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VASSALLO,D.B. Operating Reactors Branch 2

SUBJECT: Responds to 840319 & 0417 requests re containment purge valves.Valve supplier confirmed design criteria used to fabricate valves,valve internals & external hardware.Valves to be modified to limit disc travel time to 14 s.

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

May 30, 1984

Director of Nuclear Reactor Regulation
Attention: Mr. Domenic B. Vassallo, Chief
Operating Reactors Branch No. 2
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Re: Nine Mile Point Unit 1
Docket No. 50-220
DPR-63

Dear Mr. Vassallo:

This letter responds to two separate requests by your staff regarding our containment purge valves. One was conveyed during a telephone conversation on April 17, 1984. The other was forwarded by letter dated March 19, 1984. The following information is provided pursuant to those requests.

On April 17, 1984 during discussions with your staff, information regarding the containment purge valves was requested. Two items were the subject of that request:

1. Confirmation of the seismic qualification of the external hardware (brackets and bolts) between the valve body and the valve operator.

2. Confirmation that the internal valve parts were fabricated to appropriate valve industry standards.

During the April 17, 1984 telecon the valve supplier confirmed the design criteria used to fabricate the valves, their internal parts and the external hardware between the valve body and the valve operator. Documentation of this information as requested, regarding the valve design criteria, is included herein as Enclosure 1.

The March 19, 1984 letter indicated that your review of the containment system aspects of Multi-Plant Action Item B-24 at Nine Mile Point Unit 1 was complete. Further, the letter concluded this issue is resolved pending our formal confirmation of and implementation schedule for the following two items:

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1. The maximum valve closure times for containment purge valves should be limited to 15 seconds or less following a loss of coolant accident. Your letter indicated instrument delay times as well as valve disc travel time should be considered in the overall response time.

2. A leak test should be performed to demonstrate that purge isolation valve seal material has not deteriorated. The leak test should be performed every three months or within 72 hours of each usage of the purge system (for operating conditions above cold shutdown) with a maximum interval of six months between leak tests.

In response to item 1 above, our current plans are to modify the valves to limit disc travel time to 14 seconds or less. The one second conservatism will account for the time required for instrument response. Since instrument response time is typically on the order of milliseconds, the minimum one second conservatism will ensure that the total closure time following a loss of coolant accident is less than 15 seconds.

The modification to limit the valve closure time will be completed, and the technical specification amendment application reflecting the change will be submitted by the end of the next planned refueling outage.

In response to item 2 above, we have reviewed the technical justification for this additional requirement. Our review indicates that the current requirements are sufficient and consistent with our operating experience; therefore, additional testing is not necessary. The basis for this is detailed in Enclosure 2. In summary, Enclosure 2 indicates that the increased testing is not necessary, because of our current testing requirements, operating experience, and the material integrity of the resilient seals.

Sincerely,

NIAGARA MOHAWK POWER CORPORATION

CVMangan

C. V. Mangan
Vice President
Nuclear Engineering and Licensing

DAC:bd
Attachments

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ENCLOSURE 1

[illegible]

ALLIS-CHALMERS
BOX M-93 • YORK, PENNSYLVANIA 17405/717-848-1126

YORK PLANT
VALVE DIVISION

May 10, 1984

Niagara Mohawk Power Corp.
300 Erie Boulevard, West
Syracuse, NY 13202

ATTENTION: Dan Cifonelli

SUBJECT: Containment Purge & Vent Valves Qualification
Nine Mile Point Station, Unit #1

REFERENCE: NRC Correspondence Dated March 19, 1984
Docket #50-220

Dear Mr. Cifonelli:

As I indicated in our earlier conversation, the seismic requirements of Specification #N212 have been met by generic engineering analysis. While a unique analysis was not completed for the specific conditions under which these valves were intended to operate, a general analysis was completed for the equipment to properly size brackets, bolts, etc. The results of this analysis, in accordance with standard practice at Allis-Chalmers, would have been checked by a qualified Engineer or checker. While the worksheets for this rather old order are not now available, this letter affirms that, in fact, Allis-Chalmers has provided equipment which meets the seismic requirements of your specification.

Similarly, the critical internal parts, disc pins, shafts etc., have been designed and supplied in accordance with good engineering practice and applicable valve standards. The butterfly valves supplied for this plant by Allis-Chalmers were designed and manufactured in accordance with AWWA C504. This standard prescribes minimum requirements for shafts and pins to insure adequate safety factors are being met.

We feel consequently that while a formal report was not required for these particular valves, the concern for seismic qualification of external hardware and safety evaluation of internal critical valve parts has been satisfied.

Sincerely,

G. W. Andzulis
Product Engineering Manager

GWA/sy/3/3266

cc: B. Zeiders, A-C York

ENCLOSURE 2

Enclosure 2

Response to Additional Leakage Rate Testing

of Nine Mile Point Unit 1 Containment Purge Valves

I. Test Requirements

Appendix J to 10CFR50 requires that local leak rate tests, Type C, be performed on primary containment isolation valves, and sets forth the testing method, acceptance criteria, and reporting rules associated with these tests. The containment purge valves are Type C valves, because they:

1. Provide a direct connection between the inside and outside atmospheres for the primary reactor containment under normal operation,

2. Close automatically upon receipt of a containment isolation signal in response to controls intended to affect containment isolation,

3. Are required to operate intermittently under post accident conditions, and

4. Are in systems which penetrate containment.

Therefore, the purge valves are tested for local leakage in accordance to Appendix J. This requirement is reflected by the technical specifications, namely Section 4.3.3e(1) which states:

> Primary containment testable penetrations and isolation valves shall be tested at a pressure 35 psig each major refueling outage except bolted-gasketed seals shall be tested whenever the seal is closed after being opened, and at least at each refueling outage.

If a valve fails to meet the acceptance criteria, as defined in our technical specification, corrective maintenance action is taken and the test is repeated. The valve will not be put into service until the local leak rate requirements are met.

II. Operating Experience

In general, the local leak rate test results associated with the containment purge valves, which have been in service since the beginning of Nine Mile Point Unit 1 commercial operation, have been satisfactory. Three Licensing Event Reports, however, have been written regarding excessive leakage of these valves dated April 4, 1979, May 1, 1979, and June 11, 1981. The problems associated with the Licensing Event Reports were corrected during the respective current refueling outage.

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II. Operating Experience (cont'd)

In addition, during our 1982/1983 recirculation piping and safe end outage, critical seal parts including the elastomer were replaced. The new elastomer material was the same as the old elastomer material, namely Nordel of DuPont. Local leak rates since the critical seal parts were replaced have been low. This success can be attributed in part to our corrective maintenance actions. But, this success is more fundamentally attributed to the type of resilient seal utilized (Nordel of DuPont elastomer) and the normal valve operating environment which together maintain sufficient elastomer integrity.

III. Nordell Elastomer Qualification

Our review of the necessity of additional leakage rate testing as recommended in your March 19, 1984 letter, included consulting services to evaluate the adequacy of the Nordel elastomer for specific operating conditions. The conclusion of that evaluation, included as Attachment 1, was that significant elastomer degradation will not occur during an operating cycle; therefore, our testing requirements are sufficient for detecting leakage problems before they occur.

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NINE MILE POINT UNIT 1
NITROGEN PURGE AND FILL VALVES

VALVE SEAT MATERIAL EVALUATION

1. Purpose. The purpose of this evaluation is to determine the qualification of valve seats in the Drywell and Suppression Chamber (Torus) Nitrogen Purge and Fill Isolation Valves at Nine Mile Point Unit 1. In particular, the objective is to determine if the valve seating surfaces containing the elastomeric compound EPDM (ethylene-proplyene-diene terpolymer), commercially known as Nordel by DuPont, are capable of resisting degradation over time such that normal valve leakage testing is sufficient to ensure containment integrity.

2. Background. The valves in question function as containment isolation valves in accordance with 10CFR50, Appendix J, Containment Leakage Testing. As such, Type C (local leakage rate) testing is required once per operating cycle or every 24 months in order to ensure that containment leakage remains within its design limits. In the case of these valves, however, the NRC has requested that valve leakage rates be measured quarterly because the Nordel seating material has not been demonstrated to be sufficiently resistant to degradation to give confidence that leak-tightness will be retained throughout the operating cycle.

3. Valves Being Considered. The valves being considered in this evaluation are:

No.	Description	Size
201-7/ 201-8	Suppression Chamber Air Vent	20"
201-9/ 201-10	Drywell Air Vent and Fill	24"
201-16/ 201-17	Suppression Chamber N_2 Vent	20"
201-31/ 201-32	Drywell N_2 Vent and Fill	24"

All valves are butterfly valves manufactured by Allis-Chalmers Mfg. Co. with remote operators as follows:

No.	Operator	Location of Nordel
201-7	Motor--Limitorque SMB-000-2	Seat
201-8	Air--Bettis Robotarm 2732-SR	Seat
201-9	Motor--Limitorque SMB-000-5	Disc
201-10	Air--Bettis Robotarm 744-SR	Disc
201-16	Air--Bettis Robotarm 2732-SR	Seat
201-17	Motor--Limitorque SMB-000-2	Seat
201-31	Motor--Limitorque SMB-000-5	Disc
201-32	Air--Bettis Robotarm 744-SR	Disc

4. Assumptions and General Observations. The following assumptions and general observations are provided:

a. The environment which must be considered in this analysis is the normal environment to which these valves are exposed. The accident environment is not relevant to this analysis because any degradation which effects periodic testing frequency will result from exposure to the normal environment. For example, periodic valve testing during the operating cycle only provides confidence in valve condition as of the start of an accident. No amount of additional leak rate testing prior to the start of an accident serves to indicate the performance of the valves under accident conditions. Consequently, the environmental parameters which will effect Nordel performance are normal temperature and radiation exposure.

b. The above rationale notwithstanding, general conclusions will be provided in this analysis regarding the performance of Nordel under a post-accident environment.

c. Of the 8 valves in question, 201-31 and 201-32, located in the Emergency Condenser Condensate Return Valve Room of the Reactor Building, are exposed to the most severe environment. The environment of this room, given below, will be used in this evaluation:

	Normal	Accident
Temperature	104F	278F
Radiation	less than 10^4 rads	10^6 rads
Pressure	atmospheric	9 psig
Relative Humidity	10-90%	100%

d. As an elastomer such as EPDM or Nordel is compressed, there is a change in

the elastomer's arrangement and density of molecular cross-links. When the compression is released, these changes prevent the seal from returning to its original thickness or size. The loss in dimension, expressed as a percentage of the deflection due to the compression, is called "compression set." (Reference 1)

e. Under continual compression, changes in molecular cross-linking progress to where the seal takes on the shape of the confining surface and the force exerted by the seal on the confining surface relaxes. By relaxing the compression force periodically, the seal is allowed to regain much of its original structure so that when it is again compressed, it exerts a renewed force on the confining surface. (References 1 and 2)

f. Nordel possesses a high degree of inherent heat resistance. Products made from conventional Nordel can be used in air at temperatures of 250 to 300F, with intermittent service to 350°F. In a low oxygen environment (which is the case here due to N_2 inerting), Nordel can be expected to perform at even higher temperatures (References 3 and 4). In addition, heat exposure and steam exposure had negligible effects on Nordel. (Reference 3)

g. Tests have also shown that the characteristics of EPDM remain substantially unchanged under radiation exposure of less than 10^7 rads (Reference 1). Nordel has been shown to retain 85% of its tensile strength and 55% of its elongation after exposure to 5.5×10^7 rads of beta radiation (Reference 3). These tests have concluded that EPDM is acceptable for usage in nuclear power plants where exposure is limited to 10^7 rads.

h. The BWR Operator's Manual for Materials & Processes (Reference 5) states that the EPDM Nordel by DuPont is acceptable for service up to 300F and radiation exposure not to exceed 5×10^6 rads. None of the literature reviewed have indicated, based on testing or other analytical evaluation, that EPDM and in particular Nordel, is subject to accelerated degradation at temperatures below 300F or radiation levels below 5×10^6 rads.

i. The changes in cross-linking which are reflected in compression set also effect the elongation properties of elastomers such as EPDM. Hence, the results of testing where elongation is measured can be taken as an indicator of compression set. (Reference 6)

j. The valves in question are normally shut valves. Although they may be periodically opened (e.g., to add N_2 to the drywell or for purging of the drywell), they must be considered to remain closed (in the worst case)

throughout the operating cycle of the plant (approximately 24 months maximum).

k. The design of the valves is such that the Nordel seat or disc material is compressed by a steel disc or seat - both surfaces of which are essentially flat, with gradually sloping transition angles (approximately 12°).

5. Evaluation. In view of the above discussion, it is clear that the ability of these valves to remain leak tight is primarily a question of compression set and the capability of the Nordel to retain a sufficient seating force. At the temperatures (either the 104F normal temperature or the 278F accident temperature) and the radiation levels (less than 10^4 under normal conditions and 10^6 under accident conditions) involved, there is no indication that the elastomer is subjected to accelerated degradation, particularly in view of the low-oxygen, nitrogen-enriched atmosphere to which the valves are exposed. Consequently, this evaluation is reduced to a review of the basic design of the valves, considering the forces applied on the seating areas and the data available on the compression testing of Nordel.

The seating forces exerted on the Nordel by the valve operating mechanisms are smaller than those forces applied during elastomer testing in accordance with ASTM D395, Rubber Property-Compression Set. Consequently, the total deflection of the Nordel under operating conditions is less than the 25% deflection of the ASTM test (Method B). Since compression set is calculated as a percentage of the initial deflection, the compression set under actual conditions results in a large percentage of the original thickness of the Nordel being recovered when the valve is opened. The Nordel of the 24" valves (the most severe case) is deflected to 79.3% of its original thickness when the valve is shut and will be restored to approximately 98% of its original thickness when the valve is reopened. The component of the deflection which is not recoverable (the viscous component of the deflection) is obviously extremely small and hence the permanent deformation of the elastomer is also extremely small. Consequently, since the thickness of the seal is nearly unchanged, there will be only a minimal effect on sealing forces on subsequent valve closings.

6. Conclusions. The following conclusions are provided:

a. There is no evidence to suggest that satisfactorily leak tested Nordel seats require leak testing more frequently than every operating cycle (required of all containment isolation valves) because of potential time related degradation of the elastomer. Nordel has been shown to sufficiently withstand normal operating temperatures and radiation doses and will not suffer substantial

degradation due to sustained compressive stress from the normally closed valves.

b. There is substantial evidence to indicate that the Nordel will also perform satisfactorily under post-accident conditions.

c. Seal performance and expected lifetime can be improved or extended by periodically cycling (opening for several minutes) the valves in order to relax the stress on the seals. In view of the large amount of EPDM testing performed over a period of 93-day sustained compression, a program of cycling these valves quarterly is suggested.

7. References.

(1) Selecting Elastomeric Seals for Nuclear Service, Robert Barbarin, Parker Hannifin Corp/Seal Group (Power Engineering, December 1977).

(2) IE Information Notice No. 84-31: Increased Stroking Time of Bettis Actuators Because of Swollen Ethylene-Propylene Rubber Seals and Seal Set, April 18, 1984.

(3) Radiation Resistance of EPDM, Polychloroprene, and Chlorosulfonated Polyethylene, R. F. Mattia & D. R. Luh, DuPont Elastomer Chemical Dept., (Presented at 1971 Tri-State Regional Meeting of Mass/Conn/RI Rubber Groups, May 13, 1971).

(4) Nordel, Engineering Properties and Applications, DuPont Company, E13193.

(5) BWR Operator's Manual for Materials & Processes, NEDE-20583A, November 1978, Table 2.6, Gasket Materials.

(6) Investigation into Radiation Resistance of Selected Compounds, Robert Barbarin, May 24, 1973.

(7) Materials Science for Engineers, L. H. Van Vlack, University of Michigan, 1970.

(8) ASTM D395-82, Rubber Property - Compression Set