Dominion Nuclear Connecticut, Inc.
Millstone Power Station
Rope Ferry Road
Waterford, CT 06385

Dominion

October 22, 2004

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

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Docket No.: 50-336
License No.: DPR-65

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 2
10 CFR 50.55a REQUEST RR-89-53
USE OF ASME CODE CASE N-4-12, SPECIAL TYPE 403 MODIFIED FORGINGS OR BARS, CLASS 1 AND CS SECTION III, DIVISION 1

Pursuant to 10 CFR 50.55a(a)(3)(i), Dominion Nuclear Connecticut, Inc. (DNC), requests approval to use an alternative to the requirements of the American Society of Mechanical Engineers (ASME) Code, Section III, 1998 Edition with the 2000 Addenda, for the material requirements associated with the replacement of the control element drive mechanism (CEDM) housings as described in Attachment 1. Specifically, these replacement housings are to be fabricated of modified Type 403 stainless steel to the requirements of Appendix A, ASME Code Case N-4-12 (Previously Code Cases 1334 and N-2, "Requirements For Corrosion-Resisting Steel, Steel Bars, and Shapes, Section III, and Code Cases 1337 and N-4-11, Special Type 403 Modified Forgings or Bars, Class 1 and CS Section III, Division 1"). With approval of this alternative, all other requirements of Section III will be met. DNC considers this alternative to provide an acceptable level of quality and safety and therefore meets the necessary requirements for approval under 10 CFR 50.55a(a)(3)(i).

The need for this alternative became known when CEDM housing material analysis and final heat treatment was being completed in late June of 2004. It was found during this final processing that the material did not meet the applicable requirements of an earlier revision of the requested Code Case. It did meet Code Case N-2. However, that code case had been previously annulled by the ASME and was no longer available for use. Code Case N-4-11, recently revised by ASME and re-designated N-4-12, contains all the necessary requirements for the use of this material. DNC requests NRC staff review of this request be completed by January 31, 2005. This review schedule is requested to support installation of new CEDM housings during the reactor pressure vessel head replacement scheduled for the next refueling outage.

If you have any questions regarding this submittal, please contact Mr. Paul R. Willoughby at (804) 273-3572.

Very truly yours,

Leslie N. Hartz
Vice President – Nuclear Engineering

Attachment 1: 10 CFR 50.55a Request RR-89-53, Use of ASME Code Case N-4-12, Special Type 403 Modified Forgings or Bars, Class 1 and CS Section III, Division 1.

Commitments contained within this letter: None

cc: U. S. Nuclear Regulatory Commission
Region I
475 Allendale Road
King of Prussia, PA 19406-1415

Mr. V. Nerses
Senior Project Manager
U. S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Mail Stop 8C2
Rockville, MD 20852-2738

Mr. S. M. Schneider
NRC Senior Resident Inspector
Millstone Power Station

ATTACHMENT 1

10 CFR 50.55a REQUEST RR-89-53

USE OF ASME CODE CASE N-4-12, SPECIAL TYPE 403 MODIFIED FORGINGS OR BARS, CLASS 1 AND CS SECTION III, DIVISION 1

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10 CFR 50.55a Request RR-89-53

Use Of ASME Code Case N-4-12, Special Type 403 Modified Forgings Or Bars, Class 1 And CS Section III, Division 1

Proposed Alternative
In Accordance with 10 CFR 50.55a(a)(3)(i)

- Alternative Provides Acceptable Level of Quality and Safety -

1.0 ASME CODE COMPONENTS AFFECTED:

Code Class: 1

System: Reactor Coolant System (RCS)

The 69 magnetic jack assembly Control Element Drive Mechanism (CEDM) housings at Millstone Unit 2 were originally fabricated in accordance with the American Society of Mechanical Engineers (ASME) Code Case 1337-3 and made of modified Type 403 stainless steel. These housings are pressure retaining, installed on nozzles in the Reactor Pressure Vessel Head (RPVH), and encased in a non-pressure retaining shroud cover with bolted coil stacks that surround the drive mechanisms for the insertion and withdrawal of control rods for startup, operation, and shutdown of the reactor. A typical CEDM housing is shown in Figure 1. The specific component of the CEDM to which this request applies is identified on Figure 1 as the Motor Assembly Pressure Housing.

2.0 APPLICABLE CODE EDITION AND ADDENDA:

Millstone Unit 2 is currently in the third 10-year inservice inspection (ISI) interval, which started on April 1, 1999. The 1989 Edition of Section XI with No Addenda applies to the ISI program and the 1998 Edition of Section XI with No Addenda is used as the primary ASME Code Edition for Section XI Repair/Replacement program activities. The original CEDM housings met Section III, 1968 Edition through the Summer 1970 Addenda with Code Case 1337-3 used for the modified Type 403 stainless steel CEDM housing material. The replacement CEDM housings will meet Section III, 1998 Edition, 2000 Addenda, with the proposed alternative minimum material requirements contained in Appendix A subject to the approval of this request.

3.0 APPLICABLE CODE REQUIREMENTS:

CEDM housings need to exhibit certain material (i.e., strength and magnetic) properties that are not contained within the standard requirements for Type 403 stainless steel. Normally, American Society for Testing and Materials (ASTM) specifications are incorporated into the ASME Section II material specifications. Because of the reduced need for CEDM material after early RPVH fabrication in the 1960s and 1970s, the ASTM requirements were never incorporated into Section II. Consequently, ASME Section III has no specified requirements for this material at this time.

4.0 REASON FOR REQUEST:

There are no applicable material requirements for the replacement CEDM motor assembly pressure housings at Millstone Unit 2 in ASME Section III. DNC is submitting this request to allow the use of Code Case N-4-12, which will provide alternative minimum material requirements that are needed to N-stamp the housings in January 2005, which supports the Reactor Pressure Vessel Head (RPVH) replacement project scheduled for the upcoming spring 2005 outage.

5.0 PROPOSED ALTERNATIVE AND BASIS FOR USE:

The material for the original CEDM housings was fabricated using Code Case 1337-3 with a process that involved piercing a forging into a tubular housing shaped product form and then machining the CEDM housing into its final form. That process resulted in certain material properties that can not be achieved today based on a limited number of suppliers that use this process. As an alternative, suppliers have been found who will fabricate a solid tubular forging and machine the entire CEDM housing from that forging without the piercing operation. Other suppliers using this non-piercing process have provided original CEDMs to the following plants and these CEDMs have been in operation for many years with acceptable service:

- Arkansas Nuclear One – Unit 2,
- Palo Verde 2,
- Saint Lucie 1,
- Saint Lucie 2,
- Waterford 3.

The material requirements that were used for the CEDM housings at these listed plants were contained in the ASME Code Cases (1334-2, 1334-3) that later became Code Case N-2 this code case was annulled by the ASME in Supplement 4 of the 1980 Edition of Nuclear Code Cases in January 1981. Because Code Case N-2 was annulled and could no longer be used unless a licensee had previously obtained approval for its use, the supplier for the CEDM housings at Millstone Unit 2 requested

that ASME revise Code Case N-4-11 to incorporate these requirements. The ASME has since revised Code Case N-4-11 to incorporate these requirements.

The Millstone Unit 2 CEDM housings meet the minimum material requirements of ASME Code Case N-4-12 shown in Appendix A. With the use of these requirements, all other requirements, both technical and administrative, of Section III will be met upon approval of this request.

The use of the alternative requirements contained in ASME Code Case N-4-12 has been assessed against the applicable requirements of ASME Section III, 1998 Edition with the 2000 Addenda and the plant design and service conditions for the CEDM housings and found to be acceptable. This acceptance is based on the fact the requirements for the material used in this application have all been acceptable for use within the industry and are now included under one ASME approved Code Case N-4-12. Considering this assessment and the historically successful use of these material requirements at other installations, this alternative is considered to provide an acceptable level of quality and safety, consistent with criteria for alternative requests under 10 CFR 50.55a(a)(3)(i).

Subject to approval of this request, the alternative minimum material requirements in ASME Code Case N-4-12 will be used to reconcile the design records and to N-stamp the new CEDM housings in January 2005, which supports the upcoming spring 2005 RPVH replacement project.

6.0 DURATION OF PROPOSED ALTERNATIVE:

Since this request applies to the replacement of the RPVH, and is specific to the material requirements for the replacement CEDM housings, it is intended that approval of this request will apply for the life of the CEDM housings.

7.0 PRECEDENTS:

Because this is the latest ASME approved revision of this Code Case, there are no precedents for the use of this Code Case at this time.

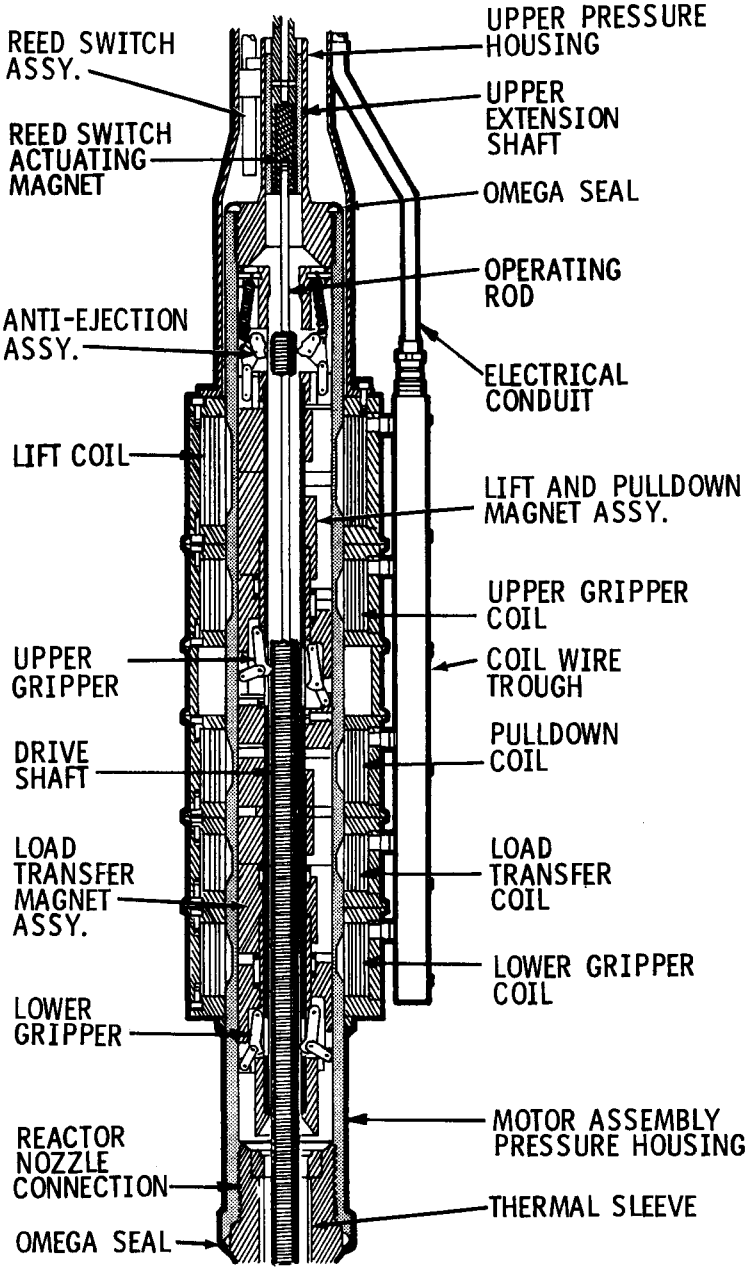

FIGURE 1: TYPICAL CONTROL ELEMENT DRIVE HOUSING

APPENDIX A

ASME CODE CASE N-4-12, SPECIAL TYPE 403 MODIFIED FORGINGS OR BARS, CLASS 1 AND CS SECTION III, DIVISION 1

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 2

Approval Date: October 18, 2004
See Numeric Index for expiration
and any reaffirmation dates.

Case N-4-12
Special Type 403 Modified Forgings or Bars, Class 1 and CS
Section III, Division 1

Inquiry: May Special Type 403 Modified forgings or bars be used in the construction of Class 1 and CS components in accordance with Section III, Division 1, and what special requirements apply to this material?

Reply: It is the opinion of the Committee that Special Type 403 Modified forgings or bars may be used for Section III Class 1 and CS components, and the following specified special requirements apply in addition to the applicable requirements specified in Section III.

Steel forgings or bars (AISI Type 403 Modified) conforming to the following chemical analysis, having specified minimum mechanical properties shown below, and complying with the specified additional requirements may be used in the construction.

(a) Chemistry

(AISI Type 403 Modified)

	Percent
Carbon	0.06 to 0.13
Manganese	0.25 to 0.80
Phosphorus, max.	0.03
Sulfur, max.	0.03
Chromium	11.50 to 13.00
Nickel, max.	0.50
Silicon, max.	0.50

(b) Mechanical properties in the annealed condition as received shall conform to the following requirements:

Tensile strength, min.	70 ksi (480 MPa)
Yield strength, min.	40 ksi (275 MPa)
Elongation in 2 in. (50 mm), min.	22.0%
Reduction of area, min.	50.0%

(c) Condition 1 material shall be given an austenitizing heat treatment, followed by air cooling or quenching in liquid media, salt bath, or oil and air cooled to room temperature, and then tempered 1125°F (605°C) minimum for four hours. Mechanical properties for Condition 1 material shall conform to the following requirements:

	Condition 1
Tensile strength, min.	110 ksi (760 MPa)
Yield strength, min.	90 ksi (620MPa)
Elongation in 2 in. (50 mm), min.	16.0%
Reduction in area, min.	50.0%
Hardness	Brinell 226 to 277 or equivalent

Condition 2 material shall be normalized and then tempered at 1250°F (675°C) minimum. Mechanical properties for Condition 2 material shall conform to the following requirements:

	Condition 2
Tensile strength, min.	100 ksi (690 MPa)
Yield strength, min.	80 ksi (550MPa)
Elongation in 2 in. (50 mm), min.	15.0%
Reduction in area, min.	45.0%

Toughness requirements shall be per NB-2300 for Class 1, and NG-2300 for Class CS, except that the drop-weight tests are not required. The acceptance standards of NB-2332 or NG-2331 and NG-2332 shall apply.

(d) The material shall conform to all other requirements of SA-182 Grade F6a for forgings, and SA-276 Type 403 for bars.

(e) The maximum operating temperature shall not exceed 700°F (370°C).

(f) Design stress intensity, yield and tensile strength values as shown in Tables 1 and 2 for the heat-treated condition may be used when the material has enhanced properties due to the special heat treatment described in (c) above.

(g) Where the method of fabrication requires welding after heat treatment, it shall be done by applying austenitic stainless steel or nickel alloy weld deposits prior to heat treatment and only on regions designed to the design stress intensity values in Table 1 for annealed properties. The minimum thickness of this weld shall be 3/16 in. (5 mm), and the maximum 1/2 in. (13 mm). Such weld deposits shall be liquid penetrant examined. Attachments to these weld deposits may be made austenitic stainless or nickel alloy welds subsequent to heat treatment, and the thickness shall not exceed that of the previously deposited weld. No welding on the ferritic base metal

is permitted after heat treatment, and no welding is permitted at any time in the regions designed to allowable stresses higher than those given in Tables 1 and 2 for annealed properties. All welding shall meet the requirements of Section IX except that the tests shall be made after final heat treatment of the specimen, and longitudinal bend test specimen of QW-160, Section IX, may be used.

(h) For Class 1, machined transitions between adjoining heavy and thin-walled sections shall consist of a taper of at least 3 to 1, with a radius at each end of at least twice the thickness of the thin wall. It is not the intent of this paragraph to eliminate integral flanges or other similar configurations, but to provide a control on machined transitions similar to that provided by NB-3361 for welded configurations.

(i) All heat-treated parts shall be examined for quench cracks by a liquid penetrant method. All cracks shall be removed, and a crack which cannot be removed within the minimum required thickness of the shell is cause for rejection.

(j) For material heat treated to Condition 1, hardness checks shall be made after heat treatment at not more than 5 ft (1500 mm) intervals, with a minimum of three different locations representing approximately the center and each end. The average of individual hardness readings at each location shall not be less than 226 Brinell or more than 277 Brinell or equivalent.

(k) Fatigue evaluation with these materials shall be in accordance with NB-3222.4 for Class 1 and NG-3222.4 for Class CS using the design fatigue strength curves of Tables I-9.0.

(l) This case number shall be identified in the marking of the material, on the certification for the material and on the Data Report Form for the component.

TABLE 1A
DESIGN STRESS INTENSITY VALUES FOR
TYPE 403 MODIFIED MATERIAL CLASS 1 AND CS COMPONENTS

	Annealed	Condition 1	Condition 2
Temperature (°F)	Design Stress Intensity S_m, (ksi)	Design Stress Intensity S_m, (ksi)	Design Stress Intensity S_m, (ksi)
-20 to 100	23.3	36.7	33.3
200	23.3	36.7	33.3
300	22.9	35.9	32.7
400	22.5	35.3	32.1
500	22.1	34.8	31.6
600	21.6	33.9	30.8
650	21.2	33.3	30.2
700	20.6	32.4	29.5

TABLE 1B
DESIGN STRESS INTENSITY VALUES FOR
TYPE 403 MODIFIED MATERIAL CLASS 1 AND CS COMPONENTS

	Annealed	Condition 1	Condition 2
Temperature (°C)	Design Stress Intensity S_m, (MPa)	Design Stress Intensity S_m, (MPa)	Design Stress Intensity S_m, (MPa)
-30 to 40	161	253	230
65	161	253	230
100	161	253	230
125	160	251	228
150	158	248	225
200	155	244	222
250	153	240	219
300	150	236	214
325	148	232	211
350	145	228	207
375[1]	142	223	202

Note 1: The maximum operating temperature is 370°C, the value listed at 375°C is provided for interpolation purposes, only.

TABLE 2A
YIELD AND TENSILE STRENGTH VALUES FOR
TYPE 403 MODIFIED MATERIAL CLASS 1 AND CS COMPONENTS

	Annealed		Condition 1		Condition 2	
Temp. (°F)	Yield Strength, (ksi)	Tensile Strength, (ksi)	Yield Strength, (ksi)	Tensile Strength, (ksi)	Yield Strength, (ksi)	Tensile Strength, (ksi)
75/100	40.0	70.0	90.0	110.0	80.0	100.0
200	36.8	70.0	82.8	110.0	73.6	100.0
300	35.5	68.6	79.9	107.8	71.0	98.0
400	34.9	67.4	78.5	105.9	69.8	96.3
500	34.4	66.4	77.4	104.3	68.8	94.8
600	33.7	64.7	75.8	101.7	67.4	92.5
650	33.1	63.5	74.5	99.8	66.2	90.7
700	32.4	61.9	72.8	97.3	64.7	88.4
750	31.4	59.9	70.7	94.2	62.8	85.6
800	30.2	57.5	68.0	90.4	60.4	82.1
850	28.8	54.6	64.8	85.9	57.6	78.0
900	27.1	51.3	61.0	80.7	54.2	73.3
950	25.2	47.6	56.6	74.8	50.3	68.0
1000	23.0	43.5	51.7	68.3	45.9	62.1

TABLE 2B
YIELD AND TENSILE STRENGTH VALUES FOR
TYPE 403 MODIFIED MATERIAL CLASS 1 AND CS COMPONENTS

	Annealed		Condition 1		Condition 2	
Temp. (°C)	Yield Strength, (MPa)	Tensile Strength, (MPa)	Yield Strength, (MPa)	Tensile Strength, (MPa)	Yield Strength, (MPa)	Tensile Strength, (MPa)
-30 to 40	276	483	621	758	552	689
65	261	483	587	758	522	689
100	252	483	567	758	504	689
125	248	479	558	752	496	684
150	245	473	551	743	490	675
175	242	469	546	736	485	669
200	241	465	542	731	482	665
225	239	462	538	726	479	660
250	238	459	535	721	476	656
275	236	455	531	715	472	650
300	234	450	526	707	468	643
325	231	444	520	697	462	634
350	227	435	511	684	454	622
375	222	425	500	668	445	607
400	216	412	487	648	433	589
425	209	398	470	625	418	568
450	200	380	450	597	400	543
475	190	360	428	566	380	514
500	178	338	402	531	357	482
525	165	313	372	492	331	447
550	151	286	340	450	302	409