DUKE POWER COMPANY
POWER BUILDING
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May 21, 1982

WILLIAM O. PARKER, JR.
VICE PRESIDENT
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TELEPHONE: AREA 704
373-4083

Mr. James P. O'Reilly, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303

Re: RII:JPO
McGuire Nuclear Station
Docket Nos. 50-369 and 50-370
IE Bulletin 79-02

Dear Mr. O'Reilly:

Attached is Revision 5 of Duke Power Company's response to IE Bulletin 79-02. Note that only pages 1 & 5 of the response and pages 14, 28-30, and 46-51 of the anchor bolt safety factor analysis have changed. These revised pages should be inserted in the previous submittal dated December 8, 1980 (Revision 4). With the submittal of this information, all known outstanding items on Unit 2 have been resolved.

Should you have additional questions regarding this matter, please advise.

Very truly yours,

William O. Parker, Jr.

PBN/jfw
Attachment

cc: Director
Division of Reactor Operations Inspection
Office of Inspection and Enforcement
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Washington, D. C. 20555

Director
Office of Nuclear Reactor Regulation
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Mr. P. R. Bemis
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IE11

MCGUIRE NUCLEAR STATION

Responses to USNRC IE Bulletin 79-02, Revision 5

Original:	July 2, 1979
Revision 1:	January 7, 1980
Revision 2:	July 24, 1980
Revision 3:	December 1, 1980
Revision 4:	December 8, 1980
Revision 5:	May 14, 1982

McGuire Nuclear Station is in the later stages of construction of Unit #2 with commercial operation of Unit #1. All pipe supports have been erected in Unit #1 and a large number have been erected in Unit #2. The following is a summary, by item, of the extent and manner in which Duke Power Company intends to satisfy Actions 1 through 9 of the IE Bulletin 79-02, Revision 2.

Response 1: Duke Power Company will account for base plate flexibility in the calculation of expansion anchor bolt loads for all Seismic Category I pipe support base plates using either a conservative hand calculation method which has been verified by non-linear finite element analysis or a specific non-linear finite element analysis for a particular base plate. The models and boundary conditions, including appropriate load displacement characteristics of the anchors, used for the finite element analyses, are based on Duke studies and on work performed by Teledyne Engineering Services which was sponsored by a group of thirteen (13) utilities formed to respond to generic items of IE Bulletin 79-02. All expansion anchor support plates designed prior to implementing these analysis methods have been reanalyzed accordingly and have been modified if required to comply with allowable anchor bolt loadings.

Response 2: The minimum factors of safety, between the expansion anchor bolt design load and the bolt ultimate capacity determined from static load test, used in Duke's design of pipe supports, are as follows:

Normal Conditions	- 4
Upset Conditions	- 4
Faulted Conditions*	- 4

These factors of safety are for wedge type and sleeve type expanison anchors. Some shell type anchors were used in the early stages of McGuire construction. Use of shell type anchors for Nuclear Safety Related applications was discontinued in February 1975. Duke Power Company has identified all pipe supports using shell type anchors and the design of these supports has been reviewed to assure that a minimum factor of safety of five (5) is maintained.

*For work completed prior to November 1, 1980, the 95% confidence level criteria, presented in the statistical analysis enclosed with this response, applies to faulted loading combinations. The design criteria for all designs after that date require a minimum safety factor of 4 for faulted conditions.

concluded that this test sample provides reasonable and adequate assurance of proper plate bolt hole size for wedge and sleeve type expansion anchors.

The supplemental Self-Drill Inspection Program implemented under MCS-1196.02-00-0003 identified 55 of 191 plate holes inspected as oversized. This oversizing was determined to be due to the self-drill anchor installation procedures. All oversized holes have been reviewed and modification made where required.

In order to address the question of the relationship of cyclic/load carrying capacity to installation procedure (anchor pre-load), the tests referred to in Response 3, performed by Teledyne Engineering Services and sponsored by the group of thirteen (13) utilities, have been performed on anchors installed in accordance with manufacturer's recommended installation procedures and have no more preload than is provided by the use of these procedures. Based on Duke's understanding of the behavior of expansion anchors and on cyclic testing which has been performed, Duke Power Company is confident that the anchors will perform adequately.

Some pipe supports with anchor bolts were physically inaccessible for inspection under the provisions of this bulletin. These have been independently assessed to verify that they are not reasonably accessible. Duke has concluded that there is reasonable and adequate assurance that these supports will perform adequately. This conclusion is based on the results of inspections of other supports and the long history of documentation associated with pipe supports. Specifically, 115 supports with and without anchor bolts were installed under Construction Procedure 308 and inspected under Construction Procedure 503 or QA Procedure M-52. It is Duke's position that this documentation assures the proper installation of the anchor bolts on inaccessible supports and satisfies the requirements of IEB 79-02.

Response 5: Nuclear Safety Related/seismic pipe supports are prohibited from being attached to block (masonry) walls using concrete expansion anchors. In response to Revision 2 of IE Bulletin 79-02, Duke Power Company has conducted an on-site confirmatory review at McGuire Units #1 and #2 of Nuclear Safety Related/seismic pipe supports to assure that no such installations exist. Results of this review have confirmed that there are no such installations of this type at McGuire Nuclear Station Units #1 and #2.

Response 6: The expansion anchor installation and inspection procedures utilized at McGuire Nuclear Station and described in Response 4 apply to all expansion anchors installed in Nuclear Safety Related pipe supports. Each expansion anchor is inspected regardless of the physical configuration of the steel members

Duke Power Company
McGUIRE NUCLEAR STATION

ANCHOR BOLT SAFETY FACTOR ANALYSIS

FOR

USNRC I & E BULLETIN 79-02

AUGUST 8, 1980
REVISED DECEMBER 1, 1980
REVISED DECEMBER 8, 1980
REVISED MAY 14, 1982

8.0 CASE-BY-CASE REVIEW OF SUPPORTS/RESTRAINTS

McGuire Support/Restraint Design Group personnel conducted several reviews of supports with anchor bolts to verify compliance with IE Bulletin 79-02. Prior to receipt of the Bulletin, base plate flexibility was not considered in the design. Supports at McGuire are generally classed as rigorous or alternate depending on the type of piping analysis employed.

Alternate analysis supports comprise approximately 6,513 of 15,276 safety related supports in Unit 1 and 4,686 of 9,817 in Unit 2. A screening of these alternate supports identified 549 which potentially would not have the Bulletin design safety factor in the normal/upset load combination if base plate flexibility were considered in Unit 1 and none in Unit 2. A detailed review of each of the support/restraints was conducted accouting for base plate flexibility. Modifications were specified as required to upgrade the support to meet this design safety factor criteria. This work has been completed.

Rigorous analysis supports comprise approximately 8,763 or 15,276 safety related supports in Unit 1 and 5,131 of 9,817 in Unit 2. These were also screened to account for base plate flexibility considerations, and 1,952 supports potentially did not have the required design safety factor in Unit 1 and 46 in Unit 2. A detailed review of each of these support/restraints was conducted accounting for base plate flexibility. Modifications were specified as required to upgrade the support/restraint to meet this design safety factor criteria. This work has been completed.

In response to concerns expressed by U. S. Nuclear Regulatory Commission Region II inspectors regarding the McGuire design criteria of $FS_F = 2.125$, McGuire Support/Restraint Design Group reviewed a sample of 1,410 rigorous supports to estimate the overall impact of upgrading Unit 1 to a faulted safety factor of 4, holding all else constant. The importance of concrete strength was examined by reviewing a 3000 psi nominal strength case and a 5000 psi nominal strength case.

Attachment 7 presents the projections derived from this analysis. Note that 604 rigorous and 98 alternate supports, in Unit 1, were identified as having a strong potential for not complying with a faulted condition safety factor of 4 (5000 psi concrete). A detailed review of standard design practices at

The minimum sample size required in using a binomial distribution assumption is 74. Large sample sizes are permitted and have correspondingly larger allowable number of anchor bolts with FS<4 to satisfy the hypothesis. These values are readily obtainable from a table of confidence limits for proprtions applicable to Binomial, Poisson, and Hypergeometric Distributions.

The Binomial distribution function and inverse sampling techniques assume a large population (N) compared with the sample (n). Some systems have fewer anchor bolts than the minimum sample size and will be analyzed absolutely, i.e., the total population (N) analyzed.

11.4 RESULTS

The results for the 39 Nuclear Safety Related systems are presented in Attachment 13.

11.4.1 Unit 1

All rigorously analyzed systems passed the acceptance criteria. Alternate Analysis systems which did not meet the criteria are NF (ice condenser refrigeration), VE (annulus ventilation), VG (diesel generator starting air), WS (solid waste), WZ (ground water drainage), and YM (demineralized water).

11.4.2 Unit 2

The rigorously analyzed systems which did not meet the criteria is II (Incore Instrumentation). There was only one support in the system utilizing anchor bolts and it was already identified for redesign due to changes in the design loads. All Alternate Analysis systems passed the acceptance criteria.

The small number of systems which did not meet the criteria and the fact that time and cost trade-offs did not permit analytical credit for the full range of conservatisms existing in the original design demonstrate clearly that

anchor bolt safety factors are generally far in excess of that required by the plant design criteria employed for McGuire Nuclear Station. Many of the anchor bolts in the sample which did not have a minimum safety factor of 4 had calculated safety factors of 3.5 or greater. As demonstrated by Attachment 6, there are no anchor bolts with a safety factor less than 2.4.

11.5 IMPACT ON FUEL LOADING AND FULL POWER OPERATION

Based on Duke's commitment in Revision 4 to the IEB 79-02 response, there is no impact of completing repairs on fuel loading or full power operation. All repairs required to meet the requirements of IEB 79-02 were completed prior to fuel loading in Unit 1 and are completed in Unit 2.

11.6 PLAN OF CORRECTIVE ACTION

All anchor bolts on each of the systems which did not meet the criteria have been screened, analyzed in detail, and repaired as necessary to achieve a condition which meets the acceptance criteria, i.e. no more than 5% of the anchor bolts on that system with a safety factor less than 4. This program was similar to the hanger baseplate review which was done to consider baseplate flexibility. Also, we expeditiously corrected all bolts identified as having a safety factor less than 4. A summary of these activities and the status is presented below.

ACTIVITY	STATUS
Unit 1	
Upgrade to Meet 95% C.L. - Systems NF, VE, VG WS, WZ & YM	Complete
Correct Bolts Identified w/ FS<4	Complete
Unit 2	
Upgrade to Meet 95% C.L. - System II	Complete
Correct Bolts Identified w/ FS<4	Complete

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ATTACHMENT 13

Unit 1

Rigorous Systems

System	Name	Actual w/FS<4	Allowed # w/FS<4	Hypothesis Accepted *
BB	Steam Generator Blowdown	2	4	Yes
CA	Auxiliary Feedwater	3	3	Yes
CF	Feedwater	0	0	Yes
FW	Refueling Water	0	0	Yes
II	Incore Instrumentation	0	0	Yes
KC	Component Cool	4	16	Yes
KD	Diesel Generator Engine Cooling Water	0	0	Yes
KF	Spent Fuel Cooling	2	2	Yes
LD	Diesel Generator Engine Lubricating Oil	0	0	Yes
NB	Boron Recycle	0	7	Yes
NC	Reactor Coolant	0	2	Yes
ND	Residual Heat Removal	0	0	Yes
NI	Safety Injection	12	12	Yes
NM	Nuclear Sampling	0	0	Yes
NR	Boron Thermal Regeneration	0	0	Yes
NS	Containment Spray	0	0	Yes

ATTACHMENT 13 (Cont'd)

Unit 1

Rigorous Systems (Cont'd)

System	Name	Actual w/FS<4	Allowed # w/FS<4	Hypothesis Accepted *
NV	Chemical & Volume Control	0	0	Yes
RN	Nuclear Service Water	4	6	Yes
RV	Containment Ventilation Cooling Water	1	9	Yes
SA	Auxiliary Steam	0	0	Yes
SM	Main Steam	0	0	Yes
SV	Main Steam Vent	0	0	Yes
VQ	Containment Pressure Control	0	0	Yes
VX	Containment Air Return Exchange	0	0	Yes
WL	Liquid Waste Recycle	2	5	Yes
YC	Chilled Water	0	36	Yes

ATTACHMENT 13 (Cont'd)

Unit 1

Alternate Analysis Systems

System	Name	Actual w/FS<4	Allowed # w/FS<4	Hypothesis Accepted *
FD	Diesel Generator Engine Fuel Oil	0	0	Yes
NF	Ice Condenser Refrigeration	13	1	No
RF	Fire Protection	0	0	Yes
VB	Breathing Air	1	1	Yes
VE	Annulus Ventilation	6	0	No
VG	Diesel Generator	16	4	No
VI	Instrument Air	0	0	Yes
VS	Station Air	0	2	Yes
WE	Equipment Decontamination	0	1	Yes
WG	Waste Gas	0	0	Yes
WS	Nuclear Solid Waste Disposal	8	0	No
WZ	Groundwater Drainage	40	1	No
YM	Demineralized Water	6	1	No

ATTACHMENT 13

UNIT 2

Rigorous Systems

System	Name	Actual w/FS<4	Allowed # w/FS<4	Hypothesi Accepted
BB	Steam Generator Blowdown	0	0	Yes
CA	Auxiliary Feedwater	0	0	Yes
CF	Feedwater	0	0	Yes
FW	Refueling Water	0	0	Yes
II	Incore Instrumentation	8	0	No
KC	Component Cool	0	0	Yes
KD	Diesel Generator Engine Cooling Water	0	0	Yes
KF	Spent Fuel Cooling	0	0	Yes
LD	Diesel Generator Engine Lubricating Oil	0	0	Yes
NB	Boron Recycle	0	0	Yes
NC	Reactor Coolant	0	0	Yes
ND	Residual Heat Removal	0	0	Yes
NI	Safety Injection	0	0	Yes
NM	Nuclear Sampling	0	0	Yes
NR	Boron Thermal Regeneration	0	0	Yes
NS	Containment Spray	0	0	Yes

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ATTACHMENT 13 (cont'd)

UNIT 2

Rigorous Systems (cont'd)

System	Name	Actual 4/FS<4	Allowed # w/FS<4	Hypothesi Accepted
NV	Chemical & Volume Control	0	0	Yes
RN	Nuclear Servic Water	0	0	Yes
RV	Containment Ve . lation Cooling Water	0	0	Yes
SA	Auxiliary Steam	0	0	Yes
SM	Main Steam	0	0	Yes
SV	Main Steam Vent	0	0	Yes
VQ	Containment Pressure Control	0	1	Yes
VX	Containment Air Return Exchange	0	0	Yes
WE	Equipment Decontamination	0	0	Yes
WL	Liquid Waste Recycle	0	0	Yes

ATTACHMENT 13 (Cont'd)

UNIT 2

Alternate Analysis Systems

System	Name	Actual w/FS<4	Allowed # w/FS<4	Hypothesis Accepted*
FD	Diesel Generator Engine Fuel Oil	0	0	Yes
NF	Ice Condenser Refrigeration	0	0	Yes
RF	Fire Protection	0	0	Yes
VB	Breathing Air	0	0	Yes
VE	Annulus Ventilation	0	0	Yes
VG	Diesel Generator	0	0	Yes
VI	Instrument Air	0	0	Yes
VS	Station Air	0	0	Yes
WG	Waste Gas	(Included in Unit 1)		
WS	Nuclear Solid Waste Disposal	(Included in Unit 1)		
WZ	Groundwater Drainage	0	0	Yes
YC	Chilled Water	0	0	Yes
YM	Demineralized Water	0	0	Yes

*The acceptance criteria requires a 95% confidence level that no more than 5% of the anchor bolts on a system have a safety factor less than 4.

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