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RECIP.NAME RECIPIENT AFFILIATION
CRUTCHFIELD,D. Operating Reactors Branch 5

SUBJECT: Forwards addl documentation for any unresolved issues noted in Franklin Research Ctr Technical Evaluation Rept TER-C5257-454 re environ qualification of electrical equipment. Proprietary version withheld.

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ROCHESTER GAS AND ELECTRIC CORPORATION • 89 EAST AVENUE, ROCHESTER, N.Y. 14649-0001

ROGER W. KOBER
VICE PRESIDENT
ELECTRIC & STEAM PRODUCTION

TELEPHONE
AREA CODE 716 546-2700

March 30, 1984

Director of Nuclear Reactor Regulation
Attention: Mr. Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Environmental Qualification of Electrical Equipment
R. E. Ginna Nuclear Power Plant
Docket No. 50-244

Dear Mr. Crutchfield:

The purpose of this submittal is to provide additional documentation for any unresolved issues noted in the FRC Technical Evaluation Report, TER-C5257-454. For convenience, we will also summarize the content and provide the submittal dates of items considered resolved in other RG&E correspondence since the December 13, 1982 "Safety Evaluation Report for Environmental Qualification of Safety-Related Electrical Equipment", which transmitted the FRC TER.

Enclosure 1 provides the necessary information. Additional References 77-84, as well as two updated Documentation Reference sheets are also attached. Please note that Reference 78 is proprietary in nature. A letter from Kerite requesting that this information be maintained confidential is enclosed with Reference 78. Thus, this information should not be placed into the Public Document Room. Based on this submittal, RG&E considers that all environmental qualification issues resultant from the FRC review are now resolved, pending final installation of equipment scheduled for the 1984 refueling outage and submittal of related qualification documentation.

Very truly yours,

Roger W. Kober

Roger W. Kober

Enclosures

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Reference 82 - Post Accident Sampling System

NUREG-0737 requires that the plant have the ability to draw a reactor coolant sample. This will be performed through a sampling line already in existence at Ginna. The only modification inside containment to perform this sample is replacement of the solenoid for valve 955 with a qualified solenoid. This is being performed in conjunction with the replacement of solenoid valves as needed for items 1, 2, 4, 5, 6, 8 and 9. The qualification report will be added as Reference 82 following installation of the solenoid.

Enclosure: Status of Environmental Qualification
of Electrical Equipment per TER-C5257-454

1. Item Numbers 1, 2, 4, 5, 6, 8, 9 - Solenoid valves (various).

   As provided in RG&E's February 1, 1983 letter, these solenoid valves will be installed and operable following the Spring 1984 refueling outages. The test reports for the ASCO and VALCOR solenoid valves will be available for review in RG&E's files. A summary of the test results will be submitted to the NRC following receipt of all documentation by RG&E.

2. Item Number 10 - Solenoid valve for the pressurizer PORV.

   The applicable qualification document was previously submitted as Reference 73, "QR52600-5940-2". As noted in Attachment 2 of our February 1, 1983 submittal, a similarity report from VALCOR was being provided to RG&E, for transmittal to the NRC. This letter is included in this submittal as Reference 77, "Similarity Qualification Test Report SKA 11419, Solenoid Valves for Rochester Gas and Electric Corp."

3. Item Numbers 13, 14 - Limitorque valve operators for valves 826 A-D, 896 A and B, and 825 A and B.

   As noted in our September 4, 1981 submittal, "aging" is addressed in our Reference 53, which is Limitorque Report B0003.

   It is important to note that in our October 31, 1980 submittal, we stated that these valves are not exposed to a DBE environment prior to the time at which they complete their safety function. Therefore, these valves actually should be categorized as being installed in a "mild environment."

4. Item Numbers 16, 18 - Limitorque operators for valves 850 A, B; 857 A, B, C; 856; 860 A-D; 704 A, B; 852 A,B.

   As noted in RG&E's previous submittal of September 4, 1981, the issue of "aging" is addressed in our Limitorque Qualification Report B0003.

5. Item Number 27 - Hydrogen Recombiner Blower Motor.

   Two items of concern were raised in the FRC TER; qualified life and splice material evaluation.

   As noted in the qualification document WCAP 7410-L, the motor was qualified for 7 years continuous duty at 150°C. Since the motor is not generally used except for testing, and the containment ambient is about 50°C, a 40 year life is certainly assured.

During the 1982 refueling outage, RG&E replaced the motor-to-lead splice insulation with qualified Raychem sleeves (designated as Category I.a in the FRC TER).

6. Item Numbers 29, 30 - Cooling fans for motors for RHR, Charging, SI, and CS pumps.

As noted in RG&E's reference 69, Westinghouse Report 71-1C2-RADMC-R1 entitled "Effects of Radiation on Insulating Materials Used in Westinghouse Medium Motors", all typical materials and combinations used in the motors, including connections and greases, have been tested by Westinghouse. The only adverse environment which might be experienced by these motors is radiation, which has been conservatively estimated at 2.8×10^6 rads. As noted in the test results, only Polyester and Teflon were at all susceptible to degradation at this level of radiation. These materials are not used in our motors. Thus, RG&E has concluded that the motors are qualified for their intended services.

It is also noted in the report that these motors have an expected operating life of 20 years. Since the motors are used intermittently, and are not operated at their maximum rating at all times, a 40-year life can be expected. Further, all fans and motors are lubricated and inspected on a periodic (roughly one year) basis in accordance with the Ginna Station preventive maintenance program. These are detailed primarily in procedures A-1011, PM-2, PM-3, and M-45.2 If any signs of degradation are apparent, major maintenance such as insulation replacement is scheduled and performed in accordance with these maintenance procedures.

Thus, the RG&E program ensures that failure due to aging is minimized.

7. Equipment Item No. 33 - Terminal blocks.

As noted in RG&E's February 1, 1983 submittal, these terminal blocks were replaced with Raychem sleeves during the Spring 1982 refueling outage.

8. Equipment Item Numbers 34, 35 - Kerite Cable in Containment.

As noted in our February 1, 1983 submittal, RG&E considers the full range of Kerite power and control cable used at Ginna to be properly environmentally qualified. However, we have received another report from Kerite documenting environmental qualification for cable used at Ginna. This proprietary report, is attached as Reference 78. The confidential attachments are not being submitted; however, they are available for review at RG&E.

As noted in the cover letter to this reference the testing was performed for a No. 16 AWG conductor, rather than No. 10 AWG. Based on a comparison of the insulation and jacket thicknesses, it is considered that the differences are insignificant. Thus, it can be concluded that the Kerite cable installed at Ginna is properly environmentally qualified.

9. Equipment Item Numbers 37, 38 - Coleman cable inside and outside containment.

In RG&E's letter of September 7, 1981 a response was provided relative to the radiation qualification of the Coleman cable (i.e., DOR Guidelines are met).

In RG&E's letter of February 1, 1983, Reference 76 was provided to show that the materials of construction of the cable outside containment could meet and exceed the required post-accident dose.

RG&E thus considers these items to be resolved.

10. Equipment Item Numbers 39, 40 - Rome and General Cable Outside Containment.

Reference 76 was provided as an attachment to our February 1, 1983 letter. This reference provided the necessary radiation qualification information for the material of construction of this cable; thus, RG&E considers these items resolved.

11. Equipment Item Numbers 41-47, 49 Transmitters.

All of these transmitters have been replaced with Foxboro NE - Series transmitters. See the discussion for item 3 of Attachment 1 to our February 1, 1983 letter.

12. Equipment Item Number 48. BAST level transmitters.

The BAST level transmitters are located in the auxiliary building, and provide signals to automatically switch the suction source of the Safety Injection Pumps from the BAST to the RWST. This function is completed before there would be any sump recirculation. Thus, these transmitters are required to perform a safety function in a "mild" environment.

13. Equipment Item No. 50 - Reactor Coolant Temperature RTD's.

As noted in our February 1, 1983 submittal, RG&E does not at this time consider the T_{COLD} RTD's to be required for operation in a harsh environment. RG&E will have installed qualified Conax RTD's in the hot legs by the end of the 1984 refueling outage. These RTD's are relied upon for input to the saturation meter. The cold leg temperature indication is used as

back-up information to help determine natural circulation, and as such it is not considered to require full environmental qualification. A summary of the qualification test report for Conax RTD's is included as Reference 79. The entire report is on file at the RG&E offices, and can be reviewed if desired.

14. Item Number 55 - Reactor Containment Fan Cooler Motors.

In our February 1, 1983 submittal, RG&E discussed most of the designated open items. Additional information is as follows:

a) Motor Inspection, Including Bearings:
During the Spring 1983 refueling outage, RG&E removed and inspected the fan cooler motor and bearings. These were found to be in excellent condition. Although not necessary, the bearings were replaced. The original bearings are currently available at RG&E for inspection, if desired. The motor, windings, and splices were also in excellent condition, with no abnormal signs of degradation.

b) Changeout of Grease:
Chevron NRRG grease is now being used in these motors. A copy of the Chevron bulletin, and applicable pages of Ginna procedure A-1011 are included with this report as RG&E Reference 80.

c) Radiation Qualification:
The radiation qualification testing used to qualify the motors used industry standard gamma techniques. As noted in Regulatory Guide 1.89,... "NUREG/CR-2089 concluded that standard gamma simulators can adequately duplicate damage from both ambient and accident radiation environments"... Thus, this issue is considered resolved.

15. Equipment Item Numbers 56, 57 - Switchgear.

An explanation was provided in RG&E's February 1, 1983 submittal.

16. Equipment Item Number 62-Sump "B" Level Detectors.

These detectors have been replaced with qualified Transamerica DeLaval (GEM) units Part No. LS57761. Excerpts of the qualification documentation is provided as Reference 81. The entire set of qualification reports "Nuclear Qualification Test Program on a Liquid Level Transmitter and Receiver" Report Nos. 45700-1 and 45700-2 are on file at RG&E, and can be reviewed if desired. The first report documents qualification for radiation, aging, seismic, and abnormal conditions. The second report documents the LOCA/SLB accident environmental testing. Note that the qualification reports are for Part No. XM-54854.

A letter documenting that the tested units are similar to the installed units is also being transmitted as part of Ref. 81. Finally, RG&E has, as required in the test conclusions, provided qualified interconnect cable for equipment interface. A summary of documentation relative to the qualification of the Boston Insulated wire cable used is also provided as part of Reference 81. Test Report 915, "Flame and Radiation Resistant Cables for Nuclear Power Plants" 11/80, is on file at RG&E.

17. Equipment Item Number 63 - Hydrogen Recombiner.

    As noted in the Franklin TER, "pending the successful resolution of the pressure switches outstanding item, this equipment is considered qualified". RG&E has decided to replace the Barton pressure instrumentation with fully qualified Foxboro NE-Series transmitters (see item 11 above) during the 1984 refueling outage.

18. Equipment Item Number 64 - Namco limit switch.

    As noted in RG&E February 1, 1983 submittal, the model number of the installed switches is EA180-11302, identical to those in the test report. This item is considered resolved.

19. Equipment Item Number 65 - LVDT for pressurizer safety valves.

    This item was discussed in RG&E's February 1, 1983 submittal. The installed units are 500 XS-ZTR. As noted in the Franklin TER, "...when model No. 500XS-ZTR is installed it will be qualified to NUREG-0588 Category I..."

20. Equipment Item Number 66 - Valcor SOV's for the reactor vessel head vent.

    As discussed in our February 1, 1983 submittal, it has been confirmed that the model number of the installed valves is V52600-6042. This is included in the listing of vales qualified by test report QR-52600-5940-2, Reference 73. Thus, this item is considered fully qualified.

21. Equipment Item No. 67 - Cont. Pressure Transmitters.

    RG&E has replaced these transmitters with fully qualified Foxboro NE-Series transmitters (see item 11 above).

In addition to the explanation of the items discussed in the Franklin TER, RG&E will address additional equipment installed, either as a result of TMI issues, or for other reasons.

23. Transmitters - In addition to equipment items 41, 42, 43, 44, 45, 46, 47, 49, 63, and 67, which are Foxboro NE-Series transmitters, RG&E has also replaced the transmitters which monitor other parameters, even though not all are required

to perform a safety function in a harsh environment. These additional transmitters are:

a. RC Wide Range Pressure (0-3000 psig) PT-420, PT-420A
Foxboro Model Number N-E11GH

b. Auxiliary Feedwater Discharge Pressure (0-2000 psig)
PT-2019, 2029, 2030
Foxboro Model Number N-E11GM [TMI II.E.1.2]

c. RHR, SI Flow (0-500, 0-800 in WC) FT-626, FT-924, FT-925
Foxboro Model Number N-E13DM

d. RHR to SI Flow (0-200" WC) FT-931A, FT-931B
Foxboro Model Number N-E13DM

e. Condensate Storage Tank Level (0-24') LT-2022, LT-2022A
Foxboro Model Number N-E13DM

f. AFW Flow (0-300" WC) FT-2001, 2002, 2013, 2014
Foxboro Model Number N-E13DM [TMI II.E.1.2]

g. AFW Flow (0-120" WC) FT-20006, 2007, 2009, 2015
Foxboro Model Number N-E13DM [TMI II.E.1.2]

When RG&E's October 31, 1980 report is fully updated, the installation of these transmitters will be noted. It should be noted that the Franklin TER suggests CVCS flow be added to the listing of environmentally qualified parameters. RG&E does not consider the CVCS flow instruments to be in a harsh environment (it would be used for normal shutdown only, since SI is used for accidents), and pressurizer level is the parameter which would be used as the prime indication of RCS inventory control. Thus, CVCS flow has not been added to RG&E's list of environmentally qualified instrumentation.

24. Post-Accident Sampling System, TMI Item II.B.3.

The only portion of the PASS required to be environmentally qualified is the equipment used to draw a reactor coolant sample. This consists of replacement of the solenoid for SOV 955. This solenoid is being installed in conjunction with those being supplied as items 1, 2, 4, 5, 6, 8 and 9. The schedule for installation and documentation is provided in paragraph 1 of this enclosure.

25. Hydrogen Monitors. TMI Item II.F.1.6. These monitors are provided by COMSIP, Inc. Pertinent excerpts, provided as Reference 83, are enclosed. The entire proprietary report is on file at RG&E. A discussion of the retest of the sample pump is also provided in the excerpts from EA&T Project 1035-8, included as part of Reference 83.

26. Lubricants. The lubricants used for motors at Ginna Station are primarily Mobil oils, such as DTE 25, 26, and Mobilux EP.1 and EP.2. As stated in enclosed Reference 84, these lubricants have a radiation resistance in excess of 3×10^8 rads. Since the greatest dose expected in these applications is about 3×10^6 rads (RHR pumps), significant margin is apparent.

27. Regulatory Guide 1.97 Guidance. A comparison of RG1.97 to present RG&E instrumentation was provided in a letter from John E. Maier to Dennis Crutchfield dated January 31, 1984.

VALCOR ENGINEERING CORPORATION
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Similarity Qualification Test Report
SKA 11419
Solenoid Valves
For
Rochester Gas & Electric Corp.

INTRODUCTION

The valves supplied to Rochester Gas & Electric Corp. on P.O. #36725-1500-08 are qualified on the basis of similarity to previously qualified valves.

DISCUSSION

Valcor Qualification Report QR52600-5940-2 (Reference 1) documents the procedures and tests conducted to qualify Valcor Series V526 solenoid valves to IEEE Standard 323-1974, based on the following conditions, without degradation of performance.

1. Normal environment of 120 F (maximum) for 40 years (minimum)
2. Experience a 2×10^8 RAD intergrated radiation dose.
3. Operate a minimum of 45,000 cycles, each cycle not exceeding one half hour duration.
4. Sustain a 4.5g minimum seismic event.
5. Experience two LOCA onsets of 346 F and 113 psig and sustain a post LOCA environment for 6.2 years minimum at 130 F.

The valves supplied to Rochester Gas & Electric Corp. are qualified on the basis of similarity as outlined below:

The following valve is structurally similar to valve V57300-5220-1 which was seismically qualified and reported in MR57300-5220-1-2, (Reference 2) except that the solenoid assembly construction is similar to valve V52600-6042-1 noted in Table I of QR52600-5940-2.

V573-5242-1

All electrical components housed within the solenoid assembly are identical to the hardware qualified. Changes such as the elimination of the zener, the rectifier or the position indication switches do not effect qualification.

DISCUSSION (continued)

The materials used in the pressure boundary assemblies of the subject valves and those used in the qualification valves are in accordance with the ASME Boiler and Pressure Vessel Code, Section III. Table I shows the similarities of materials used in these valves and qualification test valves. The other non-pressure boundary materials in these valves and qualification test valves are also similar.

CONCLUSION

Qualification is extended to the subject valves because of their similarities of design, material, construction and load requirements to the previously qualified valves in Reference 1.

REFERENCES

1. QR52600-5940-2, Qualification Test Report on SNUPPS Solenoid Valves.
2. MR57300-5220-1-2, Seismic Qualification Test Report on Solenoid Valve P/N V57300-5220-1.

N.H. Boroson
Assistant Chief Project Engineer

TABLE I

ROCHESTER GAS & ELECTRIC CORP.

VALVE MODEL NO.	NOMINAL SIZE (IN)	(3) TYPE	SEAL MATERIAL	BODY (1) MATERIAL	BONNET (2) MATERIAL	FLOW CAPACITY (CV)	RATING CLASS
V573-5242-1	1	H	Vespel	C	B	5.0	150
IEEE - 323-1974 QUALIFICATION TEST VALVE							
V52600-5291-2	3/8	E	EPDM	A	B	0.8	150
LIFE CYCLE TEST VALVES							
V52600-5291-2	3/8	E	EPDM	A	B	0.8	150
V52600-5940-2	1	F	Carbon	A	B	2.0	600
SEISMIC TEST VALVES							
V52600-6042-1	1	G	Stellite 6B	A	B	2.0	2500
V57300-5220-1	1	H	Vespel	A	B	4.0	150

(1) Body MTL:
- A - ASME SA240, Type 316
- C - ASME SA515, Grade 70
- D - ASME SA182, Type 316

(2) Bonnet MTL:
- B - ASME SA-479, Type 316

(3)
- E - Direct Operating Poppet
- F - Direct Operating Shear Seal
- G - Pilot Assist Poppet
- H - Direct Operating Balanced Poppet

VALCOR

VALCOR ENGINEERING CORP.
2 Lawrence Road, Springfield, NJ 07081
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DTF 001

DATE 3/18/83

ORIGINATOR

DATA TRANSMITTAL FORM

TO: Rochester Gas & Electric Corp.
89 East Avenue
Rochester, N. Y. 14649

PROJECT:

CONT. NO: N-EG-32516

S/O. : E09872

ATTN: G. Wrobel - EWR 2292

REPLY BY:

ITEM NO.	DOC. NUMBER	REV	DESCRIPTION	COPIES P	COPIES T	APPR.	REF.	REF
01	SKA 11419	-	IEEE Report	1			X	

REMARKS:

IPS-798

DESIGN QUALIFICATION TEST REPORT

FOR

CONAX RTD ASSEMBLIES

FOR

CLASS 1E APPLICATIONS

IN

NUCLEAR POWER PLANTS

CONAX® CORPORATION

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TABLE OF CONTENTS

1.0 SCOPE

The purpose of this document is to record the IEEE-323-74 Qualification performed by Conax Corporation on a Conax RTD Assembly.

2.0 APPLICABLE DOCUMENTS

2.1 Conax Corporation

Drawing 7138-10000	RTD Assembly
Drawing 2399-9627	Seismic Test Fixture
Drawing 2316-9626	Prototype RTD Assembly
IPS-325	Design Qualification Material Test Report for Materials used in Conax Electric Penetration Assemblies and Electric Conductor Seal Assemblies
IPS-799	Seismic Vibration Test Report for IEEE-323-74 Qualified RTD Assemblies with Electric Conductor Seal Assembly
IPS-781	IEEE-323-74 Qualification Test Procedure for Conax RTD Assemblies

2.2 Standards

IEEE Std. 323-1974	IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations.
IEEE Std. 344-1975	IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations

3.0 CLASS 1E EQUIPMENT BEING QUALIFIED

The actual equipment being qualified is the following RTD Assembly:

Description	Conax Part Number
Spring Loaded RTD Assembly	7138-10000

The RTD Assembly consists of a dual 100 ohm, 3 wire, magnesium oxide insulated, sheathed RTD probe with polysulfone end seal, a spring loaded extension nipple, Conax Nuclear Service termination head and a eight (8) conductor 18 AWG electric conductor seal assembly (E.C.S.A.).

4.0 EQUIPMENT PERFORMANCE SPECIFICATIONS

4.1 RTD Assembly

4.1.1 Accuracy shall be $\pm$ 1.0°F at 32°F and $\pm$ 1.5°F at 212°F.

4.1.2 Insulation resistance of any conductor to sheath shall be 100 megohms minimum at 100V DC at room temperature.

5.0 TEST PROCEDURE

5.1 The test procedure used was IPS-781 in Section 5 of Supplemental Data Section.

6.0 SPECIFIC FEATURES TO BE DEMONSTRATED BY TESTING

6.1 Testing will be performed in order to demonstrate that the subject RTD Assembly will continue to function per design requirements throughout a series of test phases which will simulate conditions which can be expected to occur during its design life.

6.2 The ability of the temperature indicating device to stay within its required tolerances for accuracy will be demonstrated as the primary requirement. In addition, features such as mechanical integrity will be demonstrated during simulated conditions including seismic simulations with no impairment to the function of the test unit.

7.0 RTD TEST ASSEMBLY

7.1 The following Conax RTD Test Assembly was assembled per the referenced drawings listed. The prototype assembly is identical to those in drawing 7138-10000, but was provided with a thermowell to simulate the actual installed condition.

7.1.1

RTD Test Designation Code	Type	Part Number
4	RTD	2316-9626

16.6 Results

16.6.1 D.B.E. Testing performed was in accordance with the guidelines of IEEE-323-74 and showed the ability of subjected test unit to withstand the simulated temperature - pressure profile of an actual loss of coolant accident.

17.0 CONCLUSION

17.1 Based on the results of this test program, it is shown that Gonax P/N 7138-10000 RTD Test Unit qualified all IEEE-323-74 and IEEE-344-75 criteria for safety related equipment for Nuclear Power Generating Stations.

18.0 SUPPLEMENTARY DATA SECTIONS

Section 1 - Data Sheets

Section 2 - Photographs

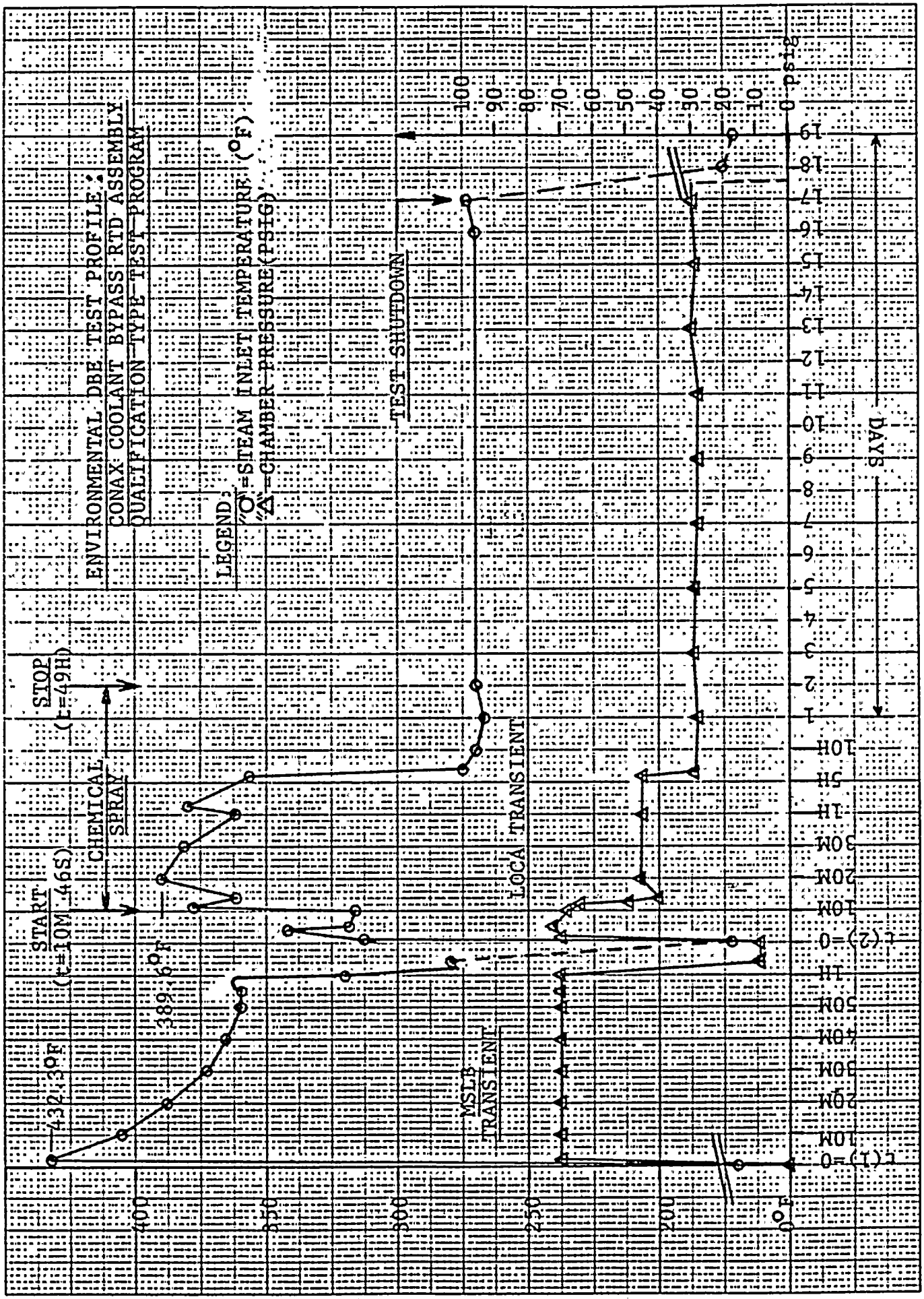
Section 3 - Radiation Test Report

Section 4 - Design Basis Event - Environmental Test Report (D.B.E.)

Section 5 - Accuracy & Calibration Data

Section 6 - Drawings

Section 7 - Typical OBE & SSE Test Response Curves


PRESSURE (PSIG)
ENVIRONMENTAL DBE TEST PROFILE
CONAX COOLANT BYPASS RTD ASSEMBLY
QUALIFICATION TYPE TEST PROGRAM
LEGEND: "O" = STEAM INLET TEMPERATURE (°F)
"Δ" = CHAMBER PRESSURE (PSIG)
TEST SHUTDOWN
START (t=10M 46S)
CHEMICAL SPRAY
STOP (t=49H)
432.3°F
389.6°F
MSLB TRANSIENT
LOCA TRANSIENT
t(1)=0
t(2)=0
DAYS
TEST DURATION (TIME)
TEMPERATURE (°F)
0 psig
0°F

Published by Chevron U.S.A. Inc. to report important product technical information.

Chevron Technical Bulletin

Chevron

CHEVRON NRR LUBRICANTS No. 10

10-1-78

Chevron markets a line of Nuclear Radiation Resistant Lubricants - currently 2 oils and 4 greases for use in environments subjected to high radiation dosages.

These specialty products have successfully served the Nuclear industry since the 1950's and to the best of our knowledge represent the only line of these products marketed generally in the non Communist world.

Because of their expense and limited application these products are available for sale only through the Central Order Desk, Richmond, California. Refer to the Price Book or the Temporary Salesfax Page attached (Table I) for ordering procedures.

The purpose of this Bulletin is to assist in the handling of technical and sales inquiries.

Technical inquiries not covered in this Bulletin should be directed to Chevron Research Company, Marketing Services, 576 Standard Avenue, Richmond, CA 94802 (tele. 415/237-4411).

Nuclear radiation affects organic lubricants. Any resulting change is generally undesirable because lubricant properties are highly optimized for a given application. Thus, it is important to use radiation-resistant oils and greases in all applications subjected to high doses of destructive nuclear radiation (radiolysis).

Certain general effects are common in the radiolysis of both oils and greases. Chemically, hydrogen and other gases evolve, and unsaturation and cross-linking of the organic molecules take place. Both low and high molecular weight materials are formed. The larger molecules predominate. This is reflected physically in an increase in viscosity and ultimate gelation as illustrated in Figure 1. Greases initially become softer due to attack on the thickening agent. Eventually, they also harden as the base oil cross-links. This is illustrated in Figure 2.

There are many specific radiolysis effects depending upon the composition of a given lubricant. For example, diester base oils, phosphate esters (antiwear additives) and halogenated materials (EP agents), each produce acids at a low radiation dose. Polymers such as polybutenes and polymethacrylates cleave readily and thus lose their V.I. improving function. Silicone antifoam agents are also easily destroyed. The approximate order of radiation stability of organic fluids used in lubricants is shown in Figure 3.

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Other factors also affect stability. High aromatic content promotes good radiation stability. An oxidizing atmosphere is bad, and increasing temperature lowers the useful life of lubricants. Fluids below polyphenyl ethers in Figure 3 can have radiation resistance improved by including selected additives.

Our nuclear radiation-resistant lubricants are made from alkylaromatic-type base oils and contain special additives. They retain their physical properties and lubricating ability over a much wider range of radiation dosage than conventional lubricants. Figure 4 compares a resistant oil with conventional materials, while Figure 5 compares a radiation-resistant grease with conventional lubricants.

Special radiation-resistant lubricants which are usable under specified nuclear radiation dosages are described in Table I. Information on operating limits and recommended uses is included. Tables II through VII give pertinent test data.

Conventional soap-thickened, mineral oil-based greases will generally withstand about 10^7 rads. Special conventional greases will withstand doses of at least 10^8 rads. Much higher doses can be tolerated by the NRR products.

Conventional compounded oils will generally take more radiation than similar greases, but the oils will exhibit wide variations in the doses that they will withstand. This depends on the base material, the additives used, the exposure conditions, and the performance property needed in the application.

Encl. - Figures 1-5
Tables I-VII

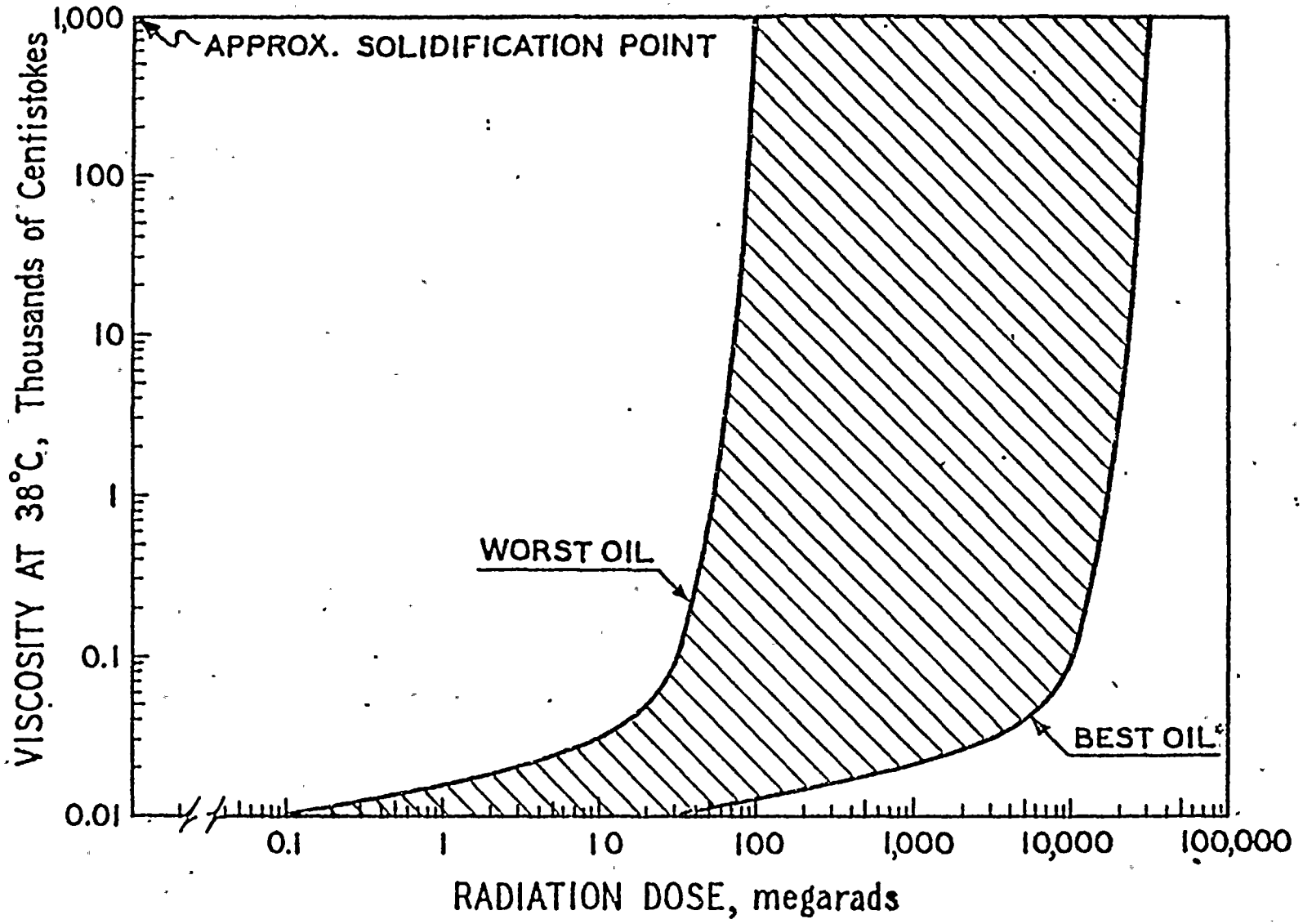


FIGURE 1: RADIATION ALTERS VISCOSITY OF OILS

* Sold by Chevron U.S.A. Inc.

CHEVRON RESEARCH COMPANY
RICHMOND, CALIFORNIA
RE 598578-1

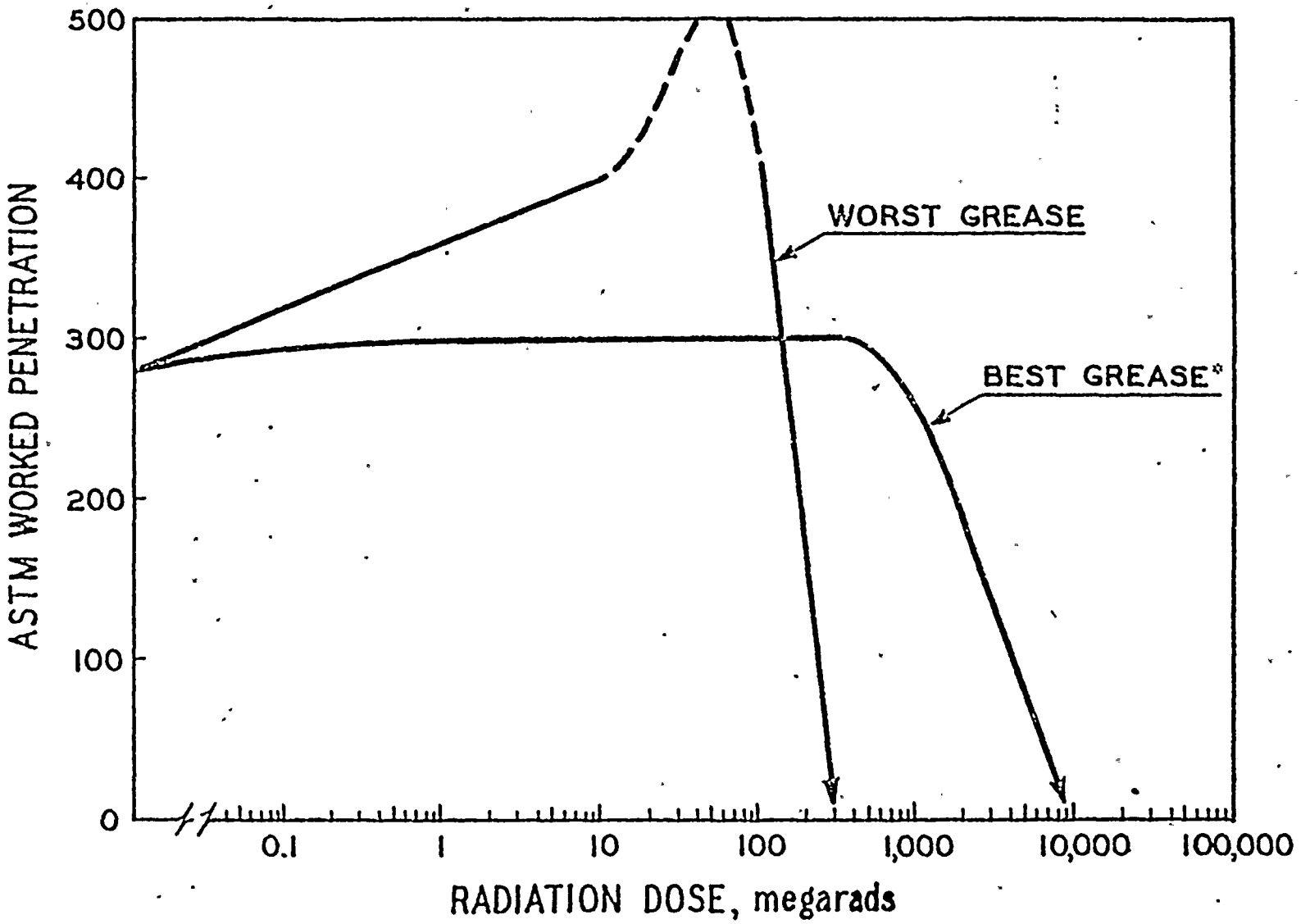


FIGURE 2: RADIATION ALTERS CONSISTENCY OF GREASES

*Sold by Chevron U.S.A. Inc.

CHEVRON RESEARCH COMPANY
RICHMOND, CALIFORNIA

RE 598579-1

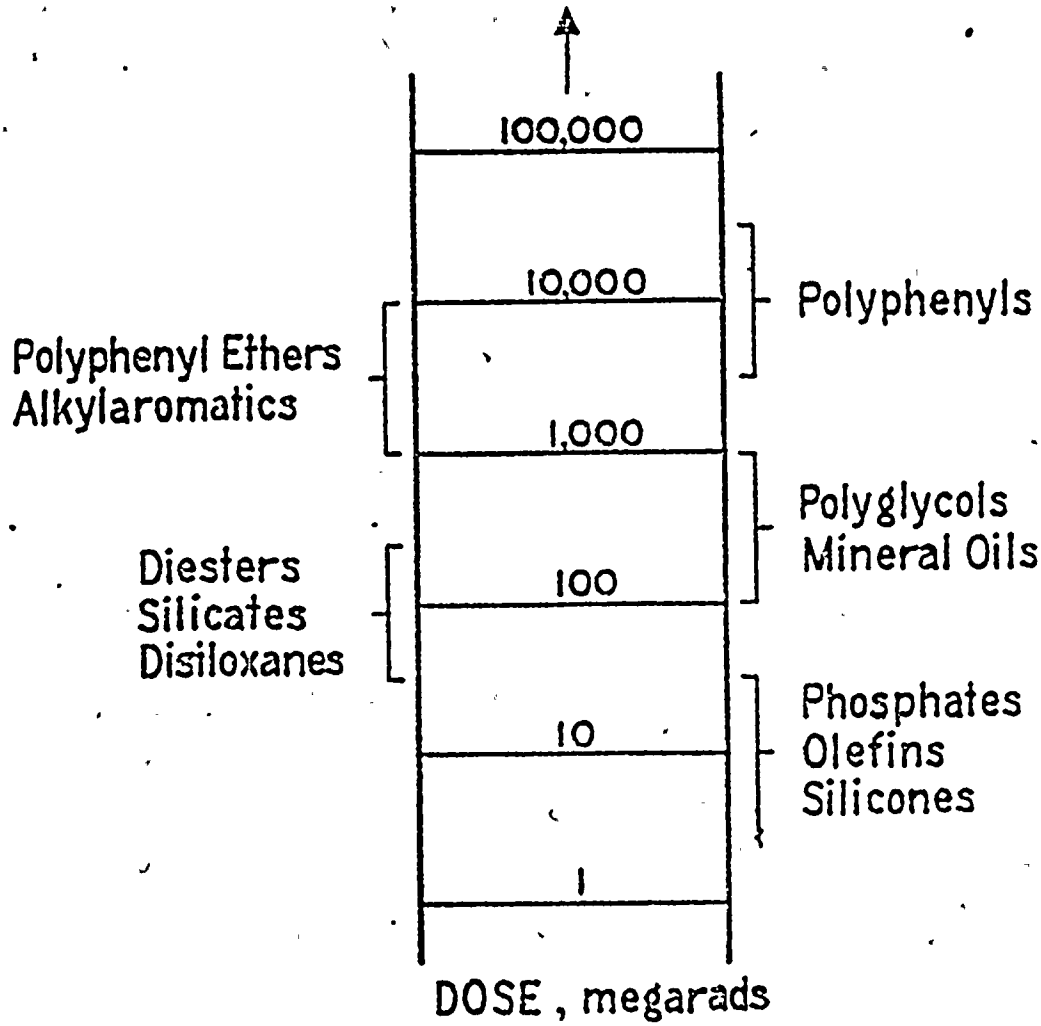


FIGURE 3: RADIATION RESISTANCE OF BASE OILS
(APPROXIMATE GELATION POINT)

CHEVRON RESEARCH
COMPANY
RICHMOND, CALIFORNIA

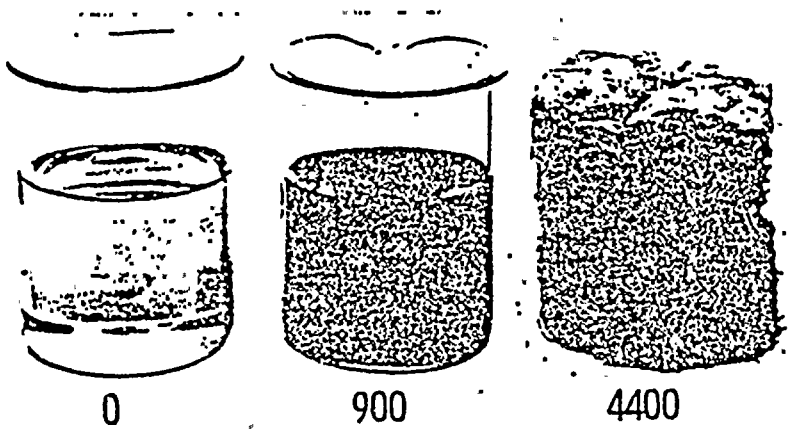
RE 598580-1

FIGURE 4

GAMMA IRRADIATED OILS

NRRO 358

Turbine Lubricant
(Mineral Oil)



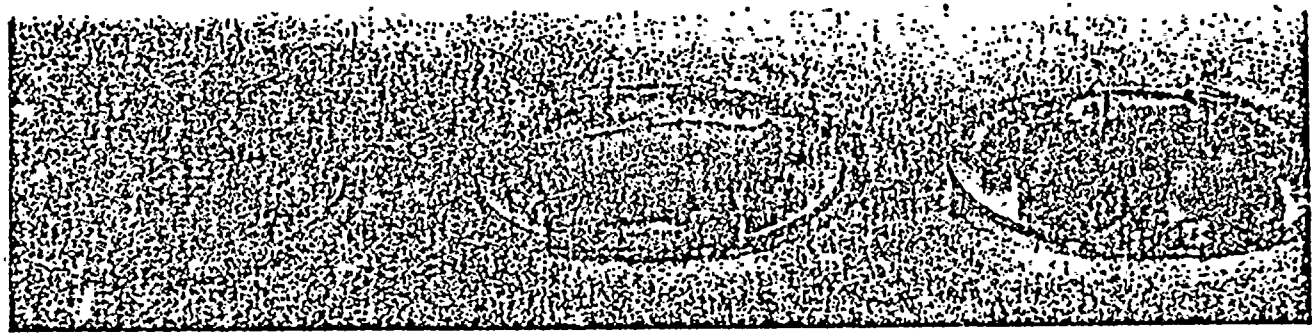
0 900 4400

Gamma Dose, Megarads

FIGURE 5

REACTOR IRRADIATED GREASES

4600 Equivalent Megarads



NRRG 235 Type Grease	Aircraft Instrument Base (Diester Oil - Lithium Soap Thickener)	Aircraft High Temperature Grease (Mineral Oil - Sodium Amate Thickener)

CHEVRON RESEARCH COMPANY
RICHMOND, CALIFORNIA

PM 780277

Table I

TEMPORARY SALESFAX PAGE

CHEVRON NRR LUBRICANTS

Greases

CMS#	Product	Operating Range, °C (°F)	Radiation Dose Limit 10^8 Rads	Product Description	Recommended Use
	Nuclear Radiation Resistant Greases				
255860	Chevron NRR Grease 159	-23 to 163 (-10 to 325)	30	Premium synthetic oil, sodium amate gelling agent, selenide oxidation inhibitor.	Antifriction bearings up to 10,000 rpm, motors, pumps, accessories; has actually withstood more than 30×10^8 rads in ball bearings operating inside a nuclear reaction.
255861	Chevron NRR Grease 235	-17 to 93 (0 to 200)	50	Synthetic aromatic oil, silica gelling agent, and selenide-oxidation inhibitor. Also contains graphite and molybdenum disulfide as "residual lubricants."	Low speed, high load sliding surfaces; screw mechanisms; provides residual lubrication in remote machinery, e.g., remote valves.
255891	Chevron NRR Grease 335	-17 to 121 (0 to 250)	50	Synthetic aromatic oil, sodium amate gelling agent, and selenide oxidation inhibitor.	Antifriction bearings up to 10,000 rpm; valve activating and screw mechanisms.
255892	Chevron NRR Grease 509	-17 to 93 (0 to 200)	50	A soft (ASTM worked penetration 360 to 380) version of NRRG-335 containing molybdenum disulfide.	Special product for an enclosed gear train; developed for W.&J. Barnes Co. Rockford, IL, and used at Hanford.
	Nuclear Radiation-Resistant Oils				
232981	Chevron NRR Oil-358	-6.7 to 107 (+20 to 225)	50	41 SSU at 210 Low Viscosity aromatic oil plus selected polymers (some scission and some crosslink)	Hydraulic pumps and accessory equipment; gear trains; control mechanisms.
232983	Chevron NRR Oil-360	-6.7 to 107 (+20 to 225)	50	86 SSU at 210 to provide a "constant viscosity" effect; selenide inhibited.	

[a] In air; can be extended in inert atmosphere.

For additional Technical Information Contact:

Chevron Research Company
Marketing Services
576 Standard Avenue
Richmond, CA 94802
Telephone (415) 237-4411

Product Ordering:

These products are sold F.O.B. Richmond, California, freight collect and will not be shipped until a Purchase Order or Telex is in our hands.

Place orders to:

Chevron U.S.A. Inc.
Central Order Group
P.O. Box 1272
Richmond, CA 94802
Telephone (415) 232-7570
Telex No. 3-4410, C.O.G. Richmond

TABLE II

Test Data on Chevron NRR Grease 159

Radiation Dose, 10^8 Rads	0			7		
ASTM Penetration						
Worked 60 Strokes	261			330		
Worked 100,000 strokes	325			307		
ASTM Drop Point, °F.	500+			500+		
Oxygen Bomb						
Copper Corrosion, 100 Hr. at 212°F.	Slight Stain			Slight Stain		
Oxidation, 100 Hr. at 250°F., psi Drop	9			24		
Water Resistance, % Grease Loss	0			0		
Evaporation, %						
22 Hr. at 300°F.	1.7			3.1		
22 Hr. at 400°F.	21			18.5		
Apparent Viscosity, poises						
0°F. at 12 Sec^{-1}	7000			2600		
0°F. at 20 Sec^{-1}	5000			2000		
Low Temperature Torque						
Temperature, °F.	-65	0	40	-65	0	40
Starting Torque, g-cm	-	2767	554	-	1106	554
Running Torque, g-cm	-	553	185	10,325	369	344
Navy Gear Wear Test, Wt. Loss of Brass Gear						
5 Lb. Load, mg/1000 Cycles	2.0			1.8		
10 Lb. Load, mg/1000 Cycles	5.7			5.0		
Bearing Performance						
10,000 rpm, Hr. at 300°F.	1577	634	-	306	265	-
10,000 rpm, Hr. at 350°F.	279	188	400	195	196	-

TABLE III

In-pile Tests[a] Chevron NRR Grease 159

Motor No.	Time in Materials Testing Reactor, Hours[b]		Radiation Dose,[b] 10^8 Rads
	Total	Irradiated	
31182[c]	1432	1049	13.7
31183[c]	1432	1049	13.7
31181	3470	2594	34

a. Test conditions: 0.3-horsepower motor in vertical position rotated at 6500 rpm; bearings were about 0.6-inch bore and outside diameter of 1.25 inches; bearing balls and races were M-2 high-speed tool steel with silver-plated separators; bearings were unshielded and were preloaded to 6 pounds; helium atmosphere.

b. 1000 Hours represent incident radiation of 13.5×10^8 rads plus 3.2×10^{18} thermal neutrons/sq. cm, plus 0.64×10^{16} fast neutrons/sq. cm; this roughly corresponds to 12.9×10^8 rads, ignoring thermal neutrons.

c. No failure.

TABLE IV

Test Data on Chevron NRR Grease 235

Dose, 10^8 Rads	NRRG-235	
	0	41 to 45[a]
ASTM Penetration		
Unworked		
Worked 60 Strokes	290	379, 388, 397
ASTM Drop Point, °F.	500+	500+
Bearing Performance in Size 204K Ball Bearing, Hr. to Failure		
10,000 rpm, 250°F.	248	
4,000 rpm, 200°F.	3000	
Navy Gear Wear Test, Wt. Loss in mg/1000 Cycles		
6000 Cycles at 5 Lb.	0.27; 0.22[c]	
3000 Cycles at 10 Lb.	0.20; 1.03[c]	
Four-Ball Wear Test		
30 Minutes at 800 rpm		
Scar Diameter, mm		
Steel/Bronze, 2 Lb. Jaw Load	0.23	
Steel/Bronze, 5 Lb. Jaw Load	0.76	
Steel/Steel, 20 Lb. Jaw Load	0.47	

a. Three separate irradiations; two in air, one in helium.

b. MIL-G-3278 specification calls for maxima of 2.5 and 3.5, respectively.

Reviewed 8/77
NRRG-300 Data
Eliminated

TABLE V

Test Data on Chevron NRR Grease 335[a]

Dose, 10^8 Rads	NRRG-335[a]				
	0	3.8	8.9	26.2	30.0
ASTM Penetration					
Unworked	276	257	238	246	221
Worked 60 Strokes	289	289	308	400	359
ASTM Drop Point, °F.	500+	500+	500+	500+	500+
Bearing Performance in					
Size 204 K Ball Bearings, Hr. to Failure					
10,000 rpm, 250°F.	763, 644				
10,000 rpm, 300°F.	220	154	155	-	39

a. NRRG-509 is a soft grade of NRRG-335. NNRG-509 contains molybdenum disulfide and has an ASTM penetration in the range 360 to 380; the radiation stability of NRRG-509 should be similar although its performance characteristics are different from NRRG-335.

Reviewed 8/77
NRRG-300 Data
Discontinued

TABLE VI

Performance of Special Oils in Specification Tests

Test or Property	Specification Requirements[a] Light	Heavy	Test Results on Chevron Oils NRRO-358	NRRO-360
Specific Gravity 60/60	Report		0.90	.94
Viscosity, SSU, at 210°F.	-	85-200	40.8	85.4
Viscosity, SSU, at 130°F.	70-120	-	73	-
Viscosity, SSU, at 100°F.	-	800-1500	123	1701
Viscosity, SSU, at 0°F.	10,000 Max.	-	-	-
Viscosity Index	65	50-100	82	22
Pour Point, °F	-70 to +15	0 to +35	+15	+20
Flash Point, °F.	200 to 400	325 to 470	280	410
Color	<7	-	4-1/2	4-1/2
Neutralization No.	0 to 0.20	0.10 Max.	Nil	Nil
Corrosion to Copper at 212°F.	None	None	Slight Tarnish	
Ash, %	0.003 Max.	0.05 Max.	0	0
Saponification No.	0.5 Max.	0.5 Max.	0.35	0.41
Carbon Residue, %	0 to 0.80	1.2 Max.	0.11	0.10
Nature of Carbon	L and F[b]	L and F	L and F	L and F
Total Sulfur, %	0.50 Max.	0.50 Max.	0.41	0.44
Precipitation No.	0.01 Max.	0.1 Max.	Trace	Trace
Foaming (After 10 Minutes)	300 ml	200 ml	Pass	Not Pass
Emulsion at 130°F. (After 30 Minutes)	Stable	-	Not Pass	-
Oxidation Corrosion (168 Hours at 250°F.)				
Evaporation Loss, %	-	-	1.3	0.6
Change in 100°F. Viscosity	-5 to +20	-	-0.4	0
Change in Neutralization No.	<0.20	-	+0.03	+0.01
Weight Change				
mg/cm^2; Copper	± 0.2 to ± 0.6	-	0.10	+0.08
mg/cm^2; Steel	± 0.2	-	0	+0.02
mg/cm^2; Aluminum	± 0.2	-	0.01	0
mg/cm^2; Magnesium	± 0.2	-	-0.01	+0.02
mg/cm^2; Cadmium	± 0.2	-	+0.01	+0.01
Mean Hertz Load, kg	-	-	-	-
Turbine Oil Oxidation, Hours	-	-	-	-

[a] Ran[illegible] requirements in 12 military specification lu[illegible]ting oils.

[b] Loose and flaky.

Re[illegible]d 8/77
Grade 3[illegible] Dropped
RD 631436

TABLE VII

Test Data on Chevron NRR Oils 358 and 360

Gamma Dose, 10^8 Rads	Chevron NRR Oil 358								Chevron NRR Oil 360			
	0	4.1	9.0	50.0					0	7.00	12.0	52
Appearance of Oil	-	-	Slt. Haze	-					-	Clear	Cloudy	-
Color, ASTM	4-	-	4-	4-1/2					4-	3-1/2	5	8
Appearance of Exposure Can	-	-	OK	-					-	- OK	Black	Black
Viscosity												
cs at 210°F.	4.43	3.51	3.80	7.10					17.2	10.9	11.0	31.1
cs at 100°F.	25.7	20.3	22.2	72.2					366	202	198	1155
SSU at 210°F.	40.8	37.9	38.8	49.5					86.6	62.6	62.9	146
SSU at 100°F.	122	99.2	107	335					1698	934	917	5370
Viscosity Index	85	22	41	43					24	-13	(1)	11
Copper Corrosion, 3 Hr. at 212°F.	1b	2c	2c	2c					1b	2a	2a	1b
Neutralization Number, mg KOH/g Micro	Nil	0.10	0.06	0.02					0.01	0.09	0.06	0.01
Four-Ball Wear Test												
Scar Diameter in mm;	0.51	-	0.50	-					-	-	-	-
10 kg Load; 30 Min. at 1200 rpm; Steel/Steel	0.51	-	0.57	-					-	-	-	-
Pour Point, °F.	+15	-20	-65	-40					+20	-20	-5	0
Evaporation, %, 22 Hr. at 210°F.	31.1	-	30.3	-					-	-	-	-

Dear Customer: This Bulletin contains important environmental, health and toxicology information for your employees who recently ordered this product. Please make sure this information is given to them. If you resell this product, this Bulletin should be given to the Buyer.

Chevron U.S.A. Inc.

CMS 255860

Material Information Bulletin

Chevron

(Approved – "Essentially Similar" to Form OSHA 20, Material Safety Data Sheet)

CHEVRON NRR GREASE 159

CMS 255860

TYPICAL COMPOSITION

Alkylbiphenyl (C_{15} - C_{20})	82%
Additives and thickeners	18%
Selenium	<1%

EXPOSURE STANDARD

No OSHA exposure standard or Threshold Limit Value has been established for this material.

PHYSIOLOGICAL & HEALTH EFFECTS	EMERGENCY & FIRST AID PROCEDURES
Eyes	
Expected to cause no more than minor eye irritation.	Wash eyes with fresh water for at least 15 minutes. If irritation continues, see a doctor.
Skin	
Expected to produce no more than minor skin irritation following prolonged or frequently repeated contact. See Additional Health Data.	Wash thoroughly with soap and water following skin contact. Launder contaminated clothing.
Inhalation	
Not expected to be acutely toxic by inhalation.	Since this material is not expected to be an inhalation problem, no first aid procedures are required.
Ingestion	
Not expected to be acutely toxic by ingestion. See Additional Health Data.	If swallowed, give a large amount of water to drink, make person vomit and call a doctor.

ROCHESTER GAS AND ELECTRIC CORPORATION

GINNA STATION

CONTROLLED COPY NUMBER 21

GINNA STATION
UNIT #1
COMPLETED
DATE :-
TIME :-

PROCEDURE NO. A-1011 REV. NO. 4

EQUIPMENT INSPECTION PERIOD AND LUBRICANT LIST

TECHNICAL REVIEW

PORC REVIEW DATE 8-3-83

J R Steiner
QC REVIEW

C R Anderson
QUALITY ASSURANCE

PLANT SUPERINTENDENT

AUG 23 1983
EFFECTIVE DATE

QA ✓ NON-QA _____ CATEGORY 1.0

REVIEWED BY: _____

THIS PROCEDURE CONTAINS 64 PAGES

EQUIPMENT	LUBRICANT	BLDG./ /FLOOR	3 MONTH SURVEILLANCE * PERIOD	MAINTENANCE PROGRAM		
				PROCEDURE NUMBER	CHECK	INSPECTION
EQUIP. NO. MG#4 PRESSURIZER ROBBINS & MYERS JIB CRANE		CONT/OP				
HOIST GEAR CASE	MOBIL DTE OIL 26			MHE-300-1	AS SPECIFIED	
OPEN GEARS	MOBILTAC E					
HOIST CABLE	NO LUBRICATION ON CABLE					
TROLLEY MOTOR						
GEAR HOUSING	MOBIL COMPOUND GG					
BEARINGS	MOBILUX EP NO. 1					
POST ACCIDENT AIR HANDLING VALVES					YEARLY	YEARLY
NO LUBRICATION REQUIRED						
CONTAINMENT RECIRCU-LATING FANS & MOTORS A, B, C, & D	CHEVRON NRRG 159		3M-37		YEARLY	YEARLY
CONTROL ROD DRIVE SHROUD COOLING FANS (1A & 1B)		CONT/OP	3M-37		YEARLY	YEARLY
MOTOR BEARINGS	CHEVRON NRRG 159			MOTOR M-45.2		

* REFERS TO LUBRICATION INSTRUCTION CODE

EQUIPMENT	LUBRICANT	BLDG./ /FLOOR	3 MONTH SURVEILLANCE * PERIOD	MAINTENANCE PROGRAM		
				PROCEDURE NUMBER	INSPECTION PERIOD	
1A & 1B REACTOR COOLANT PUMP		CONTAINMENT/ BASEMENT			YEARLY	YEARLY
PUMP BEARINGS	INJECTION WATER LUBRICATED			M-11.8.B/ F/G/H		
MOTOR	MOBIL DTE OIL 25			M-11.8.J/K		
OIL LIFT PUMP MOTOR	SEALED			M-45.2		
1A & 1B SUMP PUMPS (WEINMAN)		CONTAINMENT/ BASEMENT		M-11.17	YEARLY	YEARLY
PUMP BEARINGS	MOBILUX EP NO. 1					
MOTOR BEARINGS	SEALED			MOTOR M-45.2		
COUPLING	DRY					
REACTOR COMPARTMENT COOLING UNITS		CONTAINMENT/ BASEMENT	3M-37		YEARLY	YEARLY
MOTOR BEARINGS	CHEVRON NRRG 159			MOTOR M-45.2		
FAN BEARINGS	CHEVRON NRRG 159					
P & H HOISTS ON (3)						
REACTOR HEAD		CON/CAVITY			AS REQUIRED	
MOTOR BEARINGS	MOBIL DTE BB			MOTOR M-45.2		
GEAR CASE	MOBIL DTE BB					

* REFERS TO LUBRICATION INSTRUCTION CODE

EQUIPMENT	LUBRICANT	BLDG./ /FLOOR	3 MONTH SURVEILLANCE * PERIOD	MAINTENANCE PROGRAM		
				PROCEDURE NUMBER	INSPECTION PERIOD	
CONTAINMENT CHARCOAL FANS & FILTERS (1A & 1B)		CONT/INTER	3M-38		YEARLY	
MOTOR BEARINGS	CHEVRON NRRG 159			MOTOR M-45.2		
CHAIN FALLS AND LUGALLS			N/A	MHE-700 SERIES MHE-700 SERIES	AS REQUIRED	
FORK LIFTS			N/A	QM-1309 MAINT.	YEARLY AS REQUIRED	
AVT CONDENSATE BOOSTER PUMPS (1A,1B & 1C)		TURBINE/ BASEMENT		M-11.33	YEARLY	
MOTOR BEARINGS	MOBILUX EP NO. 2			MOTOR M-45.2		
PUMP BEARINGS	MOBIL DTE NO.797					
STANDBY AUX FEEDWATER PUMPS (1C & 1D)		AUX/ADDITION	3M-40	M-11.14	YEARLY	
MOTOR BEARINGS	MOBIL DTE NO.797			MOTOR M-45.2		
PUMP BEARINGS	MOBIL DTE NO.797					
COUPLING	MOBILUX EP NO. 0					

* REFERS TO LUBRICATION INSTRUCTION CODE

Reference 81 - Transamerica Delaval (GEM)
Sump B Level Detectors

Contents:

1. Letter from John W. Davin to Richard A. Baker of RG&E, dated January 9, 1984, certifying that the RG&E detectors, part no. LS 57761, are considered environmentally qualified based on similarity to testing performed on part no. XM-54854.

2. Excerpts from Wyle Qualification Test Report No. 45700-1, dated March 25, 1983.

3. Excerpts from Qualification Test Report No. 45700-2, Bechtel SNUPPS Test.

4. Certificate of Compliance for Boston Insulated Wire part no. 13285-H-002, Cable Type TSP #16 AWG, and lab test reports, letter dated February 3, 1982.

5. Certificate of Compliance for BIW part No. 13244-H-007, control cable 7/C-12 AWG, and lab test reports, letter dated April 1, 1982.

6. RG&E purchase order No. N-EG-21257, dated 12/9/81.

7. Excerpts from BIW Proprietary Report No. B915, "Flame and Radiation Resistant Cables for Nuclear Power Plants", November 1980.

Transamerica
Delaval

250 Mt. Lebanon Blvd., Suite 7
Pittsburgh, PA 15234
(412) 343-5666
N.Y. and W. Va. 800-441-7733

January 9, 1984

Rochester Gas & Electric Corporation
89 East Avenue
Rochester, New York 14649

Attention: Mr. Richard A. Baker

SUBJECT: Your Order #N-EG-19888 Part. no. LS 57761
Our Gems Invoice/Order #09662

Gentlemen:

This is to certify that the Gems Sensors Products furnished on the subject order have been qualified in accordance with Gems interpretation of IEEE323-1974 and IEEE344-1975 and based on the similarity to Gems P/N XM-54854, as outlined in Wyle Test Report #45700-2.

Very truly yours,

John W. Davin

John W. Davin, District Manager
Transamerica Delaval Components

JCB/nj

cc: Mr. David Dratwa, Delaval - Syracuse

Transamerica Delaval

Transamerica Delaval Inc
Gems Sensors Division
Plainville, Connecticut 06062
(203) 677-1311

Telex 99306

20 December 1983

Rochester Gas & Electric Corp.
89 East Avenue
Rochester, NY 14649

Attention: Richard A. Baker

Subject: Qualification Test Report #45700-2
Bechtel SNUPPS Test

Reference: RG & E P. O. #N-EG-19888
Ginna Station
Gems' Invoice #09662

The enclosed Qualification Report is the final report as prepared in accordance with Bechtel SNUPPS' requirements. No comments will be allowed regarding this report and no changes will be made except those requested by Bechtel SNUPPS. Any comments or changes made by Bechtel SNUPPS will be submitted by page only, rather than as a new report.

One copy of the report is enclosed. Any additional copies will be supplied only against a separate purchase order at a cost of $750.00 each. This report will discontinue the control of Gems' Quality Control Manual.

The enclosed copy of this letter shall be signed and returned to Transamerica Delaval, Gems Sensors Division within five (5) days after receipt of this report.

for Mark E. Vasil
Technical Sales/Service

SENT 1/3/83

MEV:ncm

Enc.: Report #45700-2
(1) Copy of Letter

Received-Date_____

By_____

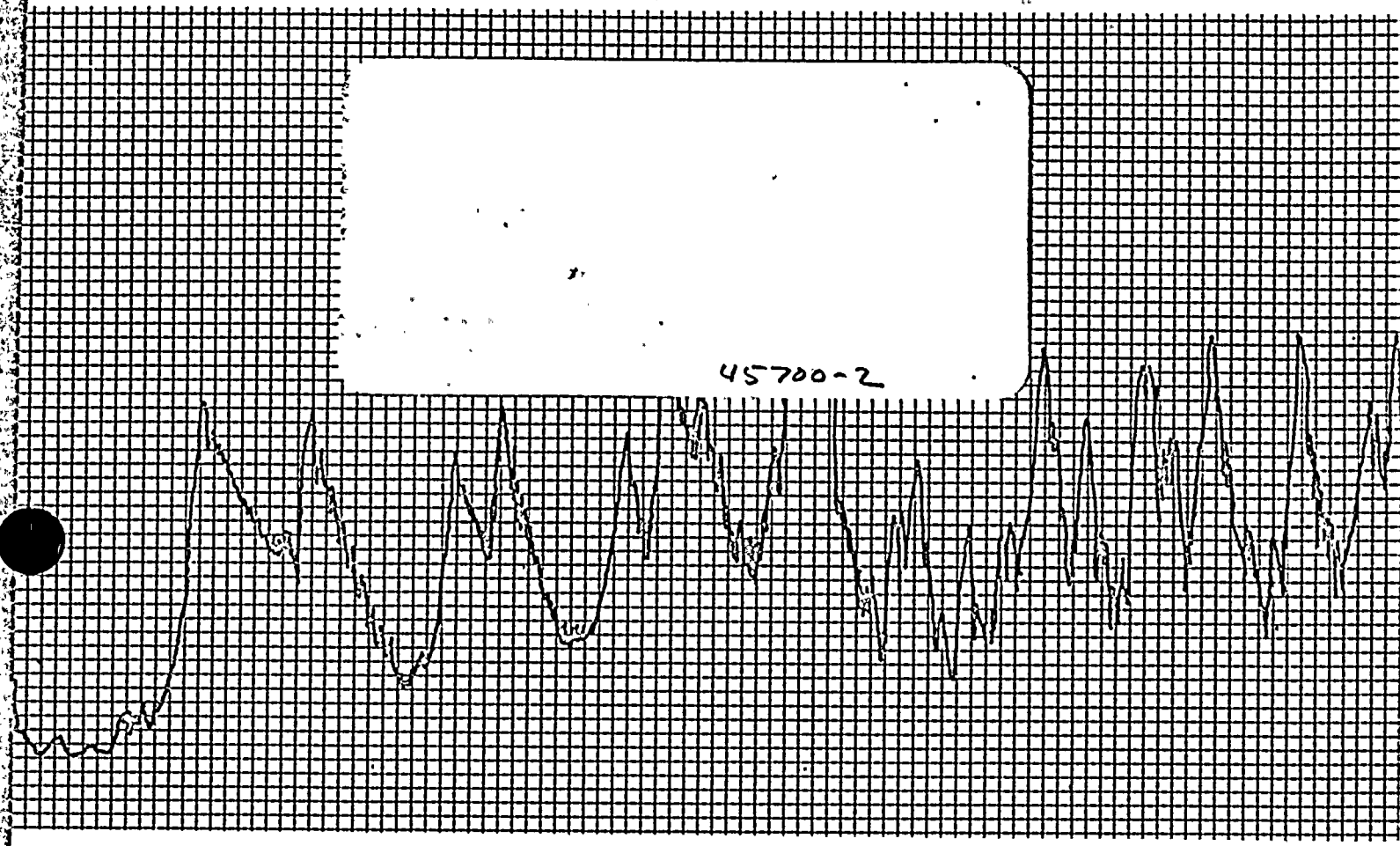
Title_____

cc:

Tel: (412) 343-5666
TRANSAMERICA DELAVAL INC.
250 Mt. Lebanon Blvd.
Pittsburgh, PA 15234
Toll-Free No. (W. VA & NY)
(1-800-441-7733)

WYLE
LABORATORIES SCIENTIFIC SERVICES & SYSTEMS GROUP

45700-2



NEQ
NUCLEAR ENVIRONMENTAL QUALIFICATION

test REPORT

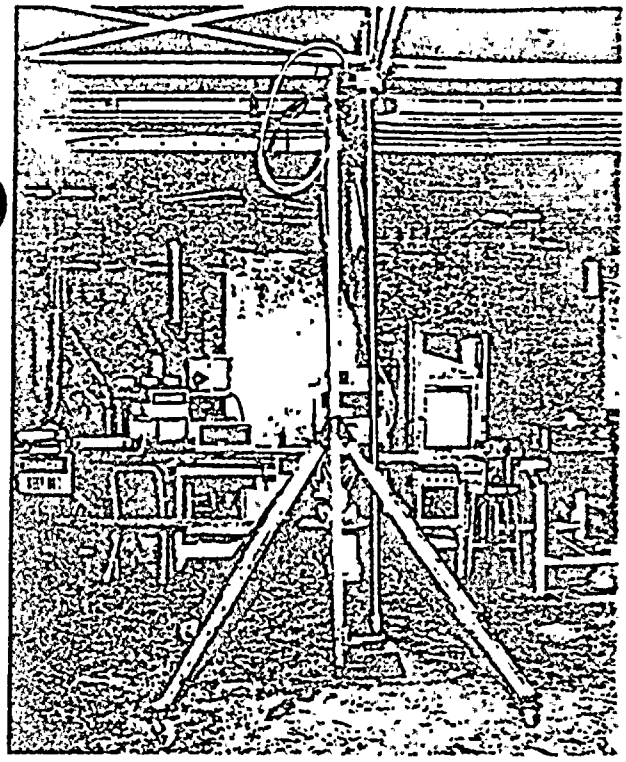
NUCLEAR QUALIFICATION TEST PROGRAM

ON

A LEVEL TRANSMITTER AND A RECEIVER

FOR

TRANSAMERICA DELAVAL
COWLES ROAD
PLAINVILLE, CONNECTICUT 06062



NEQ

Nuclear Environmental Qualification

Test Report

REPORT NO. 45700-2

WYLE JOB NO. 45700

CUSTOMER P. O. NO. 14410

PAGE i OF 342 PAGE REPORT

DATE December 14, 1982

SPECIFICATION (S) See References in Paragraph 5.0

1.0 CUSTOMER Transamerica Delaval

ADDRESS Cowles Road, Plainville, Connecticut 06062

2.0 TEST SPECIMEN One (1) Level Transmitter and a Receiver

3.0 MANUFACTURER Transamerica Delaval Gems Sensors Div.

4.0 SUMMARY

4.1 Results

The Liquid Level Transmitter and Receiver, hereinafter referred to as the test specimen, were subjected to a Nuclear Qualification Test Program to qualify them for use in nuclear power generating stations. The test program was performed as specified in Reference 5.1 and in accordance with Reference 5.2.

The results of each test are contained in Paragraph 3.0 of the appropriate sections.

STATE OF ALABAMA } ss.
COUNTY OF MADISON }

Michigan Professional Eng. Reg. No. 23187

Gregory K. Henry, being duly sworn, deposes and says: The information contained in this report is the result of complete and carefully conducted tests and is to the best of his knowledge true and correct in all respects. SEAL Gregory K. Henry 12/20/82

SUBSCRIBED and sworn to before me this 21st day of December 1982

Virginia R. Dent

Notary Public in and for the State of Alabama at large.

My Commission expires June 13, 1983

Wyle shall have no liability for damages of any kind to person or property, including special or consequential damages, resulting from Wyle's providing the services covered by this report

PREPARED BY Robert C. McCoy 12/14/82
R. C. McCoy

APPROVED BY F. R. Johnson 12/21/82
F. R. Johnson

WYLE Q. A. T. R. Stinson 12/21/82
T. R. Stinson

WYLE LABORATORIES SCIENTIFIC SERVICES & SYSTEMS GROUP
HUNTSVILLE, ALABAMA

4.0 SUMMARY (Continued)

4.1 Results (Continued)

TABLE I

NOTICES OF ANOMALY (NOA)

NOA No. 2 - On 9-17-81, at 9:30 p.m., the heating unit failed and the thermal aging chamber was turned off. The unit was repaired and at 10:55 a.m. on 9-18-81 the thermal aging chamber was turned back on and the program continued.

NOA No. 3 - On 9-30-81 at 7:30 a.m., the heating unit failed and the thermal aging chamber was turned off. The unit was repaired and, at 9:15 a.m. on 10-2-81, the thermal aging chamber was turned back on. The temperature stabilized at 120°C at 10:30 a.m. and the aging program was continued.

NOA No. 4 - On 12-4-81 at approximately 2:40 p.m., the redundant controller tripped and the temperature decreased below tolerance for approximately 75 minutes. The lowest temperature recorded was 180°F.

NOA No. 5 - On 12-20-81 at approximately 4:30 a.m., the facility power failed and the temperature decreased below tolerance for approximately 3 hours. The lowest temperature recorded was 150°F.

Reference NOA Nos. 2 through 5 presented in Appendix I of Section IV.

Notice of Anomaly No. 1 applies only to the specimen described in Wyle Laboratories' Test Report No. 45700-1 and is presented in that report.

4.2 Conclusions

All tests in this Qualification Program were successfully completed. The Notices of Anomaly were examined and were found to have no effect upon the qualification status of the test specimen.

Based upon the successful performance of the Level Transmitter and Receiver with the Wyle Laboratories-supplied interconnect cable, the Transamerica Delaval Level Transmitter and Receiver can be considered qualified to the requirements of Qualification Plan 45102-2, Revision B, provided a qualified interconnect cable is used for equipment interface.

SECTION XII

ACCIDENT QUALIFICATION (LOCA/MSLB)

1.0 REQUIREMENTS

The level transmitter shall be subjected for a period of 30 days to the LOCA/MSLB accident conditions of Figure XII-1 on a best-effort basis. The composition of the chemical spray is as follows:

- Boric Acid (.28 molar)
- Sodium Thiosulfate (.064 molar)
- Sodium Hydroxide (as required to make a pH of 11.0 maximum for the first 2 hours of the test and 8.5 to 9.0 thereafter)

The chemical spray shall be sprayed vertically downward at a rate of 0.15 (gal/min)/ft^2 of area of the test chamber projected onto a horizontal plane. Spray initiation shall begin 120 seconds into the second ramp and continue for the duration of the test.

1.1 Test Item Mounting and Orientation

A level transmitter (Type XM-54854) shall be attached to a Wyle-fabricated test fixture, utilizing mounting hardware supplied by the equipment supplier. The transmitter shall be inserted into a Wyle LOCA chamber. Penetrations will be utilized along the LOCA chamber wall to allow for passage of the Wyle-supplied cable to the test specimen. The flex conduit free end will connect to the chamber wall, thus protecting the cabling from the accident environment. All penetrations shall be potted with Scotchcast 9 epoxy. The transmitter float position shall be fixed throughout the duration of the LOCA test at the "1/2" position. The level transmitter shall be electrically connected to the receiver (Type RE-36520) during the test. The receiver shall be at room ambient conditions.

1.2 Instrumentation

The chamber pressure shall be measured with a pressure transducer in combination with a pressure gauge. The temperature of the chamber shall be measured through the use of three (3) thermocouples. The thermocouples shall be positioned along the centerline of the chamber in such a way as to be within 2 inches of the test specimen. Individual thermocouple readings shall be documented utilizing a Fluke 2240 data-logger or equivalent. These readings shall then be averaged and that

1.0 REQUIREMENTS (Continued)

1.2 Instrumentation (Continued)

average utilized for temperature control. The pH of the chemical spray shall be recorded prior to each ramp and on a daily basis thereafter. The flow rate of the chamical spray shall be recorded daily from a flow meter. The chamber temperature and pressure shall be recorded on a datalogger at 30-minute intervals, except during ramps when it shall be operated at its peak rate. The chamber temperature shall be continuously recorded utilizing a pen chart recorder.

1.3 Electrical Powering

Electrical power of 115 VAC (±5%), 60 Hz, shall be provided for operation of the receiver module. The receiver module shall be electrically connected to the level transmitter for the duration of the test.

1.4 Electrical Monitoring

Five (5) electrical monitoring channels shall be recorded on a datalogger to monitor the electrical operation of the test items. These channels shall be used to monitor the input voltage (115 VAC [±5%], 60 Hz) and the high and low alarm outputs of the receiver module. Two (2) channels on the datalogger shall be provided for recording chamber pressure and temperature. These readings shall be recorded at 30-minute intervals, except during the ramps, when the datalogger shall be operated at its peak rate. A pen chart recorder shall be used to continuously monitor chamber temperature. In addition, receiver module meter readings shall be taken at each ramp and, as a minimum, once per day.

1.5 Submergence Test

Following completion of the LOCA/MSLA simulation, the submergence test shall be performed. The Wyle LOCA chamber shall be filled to a height above the J-box using chemical spray solution as the medium. Pressure shall then be applied using GN_2 as a pressure source to simulate a depth of 15 feet at the top of the J-box. The submergence test duration shall be 30 minutes.

2.0 PROCEDURES

The transmitter was installed in the LOCA chamber and "Tefzel" insulated wire was used to replace the Wyle-supplied wire used in the previous phases of the test program to eliminate the possibility of the wiring causing an apparent specimen failure. The splices were insulated with Raychem WCSF-70/250-N heat-shrinkable tubing and the wires were routed through the chamber penetration.

The conduit was left disconnected from the chamber wall and the wires exposed to the LOCA conditions to provide qualification to the worst-case mounting configuration.

The float level was fixed by clamping a tubular aluminum spacer to the shaft and allowing the float to rest on top of the spacer. The spacer was 45 $\pm$ 1/8 inches long.

The receiver and transmitter were electrically connected by passing the Tefzel wire through a Scotchcast penetration and connecting the Cannon connector to the appropriate connector on the receiver.

The required temperature/pressure transients were accomplished by the injection of superheated steam and compressed air. The chemical spray was injected into the chamber through a fog nozzle which provided a uniform spray pattern as projected onto a horizontal plane. The flow rate was monitored using an orifice-type flowmeter and a differential pressure transducer. The transducer output was recorded on the datalogger to continuously monitor the flow rate. The pH of the chemical solution was monitored daily with Litmus paper and adjusted as necessary by adding sodium hydroxide.

After the 2-hour mark of the second transient, the temperature was maintained by injecting saturated steam and the pressure was maintained by injecting compressed air. The accident conditions were maintained for a total of 30 days.

Following the LOCA test, the submergence test was performed as required by Paragraph 1.0. The test chamber was filled with chemical solution, as described in Paragraph 1.0, until the top of the junction box was covered. The chamber was then sealed and pressurized to 6.5-7.0 psig (15-16 ft H_2O) at the top of the specimen. The pressure was maintained for 30 minutes.

3.0 RESULTS

The accident (LOCA) test required by Paragraph 1.0 was performed as specified in Paragraph 2.0. The LOCA test was conducted for 30 days. During this test, the alarm output, the slave meter reading, and the receiver meter remained within the acceptance tolerances (reference Paragraph 1.4 of Section I of this report) for the duration of the accident simulation.

An "information only" functional test was performed following the LOCA exposure. The results of those tests are presented on Data Sheets in Appendix III of this section.

Following the LOCA test, the submergence test required by Paragraph 1.5 was performed as specified in Paragraph 2.0.

The required and actual temperature/pressure profile of the LOCA/MSLB test is presented on Figure XII-1 in Appendix I of this section.

Photographs which show the test equipment used during the accident test and the specimen condition following the test are presented in Appendix II of this section.

Instrumentation which were used to obtain data during the LOCA/MSLB test and the additional functional test performed after LOCA are listed on Instrumentation Equipment Sheets presented in Appendix IV of this section.

SECTION XIII

POST-ACCIDENT QUALIFICATION TEST
FUNCTIONAL TEST
AND
POST-TEST INSPECTION

1.0 REQUIREMENTS

1.1 Post-Accident Qualification Test Functional Test

The functional test of Paragraph 1.0 of Section III shall be performed to determine the extent of the degradation incurred by the specimen during the accident qualification test. The specimen shall meet the acceptance criteria of Paragraph 1.4 of Section I.

1.2 Post-Test Inspection

Upon completion of the qualification program, the equipment will be visually inspected. The equipment will be disassembled to the extent necessary to perform the inspection. The condition of the equipment will be recorded. The test equipment disassembly shall include removing the J-box cover. The condition of the Dow 710 silicone fluid and the Wyle-supplied cable shall be annotated. Any signs of degradation shall be noted and a statement made as to whether the degradation was greater than, less than, or equal to the degradation experienced by the cable which was not immersed in the fluid.

2.0 PROCEDURES

The functional test required by Paragraph 1.0 was performed as specified in Paragraph 2.0 of Section III.

The J-box cover was removed and the silicone fluid and cable were visually inspected.

3.0 RESULTS

The functional test was performed and the receiver output recorded. The specimen met the acceptance criteria of Paragraph 1.4 of Section I.

3.0 RESULTS (Continued)

The silicone fluid in the J-box had darkened in color during the test program but remained translucent and liquid. The Wyle-supplied wire which was immersed in silicone oil (and therefore not replaced prior to LOCA) had minute cracks in the insulation, but was otherwise flexible and not discolored. The wire which was removed prior to LOCA was in the same condition as described above.

Data obtained during the post-accident qualification test functional test is contained on a Data Sheet presented in Appendix I of this section.

Equipment used to record data during the post-accident qualification test functional test are listed on an Instrumentation Equipment Sheet presented in Appendix II of this section.

Transamerica Delaval

Transamerica Delaval Inc.
Gems Sensors Division
Plainville, Connecticut 06062
(203) 677-1311

Telex 99306

25 March 1983

Rochester Gas & Electric
89 East Avenue
Rochester, NY 14649

Attention: Dick Baker
Engineering

Subject: Wyle Report No. 45700-1
Bechtel SNUPPS Test

Reference: Robert E. Ginna
P. O. #N-EG-19888

The enclosed Qualification Report is the final report as prepared in accordance with Bechtel SNUPPS' requirements. No comments will be allowed regarding this report and no changes will be made except those requested by Bechtel SNUPPS. Any comments or changes made by Bechtel SNUPPS will be submitted by page only, rather than as a new report.

One copy of the report is enclosed. Any additional copies will be supplied only against a separate purchase order at a cost of $750.00 each. This report will discontinue the control of Gems' Quality Control Manual. Final drawings are being prepared and will be submitted by 31 March 1983.

The enclosed copy of this letter shall be signed and returned to Transamerica Delaval, Gems Sensors Division within five (5) days after receipt of this report.

John T. Pech
Sales Correspondent

JTP:ncm

Enc.: Report #45700-1
One Copy of Letter

cc:

Received Date_____

By_____

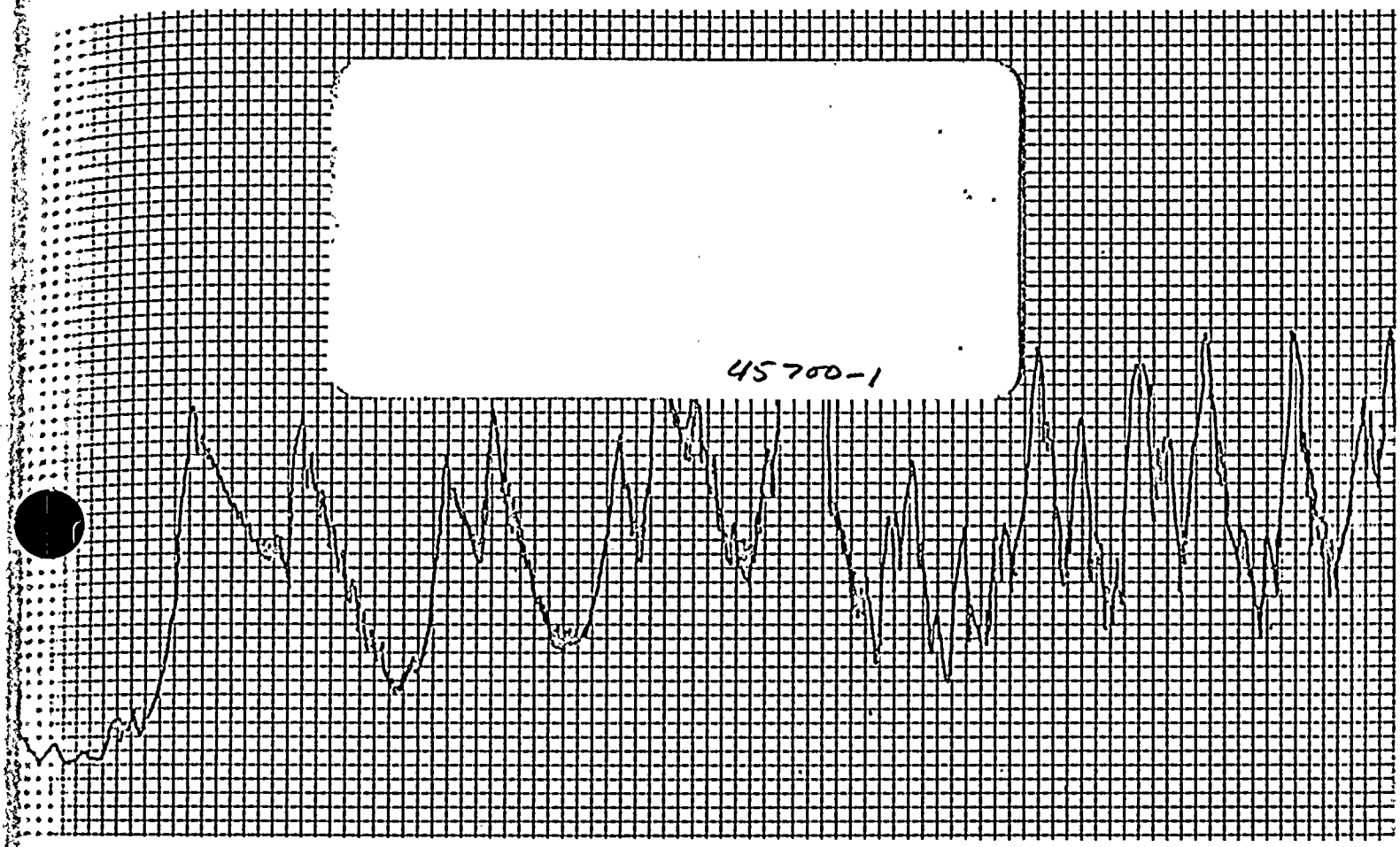
Title_____

Tel: (412) 343-5666

TRANSAMERICA DELAVAL INC.
250 Mt. Lebanon Blvd.
Pittsburgh, PA 15234

Toll-Free No. (W. VA & NY)
(1-800-441-7733)

WYLE
LABORATORIES SCIENTIFIC SERVICES & SYSTEMS GROUP



NEQ
NUCLEAR ENVIRONMENTAL QUALIFICATION

test REPORT

NUCLEAR QUALIFICATION TEST PROGRAM

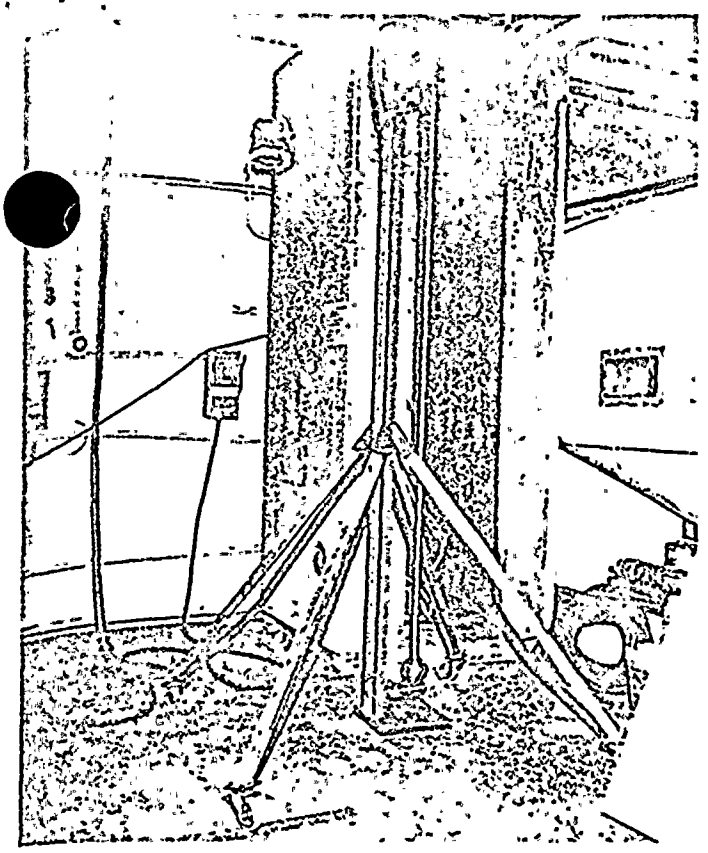
ON

A LIQUID LEVEL TRANSMITTER
AND
RECEIVER

FOR USE IN THE
STANDARDIZED NUCLEAR UNIT POWER PLANT SYSTEM
(SNUPPS)

FOR

TRANSAMERICA DELAVAL
COWLES ROAD
PLAINVILLE, CONNECTICUT 06062



NEQ

Nuclear Environmental Qualification

Test Report

REPORT NO. 45700-1

WYLE JOB NO. 45700

CUSTOMER P. O. NO. 14410

PAGE i OF 428 PAGE REPORT

DATE December 8, 1982

SPECIFICATION (S) See References in Paragraph 5.0

1.0 CUSTOMER Transamerica Delaval

ADDRESS Cowles Road, Plainville, Connecticut 06062

2.0 TEST SPECIMEN One (1) Level Transmitter and Receiver

3.0 MANUFACTURER Transamerica Delaval Gems Sensors Div.

4.0 SUMMARY

4.1 Results

The Liquid Level Transmitter and Receiver, hereinafter referred to as the test specimen, were subjected to a Nuclear Qualification Test Program to qualify them for use in the Standardized Nuclear Unit Power Plant System (SNUPPS). The test program was performed as specified in Reference 5.1 and in accordance with Reference 5.2.

The results of each test are contained in Paragraph 3.0 of the appropriate sections.

STATE OF ALABAMA, COUNTY OF MADISON } ss.

Michigan Professional Eng. Reg. No. 23187

Gregory K. Henry, being duly sworn, deposes and says: The information contained in this report is the result of complete and carefully conducted tests and is to the best of his knowledge true and correct in all respects.

SEAL Gregory K. Henry 12/8/82

SUBSCRIBED and sworn to before me this 8th day of December, 1982

Virginia L. Reed

Notary Public in and for the State of Alabama at large.

My Commission expires June 13, 1983

Wyle shall have no liability for damages of any kind to person or property, including special or consequential damages, resulting from Wyle's providing the services covered by this report.

PREPARED BY Robert C. McCoy

R. C. McCoy, Jr.

APPROVED BY F. R. Johnson

F. R. Johnson

WYLE Q. A. T. R. Stinson 12/9/82

T. R. Stinson

WYLE LABORATORIES SCIENTIFIC SERVICES & SYSTEMS GROUP HUNTSVILLE, ALABAMA

4.0 SUMMARY (Continued)

4.2 Conclusions

All tests were successfully performed with the exception of the Loss-of-Coolant Accident/Main Steam Line Break (LOCA/MSLB) test. NOA's were examined and with the exception of NOA No. 7, all were found to have no effect upon the qualification status of the test specimen. NOA No. 7 refers to an out-of-specification condition which occurred during the LOCA accident when the receiver output and meter reading were out-of-specification low. In addition, NOA No. 7, Revision A, refers to an out-of-specification condition on the functional test performed after the LOCA and before the submergence test. This functional test was not required by Qualification Plan 45102-1; however, it was performed to verify equipment condition prior to the submergence test because of the out-of-specification conditions encountered during the LOCA functional test.

The specimen cannot be considered qualified to the Loss-of-Coolant Accident in the test configuration of Qualification Plan 45102-1, Revision C. This test configuration included Bechtel- (SNUPPS) supplied interconnect cable utilized for equipment interface. See Section 3.1.2.1 of Reference 5.2. In a test on an identical Transamerica Delaval transmitter with a Wyle Laboratories-supplied Tefzel-insulated cable which was installed new and was not irradiated or aged (see Qualification Plan 45102-2, Revision A, and Test Report 45700-2). The specimen functioned properly throughout the LOCA and the subsequent functional tests.

Although the exact cause of failure is unknown, it is very probable that the Bechtel-supplied interconnect cable precipitated the failure of the specimen on which it was installed. The cable had been supplied to Wyle as "Pre-qualified" and no aging analysis was performed before the specimen (and cable) was subjected to thermal aging and irradiation prior to the subsequent LOCA test. The cable had become cracked, discolored, and very brittle during thermal aging, as documented in NOA No. 6 presented in Appendix I of Section V.

Although the anomalies discussed above occurred, the Level Transmitter and Receiver can be considered qualified to the requirements of WLQP 45102-1, Rev. C, provided that a qualified interconnect cable is used for equipment interface. This is based upon the successful performance of an identical (with the exception of mounting bracket) transmitter with a Wyle-supplied interconnect cable as documented in Wyle Laboratories Qualification Report No. 45700-2.

SECTION II

RADIATION EXPOSURE

1.0 REQUIREMENTS

1.1 Transmitter XM-54852A

The radiation requirement for the level transmitters is the normal dose of $6x10^6$ rads plus the accident dose of $1.1x10^8$ rads (a 10% conservatism margin was added) for a total dose of $1.16x10^8$ rads total integrated dose.

The first 1,000 rads of exposure shall be performed with the receiver in the chamber. The remaining exposure shall be performed with the transmitter only in the chamber, while powered to the receiver. As a minimum, the receiver module input voltage and output current, as well as the "pointer" position, shall be recorded once per day after the first 1,000 rads.

1.2 Receiver RE-36562

The radiation requirement for the receiver module is the normal dose plus the accident dose (a 10% conservatism margin was added), for a total of $1.1x10^3$ rads total integrated dose.

The receiver shall be connected to the transmitter and both units exposed to a minimum total integrated dose of $1x10^3$ rads gamma, air equivalent, using a Cobalt 60 source. The float shall be in the "1/2" position; 115 VAC (±5%), 60 Hz, shall be applied to the receiver. The converter output shall be observed during the radiation exposure and the input voltage and output current (approximately 12 mA) shall be recorded before, at least once during, and after irradiation.

2.0 PROCEDURES

The specimen was shipped in a Wyle vehicle to the Georgia Institute of Technology Neely Nuclear Research Center for the required irradiation. The specimen was assembled by Wyle personnel in the configurations required by Paragraph 1.0.

The irradiation was conducted by Georgia Institute of Technology personnel as described in the Letters of Certification presented in Appendix II of this section. The specimen was monitored before, during and after the irradiation, and the data obtained was recorded on Data Sheets which are presented in Appendix IV of this section.

3.0 RESULTS

The specimen was irradiated as required by Paragraph 1.0, and the irradiation was performed as specified in Paragraph 2.0. The specimen complied with the requirements of Paragraph 1.4 of Section I.

During the radiation exposure at Georgia Institute of Technology, the level transmitter was bumped during manipulation of the gamma source, causing the transmitter to fall from its vertical position and strike a table. The only visible damage to the transmitter was a dent in the flexible conduit. Approximately one teaspoon of oil leaked from the J-box. Reference Notice of Anomaly No. 1 presented in Appendix I of this section.

Photograph II-1 shows the extent of damage incurred during the fall. This photograph is presented in Appendix III of this section.

Letters of Certification which document the irradiation performance are presented in Appendix II of this section.

Data Sheets which contain data obtained during the daily monitoring are presented in Appendix IV of this section.

The equipment used to obtain data during the daily monitoring of the specimen is listed on an Instrumentation Equipment Sheet presented in Appendix III of Section I of this report.

SECTION III

POST-RADIATION FUNCTIONAL TEST

1.0 REQUIREMENTS

Following the irradiation, one of the two 5-feet sections of flex conduit shall be removed. A system level functional test shall be performed to determine the extent of any damage incurred during the radiation exposure. The specimen shall comply with the acceptance criteria contained in Paragraph 1.4 of Section I of this report.

2.0 PROCEDURES

2.1 Functional Tests for RE-36562 and XM-54852A

The subject equipment was evaluated utilizing the following system level functional test procedure:

1) Connect all electrical plugs and cables on the receiver and transmitter.

2) With the "ON-OFF-FULL REF" toggle switch in the "OFF" position, zero the meter, utilizing the pointer set screw adjustment. If not required, this step may be omitted. Document if zeroing is or is not performed.

3) Adjust the receiver voltage input to 115 VAC (±5%).

4) Hold the "ON-OFF-FULL REF" toggle switch on the receiver module to "FULL REF" while performing Step 5.

5) Adjust the "Calibrate" pot on the receiver module until the meter reads full scale. If not required, this step may be omitted. Document if calibration is or is not performed.

6) Position the float on the level transmitter to the "empty" position.

7) Record the meter reading. Record the receiver module converter output. The output shall be 4 to 20 milliamperes into a 100 to 800 ohm load.

8) Repeat Steps 4) and 5) for the "1/4", "1/2", "3/4", and "full" positions, utilizing the spacer bars manufactured for the base-line functional calibration.

2.0 PROCEDURES (Continued)

2.1 Functional Tests for RE-36562 and XM-54852A (Continued)

9) Repeat Steps 3) through 6) for each voltage variation extreme. The low voltage will be 105.8 VAC (-5,+0). The high voltage will be 124.2 VAC (-0,+6).

3.0 RESULTS

The post-radiation functional test required by Paragraph 1.0 was performed as specified in Paragraph 2.0. An additional insulation resistance test was performed on the cable to determine if any damage was sustained in the fall at Georgia Tech. The insulation resistance was in the range of 10^{10} ohms, which indicated that the cable suffered no damage.

The specimen complied with the requirements of Paragraph 1.0 with the exception of the "Full" and "3/4" positions of the level transmitter. Reference Notice of Anomaly No. 10 presented in Appendix I of this section. The data obtained during the post-radiation functional test is contained on Data Sheets presented in Appendix II of this section. The equipment used to obtain the data in this test is listed on an Instrumentation Equipment Sheet presented in Appendix III of this section.

SECTION IV

THERMAL AGING AND OPERATIONAL CYCLING

1.0 REQUIREMENTS

The level transmitter shall be thermally aged for 90 days (2,161.3 hours) at 120°C and uncontrolled relative humidity.

The receiver module shall be thermally aged for 59.15 days (1,420 hours) at 100°C and uncontrolled relative humidity.

Operational cycling will be performed on the system level. The level switch and the level transmitter/receiver module will be cycled for 220 cycles each, as specified by Bechtel Power Corporation (a 10% conservatism margin has been added). A cycle is defined as manually moving the float from the bottom stop to the top stop and back to the bottom stop. The receiver module/level transmitter will be electrically connected and powered with 115 (±5%) VAC, 60 Hz. Operational cycling shall be performed following completion of thermal aging.

2.0 PROCEDURES

The transmitter and receiver were installed in separate chambers and were thermally aged by exposure to the time at temperature required by Paragraph 1.0.

The cycle aging was accomplished by attaching a cord to the bottom of the float and manually raising it to the top of the transmitter shaft 220 times. The receiver was connected and powered during this cycling and the meter was observed for full-scale deflection.

3.0 RESULTS

The aging program required by Paragraph 1.0 was performed as specified in Paragraph 2.0.

During the course of the thermal aging program, the chamber which contained the transmitter was below the temperature requirement for 95 hours and 40 minutes due to heating unit failures. The heater was repaired and the transmitter was exposed to the total (accumulated) time at temperature required by Paragraph 1.0. Reference Notices of Anomaly Nos. 2, 3, 4 and 5 presented in Appendix I of this section. The receiver was exposed to the required time at temperature with no interruptions.

3.0 RESULTS (Continued)

Photographs of the transmitter and receiver, installed in their respective thermal aging chambers, are presented in Appendix II of this section.

Equipment used to record and control the temperature during the thermal aging program are listed on an Instrumentation Equipment Sheet presented in Appendix III of this section.

SECTION V

POST-AGING FUNCTIONAL

1.0 REQUIREMENTS

The functional test of Paragraph 1.0 of Section III shall be performed to determine the extent of the degradation incurred by the specimen during the aging program. The specimen shall meet the acceptance criteria of Paragraph 1.4 of Section I.

2.0 PROCEDURES

The functional test required by Paragraph 1.0 was performed as specified in Paragraph 2.0 of Section III.

3.0 RESULTS

The functional test was performed and the receiver output recorded. Following the thermal aging, the Bechtel-supplied cable was discolored, cracked, and very brittle. Reference Notice of Anomaly No. 6 presented in Appendix I of this section.

At the Customer's direction, the cable remained attached to the specimen for the remainder of the test program.

During the post-aging functional test, all measured data was within the acceptable limits as established in Paragraphs 1.4.1 and 1.4.2 of Section I. This data is tabulated on a Data Sheet presented in Appendix III of this section.

Photographs which depict the condition of the cable after thermal aging are presented in Appendix II of this section.

Equipment used to record data during the post-aging functional test are listed on an Instrumentation Equipment Sheet presented in Appendix IV of this section.

SECTION X

SEISMIC SIMULATION

1.0 REQUIREMENTS

1.1 Specimen Mounting

The specimens shall be mounted on Wyle-fabricated wall mount test fixtures as shown in Figure X-1. The level transmitter shall be mounted to the test fixture using four (4) 1/2" dia.-13 x 1-1/2" long Grade 5 bolts, washers and lockwashers which shall be torqued to 250 in.-lb; the modular receiver shall be mounted to the test fixture using four (4) 5/16" dia.-18 x 1" long stainless steel bolts, washers, lockwashers and nuts, which shall be torqued to 150 in.-lb. The specimen/fixture configurations shall then be placed on the Wyle Multiaxis Seismic Simulator Table such that the front-to-back axes of the specimens shall be colinear with the horizontal excitation of the test table. For the second orientation, the specimen/fixture configurations shall be rotated 90 degrees in the horizontal plane to the side-to-side axis and the specified sequence of tests shall be repeated. The test fixtures shall be welded to the table in each orientation. The mounting of the specimens shall simulate their actual in-service mounting configurations as closely as practical.

To account for the effects of the uniform mass of water (0.0443 lb./in.) on a submerged level transmitter, four lengths of 1/4"-dia. standard hoist wire rope (which, including the tape used for tie-down, approximately constitute the required simulated weight) shall be taped to the stem assembly of the level transmitter prior to seismic testing.

1.2 Resonance Search

A low-level (approximately 0.2 g horizontally and vertically) biaxial sine sweep from 1 to 40 Hz shall be performed in each test orientation to establish major resonances. The sweep rate shall be two octaves per minute. Transmissibility plots of the specimen response accelerometers from the resonance search test in each orientation shall be provided.

1.3 Random Multifrequency Tests

The specimens shall be subjected to 30-second duration biaxial multifrequency random motion which shall be amplitude-controlled in one-third octave bandwidths spaced one-third octave apart over the frequency range of 1 to 40 Hz. Two simultaneous, but independent, random signals shall be used as the excitation to provide phase-incoherent horizontal and vertical motions. The amplitude of each one-third octave bandwidth shall be independently adjusted in each axis until the Test Response

1.0 REQUIREMENTS (Continued)

1.3 Random Multifrequency Tests (Continued)

Spectra (TRS) envelop the Required Response Spectra (RRS). The resulting table motion shall be analyzed by a response spectrum analyzer at five percent (5%) damping, and plotted at one-third octave intervals over the frequency range of 1 to 200 Hz.

Five (5) Operating Basis Earthquake (OBE) tests, followed by one (1) Safe Shutdown Earthquake (SSE) test, shall be performed in both the front-to-back/vertical (FB/V) and the side-to-side/vertical (SS/V) orientations.

The OBE and SSE RRS are shown in Figures X-2 and X-3. TRS plots of the control accelerometers from a representative OBE and the SSE test at 5% damping in each test orientation shall be provided.

1.4 Specimen Response

Six (6) uniaxial piezoelectric accelerometers shall be mounted on the test specimens to monitor response to the seismic excitation. Placement of these accelerometers shall be as directed by the Wyle Project Engineer. FM tape and oscillograph recorders shall provide a record of each accelerometer's response. TRS plots from the SSE tests, analyzed at 5% damping, shall be included.

1.5 Electrical Powering

Electrical power of 115 (±5%) VAC, 60 Hz, single-phase, shall be provided for operation of the test specimens during the Seismic Test Program.

1.6 Electrical Monitoring

One (1) channel of electrical monitoring shall be recorded on an oscillograph recorder to monitor the 4-20-milliampere output of the receiver.

2.0 TEST PROCEDURES

The Seismic Test Program consisted of subjecting the test specimens to resonance search testing and qualification level biaxial random multifrequency testing in each of two test orientations, as specified in Paragraph 1.0. The specimens were instrumented with accelerometers, and electrically powered during the test program.

3.0 TEST RESULTS

The specimens demonstrated sufficient integrity to withstand, without compromise of structures or functions, the prescribed simulated seismic environment.

The oscillograph monitoring the Receiver output indicated no anomalous output.

Table X-I, Appendix I of this section, contains descriptions of the test runs.

Figure X-1, Appendix II of this section, shows the mounting concept of the specimens.

Figures X-2 and X-3, Appendix II of this section, show the horizontal and vertical OBE and SSE RRS, respectively.

Photographs X-1 through X-5, Appendix III of this section, show the specimen mounting details.

Photographs X-3 through X-6, Appendix III of this section, show the specimen response accelerometer locations.

Appendix IV of this section contains Transmissibility plots from the resonance search tests.

Appendix V of this section contains the Test Response Spectrum plots of the control accelerometers from a representative OBE test and the SSE test in each test orientation. Additionally, TRS plots of the specimen response accelerometers from the SSE test in each test orientation are also included.

NOTE: The TRS did not envelop the RRS in the frequency range from 1 Hz to 12.5 Hz. However, the obtained TRS constitute the machine limits of the Wyle Biaxial Seismic Simulator for this particular test arrangement.

Appendix VI contains the Instrumentation Log Sheets and the Instrumentation Equipment Sheets.

BIW CABLE SYSTEMS, INC.
65 BAY STREET · BOSTON, MA 02125 · (617) 265-2102 · TELEX 94-0604

February 3, 1982

Rochester Gas & Electric Corporation
89 East Avenue
Rochester, NY 14649

Attention: Purchasing Department

Gentlemen:

ROCHESTER GAS & ELECTRIC P.O. #N-EG-21257
BIW JOB #1D269

Enclosed is a certificate of compliance, general data sheet and laboratory test report covering BIW part number 13285-H-002, as required by your above mentioned purchase order.

If you have any questions regarding this test data, please contact us.

Very truly yours,

BIW CABLE SYSTEMS, INC.

Francis J. Ellard
Chief Inspector
Quality Control

md

Enclosure

BOSTON
INSULATED
WIRE & CABLE CO.

55 BAY STREET BOSTON MASSACHUSETTS 02125 617 265-2200 TELEX 94-0836

Certificate of Compliance

DATE 1-27-82

PURCHASE ORDER N-EG-21257

TO: Rochester Gas & Electric
89 East Avenue
Rochester, NY 14649

DESCRIPTION	T&P	REEL	LENGTH
BIW Job # 1D269 BIW P/N 13285-R-002 TSP # 16 AWG BOSTRAD 7E	3-20011	001	3300'

This is to certify that the above material furnished against the above purchase order number is made in full accordance with the referenced specifications, and meets all of the requirements of the specifications.

Electrical test reports are on file and are available for examination upon request.

Joseph Guilford

QUALITY CONTROL
SUPERVISOR

BIW CABLE SYSTEMS, INC.

65 BAY STREET · BOSTON, MA 02125 · (617) 265-2102 · TELEX 94-0604

CERTIFICATE OF COMPLIANCE

B.W. W.O. NO.	BIW ORDER NO.	CUSTOMER'S ORDER NO.
	1D269	N-EG-21257

SHIP TO
Ginna Station Constr.
1503 Lake Road
Ontario, NY 14519

SOLD TO
Rochester Gas & Electric
89 East Avenue
Rochester, NY 14649

DATE
2/3/82

QUANTITY SHIPPED	ITEM	BIW PART NUMBER	DESCRIPTION
3300'	2	13285-H-002	BIW certifies this item is in compliance with IEEE-383-1974 and the requirements of your purchase order, BIW specifications and 10CFR Part 21

This is to certify that the above material furnished against the above purchase order number is made in full accordance with the referenced specification(s) and meets all of the requirements of the specification(s) Electrical test reports are on file and are available for examination upon request.

CHIEF INSPECTOR, QUALITY CONTROL

BIW CABLE SYSTEMS, INC.

Bay Street * Boston * Massachusetts 02125

LABORATORY TEST REPORT

DATE: February 3, 1982

LAB. TEST NO.: 811053

CUSTOMER: Rochester Gas & Electric

PURCHASE ORDER NO.: N-EG-21257

BIW P/N: 13285-H-002

CABLE TYPE: TSP #16 AWG

CONTRACT NO.: 1D269

SPECIFICATION NO.: QA-20, Rev. 3 11-15-78

ITEM NO.: 2

BILL OF MATERIAL NO.:

T E S T S P E R F O R M E D

Original Tensile Strength & Elongation (jacket & insulation)

Air Oven Aging (jacket & insulation)

Set (jacket)

Stress @ 200% (jacket)

Oil Immersion Aging (jacket)

This is to certify that the following cable furnished against the above order number was tested in full accordance with the referenced specification(s) and meets all of the requirements of the specification(s).

Electrical test reports are on file and are available for examination upon request.

APPROVED BY: [redacted]
LABORATORY MANAGER

AUTHORIZED FOR RELEASE BY:
QUALITY CONTROL
CHIEF INSPECTOR

BIW CABLE SYSTEMS, INC.

LABORATORY TEST REPORT

CUSTOMER: Rochester Gas & Electric
CUSTOMER P.O. NO. N-EG-21257
CUSTOMER ITEM NO. 2
DATE February 3, 1982

LAB. TEST NO. 81I053
BIW JOB NO. 1D269
BIW PART NUMBER 13285-H-002
SPEC. OA-20, Rev. 3 11-15-78

* *

INSULATION TESTS

TEST	CONDITIONING	SPECIFIED VALUES	MEASURED VALUES
Orig. Tensile Str. Orig. Elongation	None	700 psi (min) 250%	1657 psi 455%
Air Oven Aging Tensile Strength Elongation	7 days @ 121°C	 75% OT (min) 75% OE	 110% 80%

JACKET TESTS

TEST	CONDITIONING	SPECIFIED VALUES	MEASURED VALUES
Orig. Tensile Str. Orig. Elongation	None	1800 psi (min) 300%	2561 psi 340%
Air Oven Aging Tensile Strength Elongation	7 days @ 100°C	 85% OT (min) 65% OE	 108% 78%

CABLE TESTS

TEST	REQUIREMENTS	RESULTS

BIW CABLE SYSTEMS, INC.

LABORATORY TEST REPORT

CUSTOMER: Rochester Gas & Elec. LAB. TEST NO. 811053

CUSTOMER P.O. NO. N-EG-21257 BIW JOB NO. 1D269

CUSTOMER ITEM NO. 2 BIW PART NUMBER 13285-H-002

DATE February 3, 1982 SPEC. OA-20, Rev. 3 11-15-78

* *

INSULATION TESTS

TEST	CONDITIONING	SPECIFIED VALUES	MEASURED VALUES

JACKET TESTS

TEST	CONDITIONING	SPECIFIED VALUES	MEASURED VALUES
Set	None	30% (max)	5%
Stress @ 200%	None	500 psi (min)	1317 psi
Oil Immersion Aging Tensile Strength Elongation	18 hrs. @ 121°C in ASTM #2 Oil	 60% OT (min) 60% OE	 86% 85%

CABLE TESTS

TEST	REQUIREMENTS	RESULTS

BIW | CABLE SYSTEMS, INC.

GENERAL DATA SHEET

Q.C. FORM 017

CUST. [redacted]ester Gas & Electric CUST. P.O. # N-EG-21257 ITEM # 2 BIW PART # 13285-H-002 JOB # 10269

SPEC.# QA-20, Rev. 3 [redacted]15-78 DATE 2/3/82

PHYSICAL DATA			ELECTRICAL DATA						
LOT SIZE _____ NO. INSPECTED _____ NO. PASSED _____			REEL NO.	LENGTH FT.	CONTINUITY & SHORTS (110 VAC BTWN SHLDS)	DIEL VOLTAGE WITHSTAND 5 MIN	I.R. MIN	D.C. RES. MAX	FA #
DESCRIPTION	SPECIFIED	MEASURED				2500 VAC	3240 MEGΩ/M'	4.62 Ω/M'	
JKT.DIA.	.415 MAX .405 NOM	.397 NOM.	001	3300'	ok	ok	16184	4.00	3-20011
JKT. THKN.	.045 NOM .036 MIN	.040 MIN.							
INSUL. THKN.	.023 MIN	.025 MIN.							
JKT. INSUL. THKN.	.014 MIN	.015 MIN.							
CABLE DESCRIPTION									
CONDUCTOR	2 x #16 AWG, 7/.0192" TC								
PRINT	BIW Cable Systems, Inc. 2/C #16 AWG 600 Volts								
SHIELD	Alum-Mylar tape, #18 AWG 7/.0152" TC drain wire								
COLOR CODE	Printed								

REMARKS:

APPROVED BY: [redacted]

QUALITY CONTROL MANAGER

BIW CABLE SYSTEMS, INC.
65 BAY STREET · BOSTON, MA 02125 · (617) 265-2102 · TELEX 94-0604

April 1, 1982

Rochester Gas & Electric Corporation
89 East Avenue
Rochester, NY 14649

Attention: Purchasing Department

Gentlemen:

ROCHESTER GAS & ELECTRIC P.O. #N-EG-21257
BIW JOB #1D269

Enclosed is a certificate of compliance, general data sheet and laboratory test report covering BIW part number 13244-H-007, as required by your above mentioned purchase order.

If you have any questions regarding this test data, please contact us.

Very truly yours,

BIW CABLE SYSTEMS, INC.

Francis O. Ellard
Chief Inspector
Quality Control

FJE/md

Enclosure

BIW CABLE SYSTEMS, INC.

65 BAY STREET · BOSTON, MA 02125 · (617) 265-2102 · TELEX 94-0604

CERTIFICATE OF COMPLIANCE

BIW INV. NO.	BIW ORDER NO.	CUSTOMER'S ORDER NO.
	1D269	N-EG-21257

SHIP TO
Ginna Station Construction
1503 Lake Rd.
Ontario, NY 14519

SOLD TO
Rochester Gas & Electric
89 East Avenue
Rochester, NY 14649

DATE
3/19/82

QUANTITY SHIPPED	ITEM	BIW PART NUMBER	DESCRIPTION
1100'	1	13244-H-007	BIW certifies this item is in compliance with IEEE-383-1974 and the requirements of your purchase order, BIW specifications and 10CFR Part 21

This is to certify that the above material furnished against the above purchase order number is made in full accordance with the referenced specification(s) and meets all of the requirements of the specification(s) Electrical test reports are on file and are available for examination upon request.

CHIEF INSPECTOR, QUALITY CONTROL

BIW CABLE SYSTEMS, INC.

Bay Street * Boston * Massachusetts 02125

LABORATORY TEST REPORT

DATE: April 1, 1982 LAB. TEST NO.: 82C051

CUSTOMER: Rochester Gas & Electric PURCHASE ORDER NO.: N-EG-21257

BIW P/N: 13244-H-007 CABLE TYPE: Control

CONTRACT NO.: 1D269 SPECIFICATION NO.: QA-20, Rev. 3 11-15-78

ITEM NO.: 1 BILL OF MATERIAL NO.: 5-03071

TESTS PERFORMED

Original Tensile Strength & Elongation (jacket & insulation)

Air Oven Aging (jacket & insulation)

This is to certify that the following cable furnished against the above order number was tested in full accordance with the referenced specification(s) and meets all of the requirements of the specification(s).

Electrical test reports are on file and are available for examination upon request.

APPROVED BY: _____
LABORATORY MANAGER

AUTHORIZED FOR RELEASE BY: _____
QUALITY CONTROL
CHIEF INSPECTOR

BIW CABLE SYSTEMS, INC.

LABORATORY TEST REPORT

CUSTOMER: Rochester Gas & Electric LAB. TEST NO. 82C051

CUSTOMER P.O. NO. N-EG-21257 BIW JOB NO. 1D269

CUSTOMER ITEM NO. 1 BIW PART NUMBER 13244-H-007

DATE April 1, 1982 SPEC. OA-20, Rev. 3 11-15-78

* *

INSULATION TESTS

TEST	CONDITIONING	SPECIFIED VALUES	MEASURED VALUES
Orig. Tensile Str. Orig. Elongation	None	700 psi (min) 250%	2245 psi 630%
Air Oven Aging Tensile Strength Elongation	7 days @ 121°C	 75% OT (min) 75% OE	 80% 79%

JACKET TESTS

TEST	CONDITIONING	SPECIFIED VALUES	MEASURED VALUES
Orig. Tensile Str. Orig. Elongation	None	1800 psi (min) 300%	2400 psi 350%
Air Oven Aging Tensile Strength Elongation	7 days @ 100°C	 85% OT (min) 65% OE	 99% 87%

CABLE TESTS

TEST	REQUIREMENTS	RESULTS

BIW CABLE SYSTEMS, INC.

GENERAL DATA SHEET

Q.C. FORM 017

CUST. Rochester Gas & Electric CUST. P.O. # N-EG-21257 ITEM # 1 BIW PART # 13244-H-007 BIW JOB # 1D269

SPEC.# OA-20, Rev. 3 11-15-78 DATE 3/19/82

PHYSICAL DATA			ELECTRICAL DATA							
LOT SIZE _____ NO. INSPECTED _____ NO. PASSED _____			REEL NO.	LENGTH FT.	CONTINUITY & SHORTS CHECK	DIEL VOLTAGE WITHSTAND 5 MIN	I.R. MIN	D.C. RES. MAX	FA #	
DESCRIPTION	SPECIFIED	MEASURED				3500 VAC	2617 MEGΩ/M'	1.72 Ω/M'		
JKT. DIA.	.730 MAX .715 NOM	.730 NOM.	002	1100'	ok	ok	15900	1:68	3-20184	
JKT. THKN.	.060 NOM .048 MIN	.054 MIN.								
INSUL. THKN.	.030 NOM .027 MIN	.030 MIN.								
JKT. INSUL. THKN.	.020 NOM .016 MIN	.018 MIN.								
CABLE DESCRIPTION										
PRINT	BIW Cable Systems Inc. (year) 7/C-12 AWG EPR/ HYP Insul, Hyp Jkt, 600V									
CONDUCTOR	7 x #12 AWG, 7/.0305" TC									
SHIELD	n/a									
COLOR CODE	Printed									

REMARKS:

APPROVED BY: _____
QUALITY CONTROL MANAGER

ORIGINATING DEPT.

RGE

PURCHASE ORDER NO. N-LG-21257

TO BIW CABLE SYSTEMS
65 BAY ST.
BOSTON, MA 02125

-245 Blackburn

BILL TO
ROCHESTER GAS AND ELECTRIC CORPORATION
89 EAST AVENUE
ROCHESTER, NEW YORK 14649
ATTENTION: PURCHASING DEPT.

ROCHESTER GAS AND ELECTRIC CORPORATION

DATE 12-9-81

3-19-82 call 2 wk.

SHIP TO

ATTENTION R.A. BAKER - EWR 3262
ADDRESS GINNA STATION CONSTRUCTION
1503 LAKE RD.
~~ONTARIO, NY 14519~~
BOSTON, MA

DATE REQUIRED IN OUR PLANT ON OR BEFORE	ANY QUESTIONS SHOULD BE DIRECTED TO:	CALL 716 - 546-2700	TERMS	FOB
2 16 82	J. JONES	EXT. 2324 AT ONCE	30 DAYS	BOSTON, MA

ITEM	QUANTITY	DESCRIPTION	BIN NO.	LIST	DISCOUNT
		N-60801			
	1,000	FT. OF 7/C #12 AWG CONTROL CABLE AS PER BIW QUOTATION #54334-SP DATED 10-26-81		2413.00	M FT
	3,000	FT. OF SINGLE TWISTED SHIELDED PAIR #16 AWG INSTRUMENTATION CABLE AS PER BIW QUOTATION #5437-SP DATED 11-16-81		485.00	M FT
		ABOVE ITEMS TO BE SUPPLIED WITH CERTIFICATE OF COMPLIANCE TO FULL IEEE 383-1974 FLAME AND LOCA TEST. THE SUPPLIER SHALL PROVIDE TEST REPORTS FOR ALL PRODUCTION TESTS			
		EQUIPMENT TO BE FURNISHED SHALL BE CONTROLLED BY A QUALITY ASSURANCE PROGRAM MEETING THE REQUIREMENTS OF ATTACHED RG&E QA-20, REV. 3			

DEBIT	TAX CODE	STORE NO.	CODE DEPT.	CODE DIST.	CODE STA.	CODE CL.	ACCOUNT MAJOR	ACCOUNT MIN.	WORK ORDER OR CAR GROUP	JOB NO.
	08		42	0	0	1	324	00	63-1	6429

(SHIPPING INFORMATION)				

ON OR BEFORE | EXT. | AT ONCE

ITEM	QUANTITY	DESCRIPTION	BIN NO.	LIST	DISCOUNT
		N-60801			
		DATED 11-15-78			
		CABLE SHALL BE SHIPPED IN ACCORDANCE WITH ANSI 45.2.2 LEVEL C			
		"THE PROVISIONS OF REGULATION 10 CFR PART 21 APPLIES TO THIS PURCHASE ORDER."			

DEBIT	TAX CODE	STORE NO.	CODE DEPT.	CODE DIST.	CODE STA.	CODE CL.	ACCOUNT MAJOR	ACCOUNT MIN.	WORK ORDER OR CAR GROUP	JOB NO
	08		42	0	0	1	324	00	6301	6429

(SHIPPING INFORMATION)				