NIAGARA MOHAWK

NIAGARA MOHAWK POWER CORPORATION/300 ERIE BOULEVARD WEST, SYRACUSE, N.Y. 13202/TELEPHONE (315) 474-1511

November 28, 1977

Office of Inspection and Enforcement
Region I
Attn: Mr. Boyce H. Grier, Director
U. S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, Pennsylvania 19406

Re: Docket No. 50-220
I.E. Bulletin 77-05 & 77-05A

Dear Mr. Grier:

I. E. Bulletin 77-05 dated November 8, 1977 described deficiencies in certain electrical pin and socket-type connectors. These connectors were manufactured by Bendix, ITT Cannon and Gulton Industries. A review of plant construction drawings revealed that these connector types are not used at Nine Mile Point Unit 1.

Electrical connectors of the pin and socket type are used; however, they were manufactured by D. G. O'Brien Company (see attached drawings). The connectors used at Unit 1 have been reviewed for their application in a loss of coolant accident environment.

The construction of the electrical connection assemblies at Unit 1 is substantial. For example, a typical 19 pin connector weighs approximately 7 pounds. The housing is 304 stainless steel. The electrical socket and pin connectors are gold-plated copper. The insulator materials are constructed of one of three materials depending on connector size: diallyl phthalate, high density polyethylene, or GMG (glass impregnated melamine).

The sealing function for leak tightness of the penetration is provided in the interior of the connector receptacle by molded glass. To assure leak tightness of the connector internals, two areas of ingress are considered.

A001

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The plug-receptacle interface uses a double viton O-ring seal. The cable-plug interface is sealed with individual viton O-rings around each pin and a viton O-ring around an insulator. Each pin passes through 3 insulators within the plug assembly. Additionally, a polyurethene potting compound and heat shrinkable neoprene boot are used to further protect the assembly.

Table #1 provides a listing of cable connector construction and identifies the system it is used in.

The Maine Yankee connectors are manufactured by D. G. O'Brien and are very similar to those used at Nine Mile Point Unit 1. The attached test report shows that typical Maine Yankee connectors will survive a loss of coolant environment of 55 psig, 280°F and 100% relative humidity for 48 hours. Figures E31 and E33 in FSAR Volume II show the environmental loss of coolant accident time history for the primary containment. It can be seen that the qualification testing of the Maine Yankee equipment is directly applicable to that used at Nine Mile Point Unit 1.

The differences between the Maine Yankee connectors and those used at Nine Mile Point Unit 1 are as follows:

1) Nine Mile Point Unit 1 uses 2 viton seals at the plug-receptacle interface versus one at Maine Yankee.

2) Nine Mile Point Unit 1 uses a potting compound (polyurethane) inside the neoprene boot.

3) While Maine Yankee connectors use diallyl phthalate exclusively for insulators, Nine Mile Point Unit 1 connectors use either GMG, high density polyethylene or diallyl phthalate for insulator materials.

A direct comparison of the other insulating materials based on National Electrical Manufacturers Association values(1) (tested in accordance with ASTM) indicates:

Insulation Material	Resistance to Heat Continuous Operation
Diallyl Phthalate	400 - 450 F
GMG	280 F
High Density Polyethylene	250 F

(1) Modern Plastics Encyclopedia

The above comparisons show that while the GMG and high density polyethylene insulators do not have the same resistance to heat for continuous operation as those that were tested, the resistance temperature is similar to that expected during a postulated loss of coolant accident. Considering the short time that these temperatures exist (approximately 60 seconds)[2] it is unlikely that the insulators would be affected. Connectors with the high density polyethylene and GMG insulators are used for power connection to core spray valves and isolation valves. These power circuits are energized for a short time (approximately 30 seconds) immediately after a loss of coolant initiation and thereafter remain de-energized. The connectors therefore are expected to perform their function prior to any unlikely insulation failure which might occur during exposure to high temperature.

The radiation effects on components used for the D. G. O'Brien electrical penetrations have been analyzed. The organic materials would be the most significantly affected by the post-loss of coolant accident environment. The total combined accident dose (gamma and beta) in the primary containment using Regulatory Guide 1.3 is 1495 megarads (using the inventories from Page E131 Volume II FSAR). The neoprene boot and polyurethane filler is expected to see the total dose. The viton seals and stainless steel housings are expected to be affected by the gamma dose (715 megarads). The radiation levels inside the electrical connector would be about 36 megarads. The materials used in the connectors will accept the following radiation levels:

Material	Exposure for Moderate Damage to Most Sensitive Property[3]
Viton "O" rings	800 megarads
Neoprene	5 megarads
Polyethylene	85 megarads
Resins-Glass Fabric Reinforced (GMG, Diallyl Pthalate)	40 megarads
Polyurethane	3000 megarads

(2) FSAR, Volume II, Page E 130

(3) Approximately 25 percent damage

Kirchner J. F., and Bowman P. E., Effects of Radiation on Materials and Components, New York, Rhienhold (1964)

The neoprene boot may fail from the loss of coolant accident. However, all other materials in the connector would not be expected to be significantly affected. Therefore, the electrical connector is expected to perform its design function after exposure to these radiation effects.

Normal radiation levels are not expected to exceed 0.4 megarads over the life of the plant. At this radiation level, no electrical connector materials would be significantly affected.

In regard to I. E. Bulletin 77-05A, electrical connectors installed on the primary containment electrical penetrations are the only pin and socket type connectors used for safety related interconnecting cable which mitigates accidents. Both the inside and outside electrical connectors are designed, constructed and installed to the same criteria. The environment outside containment during postulated accidents is considerably less severe than that within the containment.

Based on the above, continued operation of Nine Mile Point Unit 1 will not create undue risk to the health and safety of the public. Additionally a test program has been initiated to demonstrate operability of the connectors. The program will test the two types of pin constructions described in Table 1 in a simulated loss of coolant accident environment without radiation effects and thermal aging. The test will generally follow the guidelines of IEEE 323 test requirements.

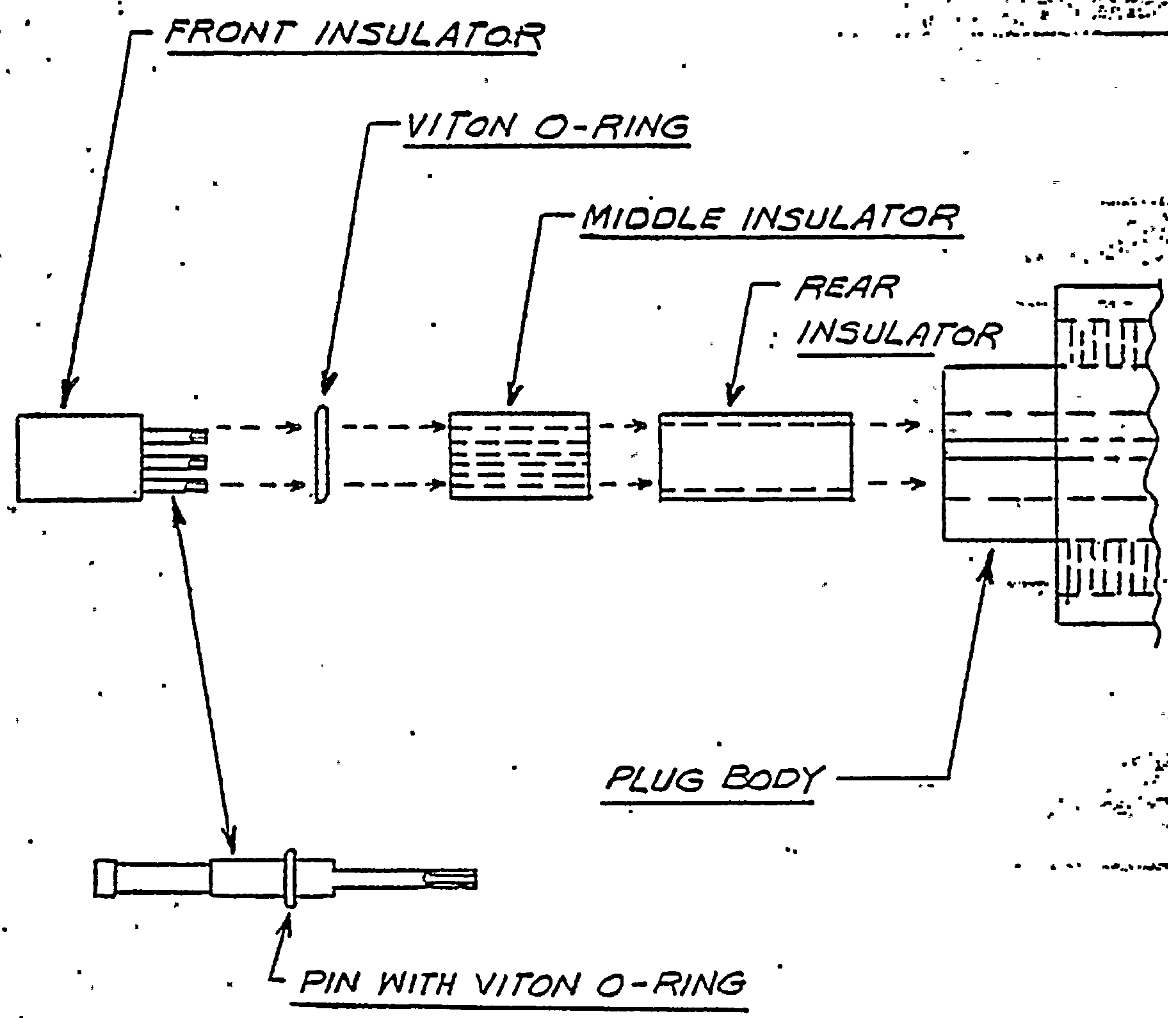
Very truly yours,

NIAGARA MOHAWK POWER CORPORATION

R. R. Schneider
Vice President-Electric Production

/szd

Attachments



NIAGARA MOHAWK

NIAGARA MOHAWK POWER CORPORATION

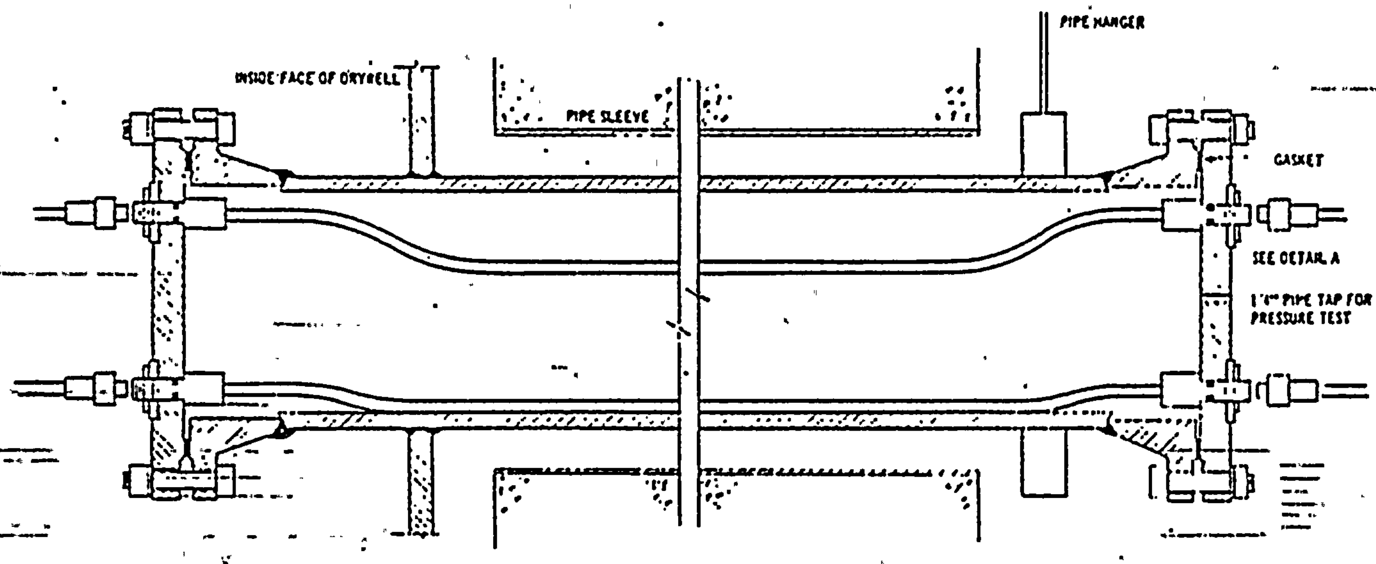
NINE MILE POINT NUCLEAR STATION

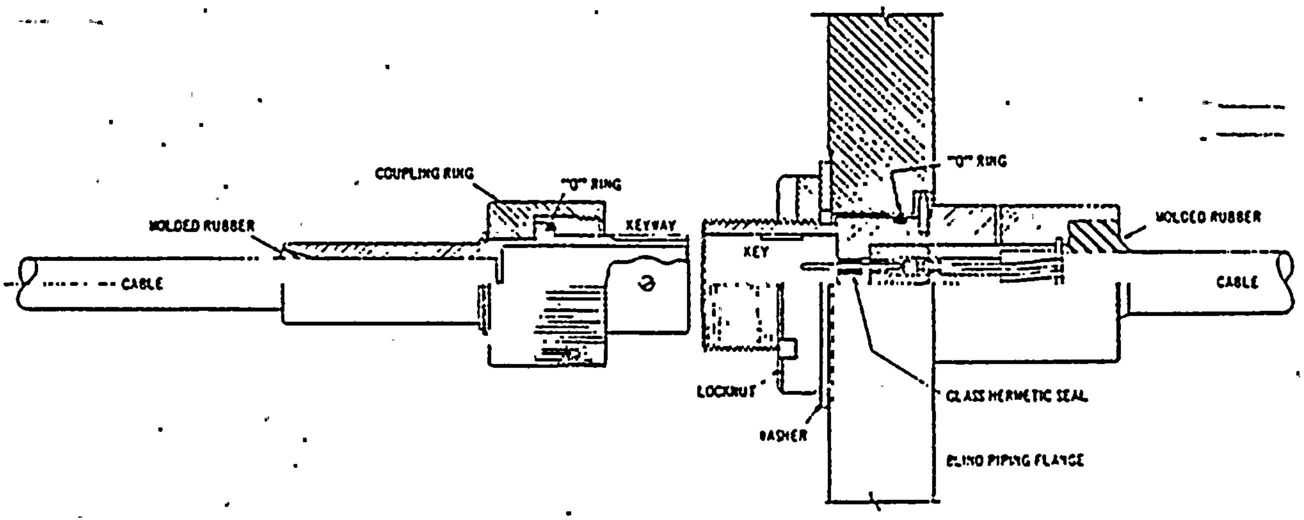
PLUG ASS'Y

DR.	TR.	CK.	DATE 11-25-71	SCALE
APPROVED		APPROVED		INDEX
APPROVED		APPROVED		NO.

MK.	DATE	BY	REVISION	CK.	APP.

ELECTRICAL PENETRATIONS – LOW VOLTAGE





DETAIL A

Table 1

ELECTRICAL PENETRATION CONNECTORS REQUIRED TO MITIGATE AN ACCIDENT

		PENETRATION ELECTRICAL CONNECTOR CONSTRUCTION			
Penetration Number	Service	Pin Construction	Front Insulator	Mid Insulator	Rear Insulato
X-E178D	Core Spray IV 40-01 Power	4#8	HDPE	HDPE	GMG
X-E178H	Core Spray IV 40-01 Control	19#16	DIAL	DIAL	DIAL
X-E179A	Clean-Up Return IV 33-01 Power	4#8	HDPE	HDPE	GMG
X-E179B	Clean-Up Supply IV 33-02 Power	4#8	HDPE	HDPE	GMG
X-E179E	Clean-Up Return IV 33-01 Control	19#16	DIAL	DIAL	DIAL
X-E179F	Clean-Up Supply IV 33-02 Control	19#16	DIAL	DIAL	DIAL
X-E188G	Electromatic Valves NR108C, NR108D	19#16	DIAL	DIAL	DIAL
X-E188H	Electromatic Valve NR108F	19#16	DIAL	DIAL	DIAL
X-E189D	Core Spray IV 40-09 Power	4#8	HDPE	HDPE	GMG
X-E189H	Core Spray IV 40-09 Control	19#16	DIAL	DIAL	DIAL
X-E202-H	Main Steam IV 01-02 Control	19#16	DIAL	DIAL	DIAL
X-E210-B	Core Spray IV 40-10 Power	4#8	HDPE	HDPE	GMG
X-E210-E	Core Spray IV 40-10 Control	19#16	DIAL	DIAL	DIAL
X-212A	Main Steam IV 01-02 Power	4#8	HDPE	HDPE	GMG
X-212E	Main Steam IV 01-02 Control	19#16	DIAL	DIAL	DIAL

Table 1 (Continued)

ELECTRICAL PENETRATION CONNECTORS REQUIRED TO MITIGATE AN ACCIDENT

Penetration Number	Service	PENETRATION ELECTRICAL CONNECTOR CONSTRUCTION			
		Pin Construction	Front Insulator	Mid Insulator	Rear Insulato
X-E228F	Electromatic Valves NR108A NR108B	19#16	DIAL	DIAL	DIAL
X-E228G	Electromatic Valve NR108E	19#16	DIAL	DIAL	DIAL
X-E228H	Main Steam IV 01-01 Control	19#16	DIAL	DIAL	DIAL
X-E229A	Main Steam IV 01-01 Power	4#8	HDPE	HDPE	GMG
X-E229E	Main Steam IV 01-01 Control	19#16	DIAL	DIAL	DIAL
X-E231D	Core Spray IV 40-11 Power	4#8	HDPE	HDPE	GMG
X-E231H	Core Spray IV 40-11 Control	19#16	DIAL	DIAL	DIAL
X-E233A	Reactor Shutdown Cooling System Supply IV 38-01 Power	4#8	HDPE	HDPE	GMG
X-E233B	Reactor Shutdown Cooling System Supply IV 38-13 Power	4#8	HDPE	HDPE	GMG
X-E233E	Reactor Shutdown Cooling System Supply IV 38-01 Control	19#16	DIAL	DIAL	DIAL
X-E233F	Reactor Shutdown Cooling System Supply IV 38-13 Control	19#16	DIAL	DIAL	DIAL

Material Abbreviations

HDPE	-	High Density Polyethylene
DIAL	-	Diallyl Phthalate
GMG	-	Glass Impregnated Melamine

Pin Construction

First Number	-	Number of Pins (Contacts
Second Number	-	Pin Diameter in AWG (American Wire Gauge)

DBA TEST - STONE & WEBSTER CABLE ASSEMBLY

Engineering Report No. 184

September 1971

D. G. O'Brien, Inc.
Framingham, Massachusetts

Prepared By: Harold [signature]

Approved By: R B Henderson
Lawrence J. Mishell

1.0 Summary

1.1 A Cable Assembly consisting of typical cables from the Maine-Yankee Nuclear Power Plant installation were assembled to D.G. O'Brien, Inc. 19-pin plugs following the standard recommended termination procedures. Both plugs were then connected to a splice receptacle which duplicates one pressure barrier and electrical termination in one end of a nozzle.

1.2 The assembly was electrically tested, subjected to the environmental conditions of a Design Basis Accident for 48 hours and again electrically checked.

1.3 The electrical connectors showed no direct electrical or mechanical degradation due to exposure.

1.4 There are physical indications that the jacket on one cable split and the primary insulation extruded thru the opening. The shrink tubing on a second cable in the same bundle split down to the boot and appears to continue down into the boot cavity. Electrical characteristics on this plug were markedly lower than the other plug and the receptacle.

1.5 Some extrusion of the cable is evident at points where sealing boots or termination tapes were applied. This is undoubtedly attributed to the tension introduced in these members during the termination process. The extrusion may have contributed to the cable jacket failure that was mentioned previously.

2.0 Reference Documents

2.1 MY-64 Specification

2.2 DGO TP-EV-101

3.0 Test Equipment

3.1 Associated Research Megger Model 2850

3.2 DGO, Inc. Steam Tank

TITLE DBA TEST-STONE & WEBSTER CABLE ASSEMBLY

4.0 Test Procedures

4.1 Disassemble plugs from the receptacle and inspect for cleanliness.

4.2 Measure and record insulation resistance on each component. They should all be above 5000 megs.

4.3 Reassemble plugs to receptacle making sure O-rings are properly installed. Repeat IR measurement.

4.4 Tape the ends of the cable following MP-EC-122, steps 7.2 thru 7.6 modified to suit the cable. Engineering has the supplies for this taping and will assist technicians in the proper application. Take a photograph of completed assembly.

4.5 Place cable assembly in the test tank without bending the cables. The single one inch diameter cable should be <u>UP</u>.

4.6 Run the cable assembly ~~for 48 hours~~ at the following conditions:

~~P = 55 psig~~ ~~T = 280°F~~ ~~RH 100%~~

Follow TP-EV-101 but disregard the leak requirements.

4.7 Remove cable from test tank and record observations of appearance. Take a photograph.

4.8 Remove tape from end of 19 conductor cable (one inch diameter) and measure and record insulation resistance values.

4.9 Disassemble plugs from receptacle and record observations. Take photos where practical.

4.0 TEST RESULTS

4.1 Fill out all applicable test records.

4.2 As a minimum, the following information should be recorded:

1. Time at which events start and finish.
2. Chamber pressure.
3. Chamber temperature.
4. Pressure of helium environment.
5. Temperature of helium environment.
6. Helium leak rate.
7. Date of test.
8. Signature of test operator.

4.3 If for any reason the test data leads you to believe that problems exist, immediately contact your supervisor for additional information and appropriate action.

ORIG.	DWN.	APP'D	DATE	USAGE	REVISION	REV.NO.	APP'D

TITLE DBA TEST - STONE & WEBSTER CABLE ASSEMBLY

5.0 Test Results

5.1 Test results are recorded as insulation resistance measurements before and after exposure. Data sheets are included with this report.

5.2 Photographs taken before and after the test are also included. The reproducibility of these photographs is less than desired but the significant physical failures can be observed.

TEST PROCEDURE

D. G. O'BRIEN, INC.

TP. EV-101
SHEET 1 OF 4
REV. A

TITLE STEAM PRESSURE TEST - ELECTRICAL PENETRATIONS

1.0 TEST REQUIREMENT

1.1 The electrical penetration assembly is to be subjected to a steam environment as specified by the Q/A method sheet. This atmosphere will consist of both pressure and temperature characteristics. The test will last for a period as specified by the Q/A method sheet. At the conclusion of the test, the steam atmosphere will be replaced with helium and the leak integrity of the electrical penetration verified.

1.2 The application of this environment is to be considered as a prototype test only. Production units will not be subjected to this environment unless so required by the specification.

1.3 All the final test results must conform to the requirements of the customer specifications.

1.4 Where large volumes are involved, a mixture of 10% Helium and 90% Nitrogen (dry) will be utilized to reduce excessive background contamination and to conserve Helium.

ORIG.	DWN.	APP'D	DATE	USAGE	REVISION	REV.NO.	APP'D
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2.0 EQUIPMENT REQUIRED

2.1 Test chamber.

Test chambers 270, 280 and 290 are available and applicable to this test.

2.2 Source of steam.

For most applications where this procedure is applicable, the steam source will be a unit normally used by local garages for steam cleaning of engines. This is not a piece of equipment owned by DGO and will be rented on an as-required basis.

2.3 Mass spectrometer - Consolidated Electrodynamics Model 24-120B with its associated equipment.

2.4 Helium bottles.

2.5 Thermolyne - Model No. PM1K50.

2.6 Equivalent instrumentation may be substituted with the approval of the Quality Assurance Test Engineer.

TEST PROCEDURE

D. G. O'BRIEN, INC.

TP. -EV-101
SHEET 3 OF 4
REV.

TITLE STEAM PRESSURE TEST - ELECTRICAL PENETRATIONS

3.0 TEST PROCEDURE

3.1 Place the electrical penetration into the appropriate chamber.

3.2 Make the necessary connections to the test cover from the electrical penetration for connecting the Helium leak detector.

3.3 Close the cover with a sufficient number of latches to contain and seal the pressure environment.

3.4 Connect the Helium leak detector and the Helium source to the tank.

3.5 Evacuate the electrical penetration through the mass spectrometer by following the procedure in DGO TP-LK-109.

3.6 Inject helium into the canister and establish the leak rate of the electrical penetration.

3.7 ~~Disconnect the mass spectrometer from the chamber and replace the vacuum established within the electrical penetration with dry nitrogen at approximately 2 psig.~~

3.8 Replace the helium atmosphere in the test chamber with the steam atmosphere specified on the appropriate Q/A method sheet.

3.9 Maintain the environment on the electrical canister as specified.

3.10 Remove the steam and nitrogen atmosphere and repeat the helium checks by following the steps in 3.4 to 3.6.

ORIG.	DWN.	APP'D	DATE	USAGE	REVISION	REV.NO.	APP'D

Central Files

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
631 PARK AVENUE
KING OF PRUSSIA, PENNSYLVANIA 19406

November 28, 1977

Docket No. 50-220

Niagara Mohawk Power Corporation
ATTN: Mr. R. R. Schneider
Vice President
Electric Operations
300 Erie Boulevard West
Syracuse, New York 13202

Gentlemen:

The enclosed IE Circular 77-14 is forwarded to you for information. No written response is required. Should you have any questions related to your understanding of this matter, please contact this office.

Sincerely,

Robert T. Carlson
for Boyce H. Grier
Director

Enclosures:
1. IE Circular 77-14
2. List of IE Circulars Issued in 1977

cc w/encls:
T. E. Lempges, General Superintendent, Nuclear Generation
T. J. Perkins, Station Superintendent
C. L. Stuart, Operations Supervisor
E. B. Thomas, Jr., Esquire
A. Z. Roisman, Counsel for Citizens Committee for Protection of the Environment

A02