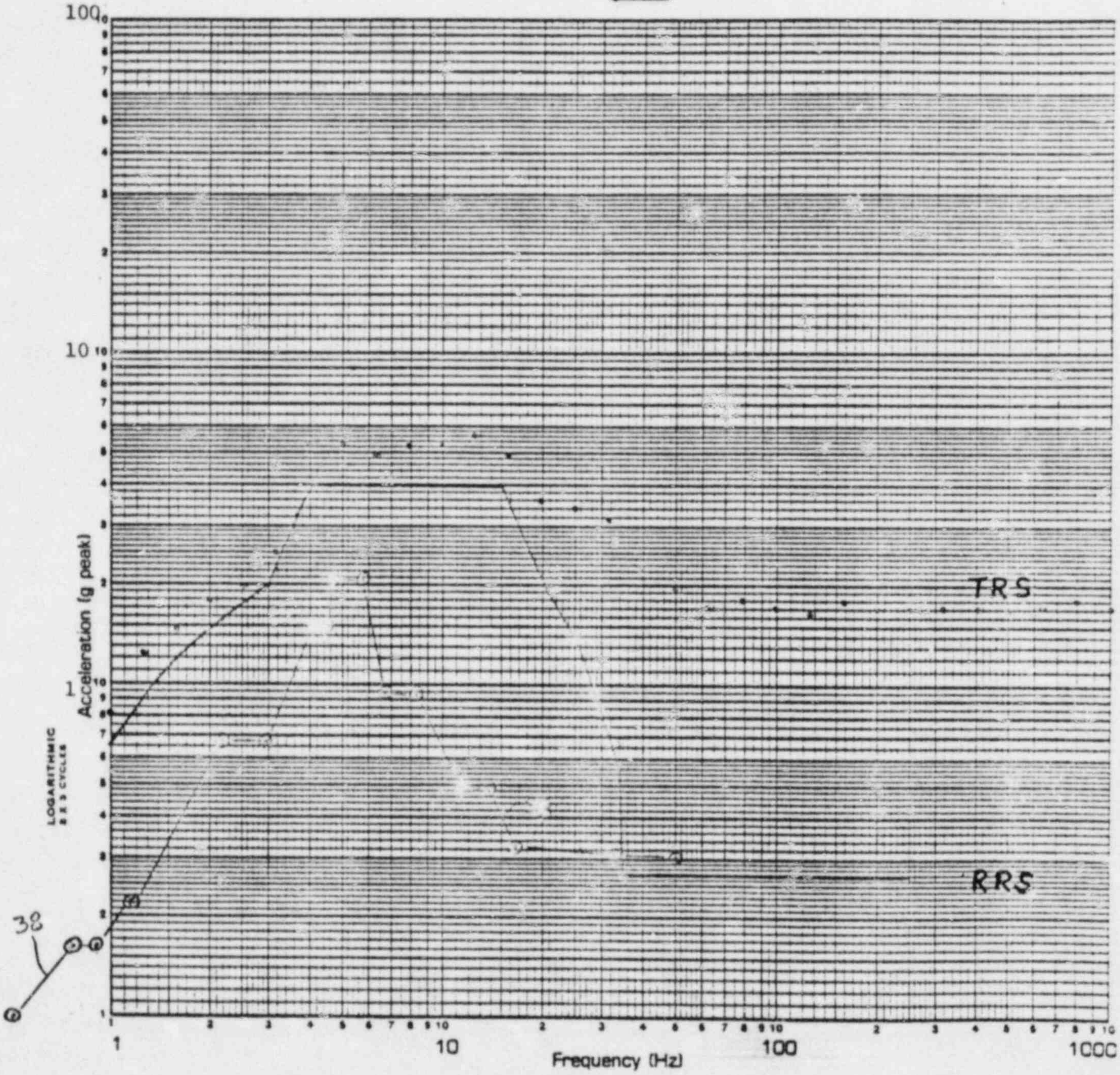
1.0 ☐ 10 ☐ 100 ☒ 1000☐

DAMPING 2%

Legend

- • TRS
- ⊙ Byron/Braidwood RRS

Byron/Braidwood Station
Commonwealth Edison Co.



SPECIMEN —

AXIS SS|V

LOCATION NO. 4CA

TEST RUN NO. 15

Fig. 8.4

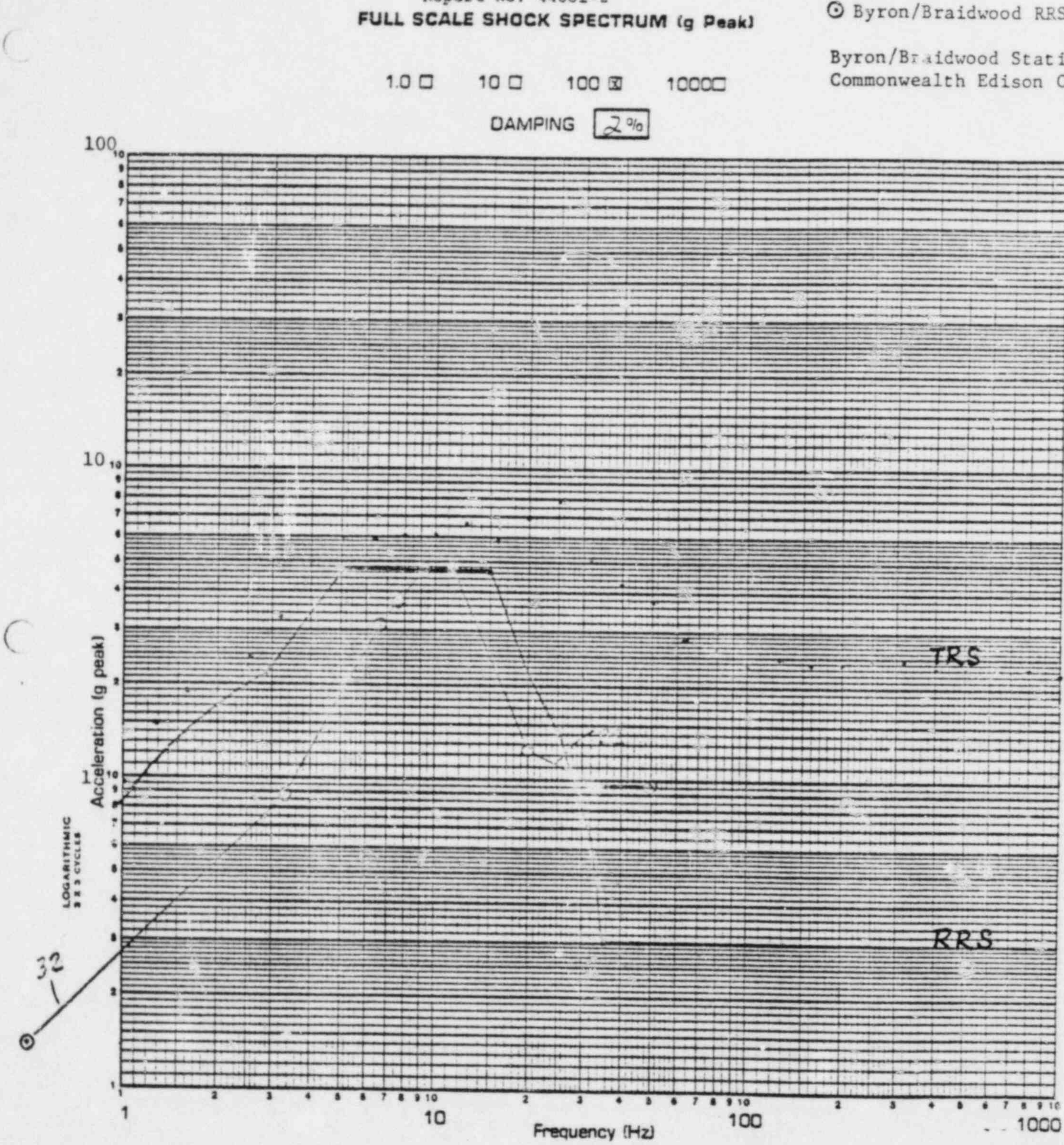
Comparison TRS vs RRS Horizontal OBE
Side-to-Side/Vertical 2% Damping

Legend

- • TRS
- ⊙ Byron/Braidwood RRS

Byron/Braidwood Station
Commonwealth Edison Co.

Page No. III-444
Report No. 44681-2



SPECIMEN —

AXIS FB/V

LOCATION NO. VCA

TEST RUN NO. 9

Fig 8.5

Comparison of TRS vs RRS Vertical DBE (SSE)
Front-to Back/Vertical 2% Damping

Legend

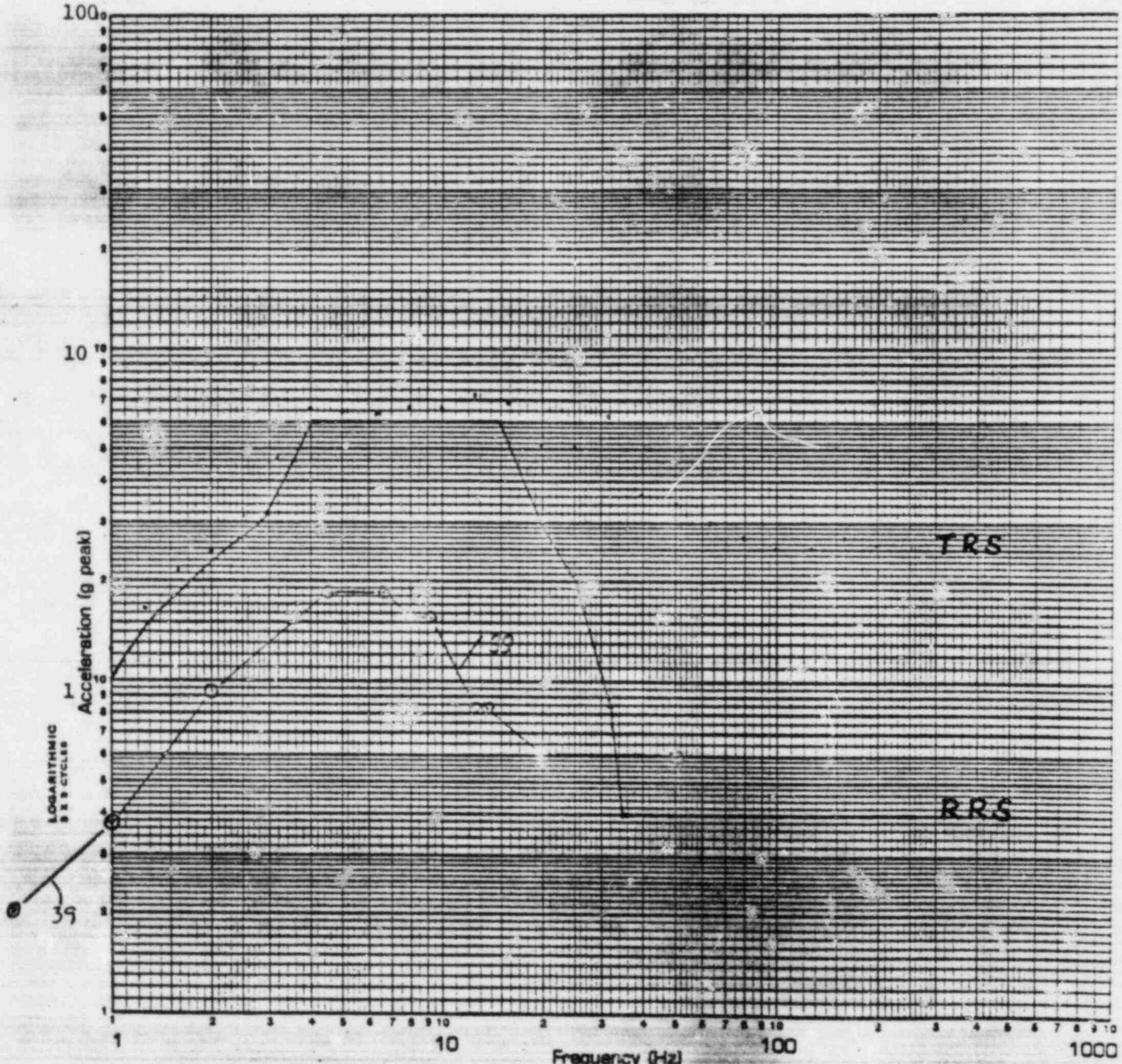
• TRS
⊙ Byron/Braidwood RRS

Byron/Braidwood Station
Commonwealth Edison Co

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000☐

DAMPING 2%



SPECIMEN —

AXIS FB/V

LOCATION NO. HCA

TEST RUN NO. 9

Fig. 8.6

Comparison of TRS vs RRS Horizontal DBE (SSE)
Front-toBack/Vertical 2% Damping

Legend

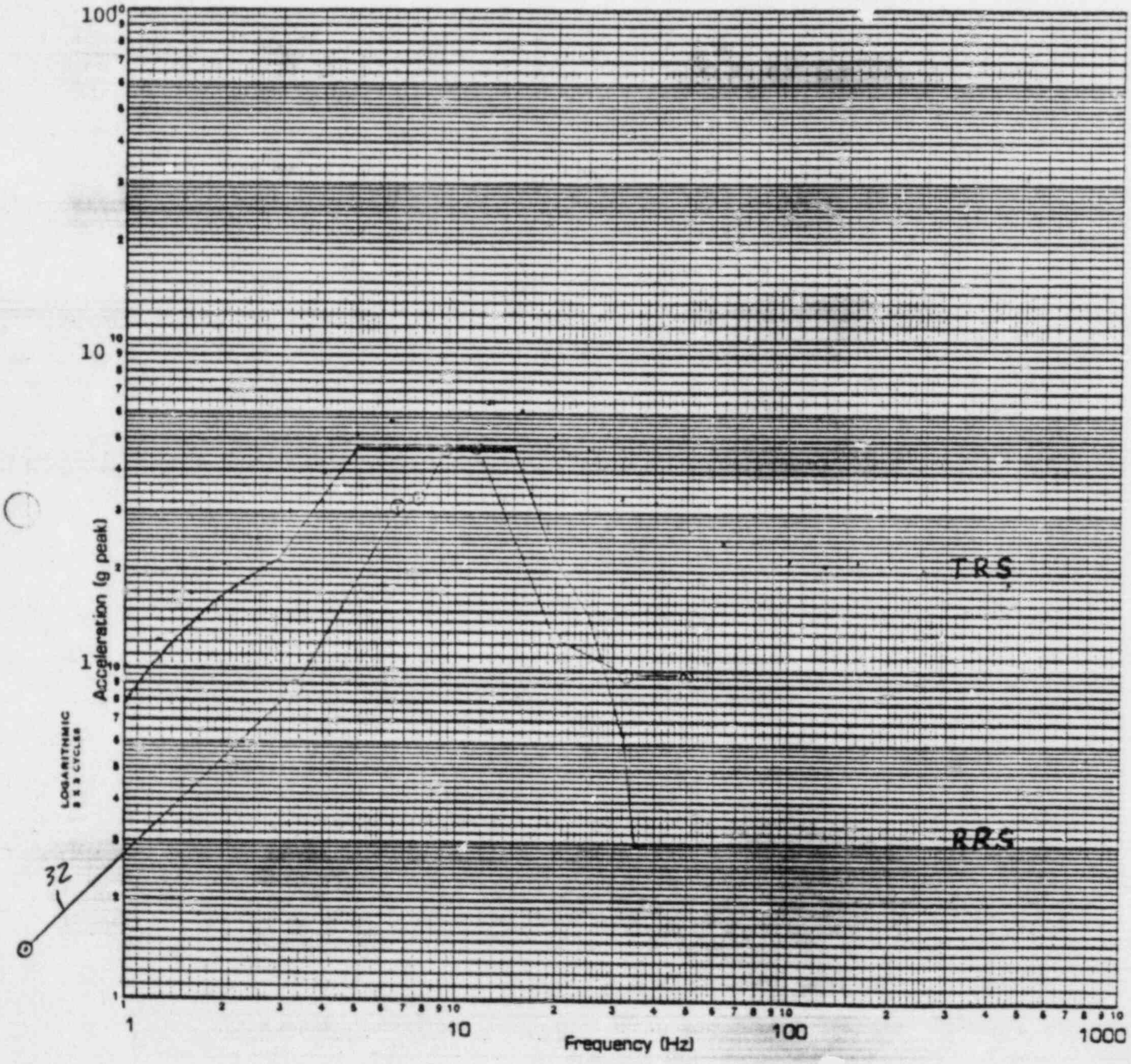
- • TRS
- ⊙ Byron/Braidwood RRS

Byron/Braidwood Station
Commonwealth Edison Co.

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000☐

DAMPING 2%



SPECIMEN —
AXIS SS/V
LOCATION NO. VCA
TEST RUN NO. 16

Fig. 8.7

Comparison of TRS vs RRS Vertiacl DBE (SSE)
Side-toSide/Vertical 2% Damping

Legend

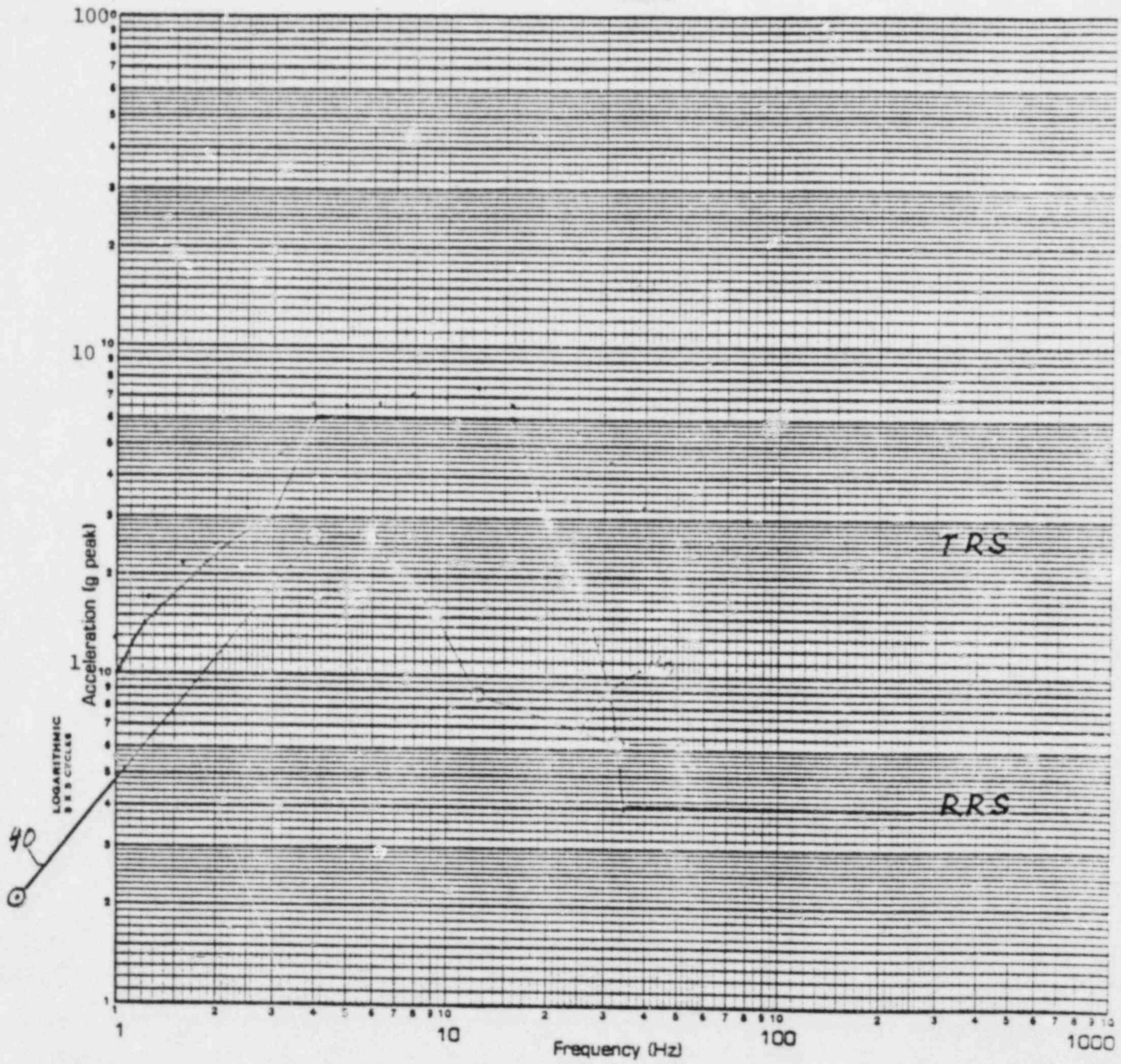
- • TRS
- ⊙ Byron/Braidwood RRS

Byron/Braidwood Station
Commonwealth Edison Co.

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000☐

DAMPING 2%



SPECIMEN —

AXIS SS/V

LOCATION NO. HCA

TEST RUN NO. 16

Fig 8.8

Comparison of TRS vs RRS Horizontal DBE(SSE)
Side-to-Side/Vertical 2% Damping

J. S. [illegible] 38

SARGENT & LUNDY
ENGINEERS
FOUNDED 1891
55 EAST MONROE STREET
CHICAGO, ILLINOIS 60603
(312) 269-2000

January 31, 1983
Project Nos. 4391/2-00
4683/4-00

Commonwealth Edison Company
Byron/Braidwood Stations - Unit 1 & 2

Storage Batteries
S&L Contract F/L 2819
CECo P.O. Nos. 194757/194758
Gould S.O. KE 5145, 5147, 5149, 5186

Mr. Howard D. Rubin,
Product Manager
Utility Batteries and Chargers
Gould Inc. Industrial Battery Division
2050 Cabot Boulevard West
Langhorne, PA 19047

References: 1) Gould Report on Environmental Qualification of Class 1E Load-Acid Storage Batteries Application Engineering File No. 068399 November 19, 1982.

2) Wyle Test Report No. 44681-2 (2 Volumes), October 27, 1981.

Dear Mr. Rubin:

Your transmittal of December 14, 1982, submitted the referenced reports for which we offer the following comments:

1) Random selection of cells is required for the type test per IEEE 535-1979 Section 8, P8. However, no attempt was made to randomly select the NCX 1680 test cells, "Test specimens to be inspected and evaluated at (utility) customer installation to assure suitability for qualification purposes" (Reference 1, Section 1, Part 2.1, PCT/4). Please justify.

2) No discussion was made on the accuracy of the test data even though this was a requirement of the test plan (Reference 1 Section 1, Part 9(4E), PCT/11). Please justify.

3) Please provide the 10 year ambient time-temperature profile for the battery room, (which was air-conditioned) where the NCX 1680 test cells were aged.

4) The battery load for NCX 1680 test cell was not clearly defined. This information is required for comparison with anticipated load for NCX 1200. Please provide the same.

5) NCX 1200 cells (Dwg. #107006D Rev. F) were purchased but type NCX 1680 cell (Dwg. #106288D Rev. K) were tested. The report states that both types are identical based on a comparison of their respective assembly drawings. However, this alone is insufficient to demonstrate similarity as required by IEEE 535-1979. For example, alloy composition is not delineated on the drawings. Please demonstrate similarity within the guidelines of IEEE 535-1979.

6) Seismic Test Series No. 4 test, for the NCX 1680 cells failed. After the test, cell spacer material was changed from Urethane to Polyethelyne foam type Dow Chemical (Ethe Foam No. 220) on 3/12/82, ECO #0017. This spacer material was used on failed seismic test No. 5 and successful seismic test No. 6 for the NCX 1680 naturally aged cells.

   a) Has this material been changed out on delivered NCX 1200 cells to Byron/Braidwood?

   b) What effect does temperature and radiation aging have on this material?

   c) Will these aging mechanisms affect the seismic test results?

7) IEEE 450-1975 was used for capacity test as indicated in Reference 1 (Section 7, Addendum, PCT/72). IEEE 450-1980 was used as a reference in the test plan. Why wasn't the capacity test indicated in 450-1980 used during Wyle's test? Note capacity test requirements are different in these revisions.

8) IEEE 535-1979, Section 8.3.1.4, says "Cells are qualified when there is no abrupt changes of more than five percent of the current or voltage of the discharge during seismic test and when the post seismic discharge capacity is 80% or more of the cells rated discharge capacity. The first part of this qualification criteria was not addressed in qualifying the naturally aged NCX 1680 cells.

9) It was not specifically identified in the reports (Reference 1 & 2) to what environmental and operating conditions including temperature and load durations that the purchased NCX 1200 were being qualified. This is important because anything that affected electroyte temperature affects its life. Also, an average ambient temperature is not sufficient for qualification because cell life is exponentially related to electrolyte temperature (IEEE 535-1979, Section 6(7), Note, P7). Please provide information on the same.

10) The reports do not adequately deal with cell interface and connections in accordance with IEEE 535-1979 Section 5(4), P6. Please provide information on the same.

The aforementioned reports cannot be accepted until all of the noted comments are resolved. The documents must be revised as noted or acceptable justification provided. Enclosed is a stamped Status 4 copy of the cover sheets for each of the documents.

If you have any questions, please don't hesitate to call me at (312) 269-3794.

Yours very truly,

Ronald John Zakaras

R. J. Zakaras
Engineering Analyst
Component Qualification Division

RJZ:lmd
In duplicate
Copies:
J. T. Westermeier
D. L. Leone/W. C. Cleff
T. Eisenbart
K. L. Adlon
J. S. Paniaguas
~~AEM/APD/RDR/RJZ~~
CQD File 005572