Duke Power Company
McGuire Nuclear Generation Department
12700 Hagers Ferry Road (MG01VP)
Huntersville, NC 28078-8985

T. C. McMeekin
Vice President
(704)875-4800
(704)875-4809 Fax

DUKE POWER

May 30, 1995

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 22055

Subject: McGuire Nuclear Station, Unit 1
Docket No. 50-369
Request for Additional Information
TAC No. M89625/6

Dear Sir:

By submittal dated May 18, 1994, Duke Power Company proposed the integration of the McGuire Nuclear Station Unit 1 Reactor Vessel Material Surveillance Program with that of the Diablo Canyon Unit 2.

During the submittal review, the need for additional information concerning specific aspects of the submittal were identified by Mr. John Tsao of your staff. The information requested by Mr. Tsao was discussed during a teleconference on January 18, 1995 with Mr. Victor Nerses and J.C. Tsao, representing ONRR and J.D. Gilreath, A.M. McClenny, and J.M. Washam representing Duke Power Company. At the conclusion of the conversation, agreement was reached that the formal response would be delayed until May 30, 1995, in order to obtain additional data from the third surveillance capsule report from Diablo Canyon. The report is presently in draft form; however, sufficient data is available to address the subject areas of interest.

A001
1/1

To this end, find enclosed the Duke Power Company response to the request for additional information as received by FAX on January 6, 1995.

Please contact John Washam at (704) 875-4181 if questions arise concerning this response.

Very truly yours,

T.C. McMeekin

xc. Mr. S.D. Ebneter
Regional Administrator, Region II
U.S. Nuclear Regulatory Commission
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

Mr. Victor Nerses, Project Manager
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
One White Flint North, Mail Stop 9H3
Washington, DC 20555

Mr. George F. Maxwell
Senior NRC Resident Inspector, McGuire
McGuire Nuclear Station

bcc:
J.E. Snyder
A.M. McClenny
J.D. Gilreath
File:RAI
ELL (EC050)

1) Provide irradiated material data to show that the axial weld, heat number 12008 and 21935 in McGuire Unit 1 has a similar embrittlement trend (material response to irradiation) as the embrittlement trend in the Diablo Canyon surveillance weld, heat number 12008 and 21935.

If Duke Power does not have the irradiated weld data, 1) can Duke Power insert the specimens of the weld in question in a surveillance capsule in the McGuire Unit 1 vessel for the future tests to support the assumption that there is a similar embrittlement trend between the McGuire weld and Diablo Canyon weld, or 2) Can Duke Power find irradiated data from the same weld in another reactor to compare them to the embrittlement trend of the Diablo Canyon weld.

Duke Power addressed this issue in Attachment 1, page 2, in general terms, but the staff is looking for specific numbers and values.

Duke has performed a search for irradiated weld material data of heat number 12008/21935 and could find no additional test data other than that of Diablo Canyon Unit 2. No spare weld material of this heat was discovered for the insertion into McGuire Unit 1. PG&E is maintaining a small piece of this weld material. However, it is reserved for potential future issues, and is not available for additional capsules at McGuire.

We do not feel it is necessary to perform additional testing with 12008/21935 material from the McGuire Unit 1 vessel since the environments are so similar. The only significant difference is the T_{cold} operating temperature between the two plants with a differential of approximately 13 degrees (McGuire T_{cold} is 13° hotter). This is a significant conservatism which should more than envelop any other minor differences between the two plants.

The following data is a comparison of the McGuire and Diablo Canyon irradiated weld surveillance results. The McGuire surveillance weld data is heat number 12008/20291 which is representative of the McGuire Unit 1 intermediate shell longitudinal weld seams. The Diablo Canyon surveillance weld data is heat number 12008/21935 and is representative of McGuire Unit 1 and Diablo Canyon Unit 2 limiting weld.

Even though these surveillance weld materials are not the same heat number, they are similar enough to show that the McGuire data is trending below the Diablo Canyon data. This in conjunction with the similarity of the other parameters, indicate the use of Diablo Canyon data for McGuire would be a reasonable and conservative approach.

COMPARISON OF MCGUIRE UNIT 1 AND DIABLO CANYON UNIT 2 SURVEILLANCE WELD MATERIAL DATA

Station Surveillance Weld Material	Heat #	Cu	Ni	Reference
Diablo Canyon Unit 2	12008/21935	0.22	0.87	See Answer to Question 4
McGuire Unit 1	12008/20291	0.20	0.87	WCAP-13949, McGuire Unit 1, Capsule V, Feb. 1994

Station Surveillance Weld Material	HEAT #	Fluence x 10^{19}n/cm^2	ΔRT_{NDT}	Initial RT_{NDT}	Reference
Diablo Canyon Unit 2	12008/21935	0.716	173.8	-50	WCAP-14363, Capsule Y Diablo. Canyon Unit 2, DRAFT
Diablo Canyon Unit 2	12008/21935	0.960	204.2		
Diablo Canyon Unit 2	12008/21935	1.077	212.5		
McGuire Unit 1	12008/20291	0.472	160	-50	WCAP-13949, McGuire Unit 1, Capsule V, Feb. 1994
McGuire Unit 1	12008/20291	1.409	165		
McGuire Unit 1	12008/20291	2.186	175		

2) Provide: 1) neutron flux spectrum at the Diablo Canyon capsule where the surveillance weld, heat number 12008 and 21935, is located and at the reactor vessel wall and 2) the neutron flux spectrum at the McGuire reactor vessel where the weld is located. Provide a comparison. Duke Power provided only neutron fluence comparison between Diablo Canyon and McGuire at 32EFPY.

See following letter from S. L. Anderson (Westinghouse) dated May 25, 1995, addressing this question. Please note statement in second paragraph of attachment, "... *the design of the reactor internals and pressure vessel are identical, these relative spectra apply to both of these plants.*" Therefore, all data contained in Tables 1 and 2 apply to both McGuire Unit 1 and Diablo Canyon Unit 2 stations.

SE-FSRE-95-186
May 25, 1995
(412) 374-5165

Mr. Jeff Gilreath
Duke Power Company
526 South Church Street
P. O. Box 1006
Charlotte, NC 28201-1006

Dear Mr. Gilreath:

SUBJECT: Transmittal of Neutron Spectra for McGuire Unit 1 and Diablo Canyon Unit 2.

The attached writeup entitled "Neutron Energy Spectra at Surveillance Capsule and Pressure Vessel Inner Radius Locations" provides the additional neutron exposure information requested by the NRC to support the evaluation of the proposed integrated reactor vessel surveillance program for McGuire Unit 1.

If you have any questions or require any additional information, please feel free to contact me.

very truly yours,

WESTINGHOUSE ELECTRIC CORPORATION

S. L. Anderson

S. L. Anderson, Engineer
Fluid Systems and Radiation Engineering

ATTACHMENT

NEUTRON ENERGY SPECTRA AT SURVEILLANCE CAPSULE
AND PRESSURE VESSEL INNER RADIUS LOCATIONS

The attached tables provide the energy distributions of neutron flux and fluence at the center of reactor vessel surveillance capsules and at the pressure vessel inner radius for the Diablo Canyon Unit 2 and the McGuire Unit 1 reactors. In order to provide a direct comparison from location to location, the spectral data have been normalized to a neutron flux of 1.0 n/cm^2-sec ($E > 1.0$ MeV). Also included in the tables are the ratios of [dpa/sec]/[ϕ($E > 1.0$ MeV)] and [ϕ($E > 0.1$ MeV]/[ϕ($E > 1.0$ MeV)]. These ratios provide an indication of the relative embrittlement associated with the various spectra.

Since these reactors are sister units; i.e., the design of the reactor internals and pressure vessel are identical, these relative spectra apply to both of these plants. Absolute spectra can be determined by multiplying the data from Tables 1 and 2 by the appropriate flux or fluence ($E > 1.0$ MeV).

The data in Tables 1 and 2 were calculated using the DORT two-dimensional discrete ordinates code and the BUGLE-93 cross-section library. The BUGLE-93 library is derived from the ENDF/B-VI data files and its use for vessel fluence calculations is consistent with the proposed fluence regulatory guide DG-1025.

Relative to the surveillance capsule spectra for Diablo Canyon Unit 2, Capsules U and X were located at the 56.0 degree location and Capsule Y was positioned at the 58.5 degree azimuth. In regard to the Mcguire vessel weld locations, the 0.0 degree spectrum from Table 2 is representative of the 180 degree longitudinal weld; whereas, the 30.0 degree spectrum from Table 2 is applicable to both the 60 degree and 300 degree longitudinal weld positions. The remaining vessel data are presented for comparison.

TABLE 1

RELATIVE NEUTRON SPECTRUM AT SURVEILLANCE CAPSULE LOCATIONS

Lower Energy [MeV]	58.5 Deg. Capsule	56.0 Deg. Capsule
1.42E+01	1.19E-04	1.10E-04
1.22E+01	3.83E-04	3.56E-04
1.00E+01	1.70E-03	1.59E-03
8.61E+00	3.35E-03	3.14E-03
7.41E+00	5.93E-03	5.59E-03
6.07E+00	1.45E-02	1.37E-02
4.97E+00	2.26E-02	2.16E-02
3.68E+00	4.78E-02	4.62E-02
3.01E+00	4.03E-02	3.94E-02
2.73E+00	3.26E-02	3.19E-02
2.47E+00	3.95E-02	3.88E-02
2.35E+00	2.55E-02	2.51E-02
2.23E+00	2.88E-02	2.84E-02
1.92E+00	8.41E-02	8.36E-02
1.65E+00	1.05E-01	1.05E-01
1.35E+00	1.69E-01	1.70E-01
1.00E+00	3.78E-01	3.85E-01
8.21E-01	2.74E-01	2.80E-01
7.43E-01	1.38E-01	1.39E-01
6.08E-01	4.74E-01	4.90E-01
4.98E-01	3.94E-01	4.05E-01
3.69E-01	4.55E-01	4.68E-01
2.97E-01	4.61E-01	4.79E-01
1.83E-01	5.55E-01	5.59E-01
1.11E-01	5.69E-01	5.81E-01
6.74E-02	4.23E-01	4.27E-01
4.09E-02	3.34E-01	3.33E-01
3.18E-02	1.11E-01	1.06E-01
2.61E-02	4.62E-02	4.12E-02
2.42E-02	1.24E-01	1.27E-01
2.19E-02	9.19E-02	8.51E-02
1.50E-02	1.13E-01	1.34E-01
7.10E-03	2.84E-01	2.66E-01
3.36E-03	3.72E-01	3.89E-01
1.59E-03	3.67E-01	3.66E-01
4.54E-04	5.67E-01	5.56E-01
2.14E-04	3.02E-01	2.90E-01
1.01E-04	3.39E-01	3.31E-01
3.73E-05	4.41E-01	4.31E-01
1.07E-05	5.20E-01	5.05E-01
5.04E-06	2.86E-01	2.75E-01
1.86E-06	3.53E-01	3.32E-01
8.76E-07	2.44E-01	2.25E-01
4.14E-07	1.79E-01	1.54E-01
0.00E+00	6.88E-01	5.19E-01
Flux (E > 1.0 MeV)	1.00	1.00
dpa/sec	1.92E-21	1.94E-21
Flux (E > 0.1 MeV)	4.41	4.49

TABLE 2

RELATIVE NEUTRON SPECTRUM AT PRESSURE VESSEL IR LOCATIONS

Lower Energy [MeV]	0.0 Deg Vessel	15.0 Deg Vessel	30.0 Deg Vessel	45.0 Deg Vessel
1.42E+01	7.23E-04	5.63E-04	4.01E-04	3.29E-04
1.22E+01	2.11E-03	1.69E-03	1.21E-03	1.02E-03
1.00E+01	7.89E-03	6.53E-03	4.78E-03	4.22E-03
8.61E+00	1.42E-02	1.20E-02	8.81E-03	7.85E-03
7.41E+00	2.26E-02	1.98E-02	1.45E-02	1.33E-02
6.07E+00	5.64E-02	5.04E-02	3.57E-02	3.30E-02
4.97E+00	7.49E-02	6.96E-02	5.15E-02	4.85E-02
3.68E+00	1.19E-01	1.16E-01	9.36E-02	9.18E-02
3.01E+00	7.56E-02	7.56E-02	6.60E-02	6.66E-02
2.73E+00	5.15E-02	5.25E-02	4.79E-02	4.95E-02
2.47E+00	5.63E-02	5.76E-02	5.46E-02	5.69E-02
2.35E+00	3.38E-02	3.52E-02	3.43E-02	3.63E-02
2.23E+00	3.33E-02	3.47E-02	3.52E-02	3.70E-02
1.92E+00	8.42E-02	8.71E-02	9.14E-02	9.52E-02
1.65E+00	8.48E-02	8.79E-02	9.85E-02	1.01E-01
1.35E+00	1.14E-01	1.19E-01	1.40E-01	1.42E-01
1.00E+00	1.69E-01	1.75E-01	2.22E-01	2.15E-01
8.21E-01	1.07E-01	1.11E-01	1.46E-01	1.38E-01
7.43E-01	5.48E-02	5.68E-02	7.87E-02	7.43E-02
6.08E-01	1.46E-01	1.50E-01	2.19E-01	1.98E-01
4.98E-01	1.19E-01	1.22E-01	1.85E-01	1.65E-01
3.69E-01	1.30E-01	1.34E-01	2.05E-01	1.82E-01
2.97E-01	1.35E-01	1.36E-01	2.11E-01	1.82E-01
1.83E-01	1.70E-01	1.74E-01	2.83E-01	2.44E-01
1.11E-01	1.62E-01	1.65E-01	2.75E-01	2.32E-01
6.74E-02	1.15E-01	1.17E-01	2.03E-01	1.70E-01
4.09E-02	9.21E-02	9.39E-02	1.67E-01	1.41E-01
3.18E-02	3.44E-02	3.50E-02	6.49E-02	5.44E-02
2.61E-02	2.22E-02	2.28E-02	4.27E-02	3.63E-02
2.42E-02	3.88E-02	3.88E-02	6.82E-02	5.51E-02
2.19E-02	2.45E-02	2.43E-02	4.29E-02	3.46E-02
1.50E-02	4.95E-02	4.95E-02	9.30E-02	7.64E-02
7.10E-03	9.15E-02	9.31E-02	1.79E-01	1.49E-01
3.36E-03	1.02E-01	1.06E-01	2.03E-01	1.68E-01
1.59E-03	9.41E-02	9.65E-02	1.92E-01	1.58E-01
4.54E-04	1.51E-01	1.55E-01	3.18E-01	2.61E-01
2.14E-04	8.68E-02	8.96E-02	1.88E-01	1.54E-01
1.01E-04	9.02E-02	9.39E-02	1.99E-01	1.63E-01
3.73E-05	1.19E-01	1.24E-01	2.71E-01	2.20E-01
1.07E-05	1.46E-01	1.52E-01	3.43E-01	2.78E-01
5.04E-06	8.48E-02	8.88E-02	2.04E-01	1.65E-01
1.86E-06	1.13E-01	1.19E-01	2.81E-01	2.27E-01
8.76E-07	8.62E-02	9.09E-02	2.18E-01	1.77E-01
4.14E-07	8.09E-02	8.49E-02	2.09E-01	1.70E-01
0.00E+00	9.48E-01	1.23E+00	3.24E+00	3.00E+00
Flux (E > 1.0 MeV)	1.00	1.00	1.00	1.00
dpa/sec	1.55E-21	1.53E-21	1.64E-21	1.58E-21
Flux (E > 0.1 MeV)	2.05	2.07	2.65	2.45

3) Provide the vessel inlet temperature for each fuel cycle at McGuire Unit 1 and Diablo Canyon Unit 2 because the staff does not know how and where those two Temperatures on Page D-6 were obtained.

Refueling Outage EOC-#	McGuire U1 0% Power T_{COLD} °F	**McGuire U1 100% Power T_{COLD} °F**	Diablo Canyon U2 0% Power T_{COLD} °F	**Diablo Canyon U2 100% Power T_{COLD} °F**
1	557	**558.1**	547	**545**
2	557	**558.1**	547	**545**
3	557	**558.1**	547	**545**
4	557	**558.1**	547	**545**
5	557	**558.1**	547	**545**
6	557	**558.1**	547	**545**
7	557	**558.1**		
8	557	**558.1**		
9	557	**558.1**		

These temperatures have minimal deviations during each cycle. The McGuire Solid State Protection System monitors these temperatures within a tolerance of ± 2F.

As shown in figure 5-19 of the McGuire FSAR, T_{cold} remains fairly constant at approximately 558F. A Licensee Event Report search indicated the Technical Specification was violated once. The minimum NC system temperature of 536.7F was reached during a 79 minute event. This event is documented in the Duke Power Company, McGuire Nuclear Station Reportable Occurrence Report No. 370/83-62, dated December 1, 1983.

Diablo Canyon Unit 2 reported no significant operating temperature deviations (operating below 525F) in GL92-01 submittal. Their OP L-1 requires Tave = 547F prior to entering Mode 2. OP L-5 requires Tave > 541F until reactor is subcritical.

Attached are the McGuire and Diablo Canyon Reactor system temperature versus power curves found in chapter 5 of the FSAR.

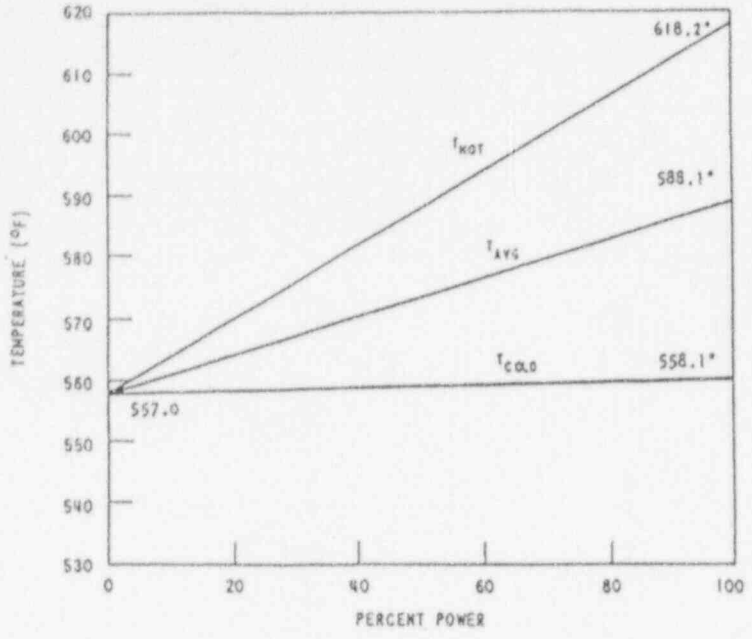
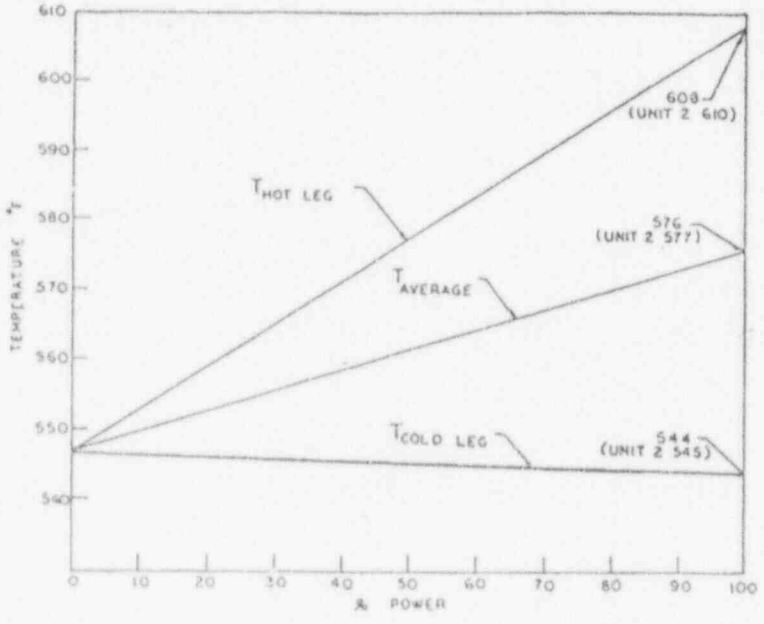


Figure 5-19.
Relationship Between Reactor Coolant System Temperature and Power



FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 5.3-1 HOT LEG, COLD LEG, AND AVERAGE REACTOR COOLANT LOOP TEMERATURE AS FUNCTION OF PERCENT FULL POWER

4) In the staff's reactor vessel material database for the McGuire weld (obtained from Duke Power's response to Generic Letter 92-01), the copper content and nickel content for the weld, heat number 12008 and 21935, are 0.22% and 0.86%, respectively. In Attachment 2, page D-4, the copper content was reported 0.20% and no nickel content was reported. Clarify.

The .20% copper and no nickel reported, was a chemical analysis taken for the McGuire Vessel during fabrication and documented in Combustion Engineering, Inc., Metallurgical Research & Development, "Chemical Analysis of Wire-Flux Test Coupon", Job Number X-32255, 10-14-69, and later referenced in toughness tables for MNS1 reactor vessel in WCAP-10786 (see reference below).

The 0.22% copper and 0.86% nickel is the average of all known measured values (as of 7/92) for the tantum weld 21935/12008. Most of these data points come from Diablo Canyon Surveillance Capsule Reports (see table below).

REFERENCE	WT. % CU	WT. % NI
WCAP-10786, "Analysis of Capsule U from the Duke Power Company McGuire Unit 1 Reactor Vessel Radiation Surveillance Program", S. E. Yanichko, T. V. Congedo and W. T. Kaiser, February 1985, Table A-1, MNS1 Rx Vessel Toughness Table	0.200	--
WCAP-8783, "Pacific Gas and Electric Company Diablo Canyon Unit No. 2 Reactor Vessel Radiation Surveillance Program", J.A. Davidson and S.E. Yanichko, December 1976.	0.220	0.830
WCAP-10472, "Evaluation of Diablo Canyon Units 1 and 2 Reactor Vessel Beltline Weld Chemistry". S.E. Yanichko and M.K. Kunka, September 1983 (Proprietary).	0.230 0.210 0.220	0.900 0.760 0.900
WCAP-11851, "Analysis of Capsule U from the Pacific Gas and Electric Company Diablo Canyon Unit 2 Reactor Vessel Radiation Surveillance Program", S. E. Yanichko, et al., May 1988.	0.219 0.212 0.213	0.86 0.88 0.90
WCAP-12811, "Analysis of Capsule X from the Pacific Gas and Electric Company Diablo Canyon Unit 2 Reactor Vessel Radiation Surveillance Program", E. Terek, et al., December 1990.	0.225 0.213 0.225	0.875 0.856 0.877
GL92-01 Average	**0.217**	**0.864**
WCAP-14363, "Analysis of Capsule Y from the Pacific Gas and Electric Company Diablo Canyon Unit 2 Reactor Vessel Radiation Surveillance Program", E. Terek, et al., DRAFT.	0.196 0.24 0.23	0.763 0.968 0.910
New Average	**0.218**	**0.868**