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William J. Museler
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SEP 28 1992

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

In the Matter of the Application of) Docket Nos. 50-390
Tennessee Valley Authority) 50-391

WATTS BAR NUCLEAR PLANT (WBN) - UNITS 1 AND 2 - SUPPLEMENTAL INFORMATION ON SHALLOW UNDERCUT ANCHORS

Reference: TVA letter from J. H. Garrity to USNRC Document Control Desk dated October 16, 1991, "WBN Test Program for the Evaluation of Shear Capacity of Shallow Undercut Anchors - Summary Report"

As summarized in the referenced letter, TVA conducted a test program to evaluate the capacity of shallow undercut anchors. This test program was intended to verify that the ultimate shear capacity of shallow undercut anchors that are not installed near a free edge provide an acceptable safety margin. The following information supplements that referenced letter.

The four shallow undercut anchorage configurations listed below had an unacceptable factor of safety of less than 4 for shear loads. The ultimate shear capacity of these configurations was controlled by concrete failure.

Shallow UC Anchor Configuration

Diameter (in)	Embedment (in)	Factor of Safety
1/2	3-1/4	3.46
5/8	3-3/4	2.57
3/4	3-1/2	1.81
3/4	5	3.50

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TVA usage of the first three configurations for new designs was discontinued with issuance of Revision 5 of Civil Design Standard DS-C1.7.1 on May 6, 1991 (Revision 5 placed a hold on usage of all shallow type II installations. The hold was removed and the three configurations were deleted by DSCN-CEB-91-03 on July 31, 1991). The fourth configuration was discontinued for use in new designs by DSCN-CEB-92-02 on August 21, 1992. Copies of Table 3 of DS-C1.7.1 for Revision 5, DSCN-CEB-91-03, and DSCN-CEB-92-02 are attached.

As part of the work performed in 1991, TVA established that the 3/4-inch diameter with 3-1/2-inch embedment anchor had not been utilized at WBN or other TVA plants. Similar steps have been initiated to verify either that the other three configurations have not been utilized or that appropriate factors of safety exist where these configurations have been used.

The current Table 3 (DSCN-CEB-92-02) provides the following minimum acceptable embedments for these anchor sizes: (Factors of safety less than 4 are for a steel shear failure mechanism.)

REVISED
Shallow UC Anchor Configuration

Diameter (in)	Embedment (in)	Factor of Safety
1/2	4-3/4	4.37
5/8	5-1/4	2.97 (steel failure)
3/4	6-1/2	2.49 (steel failure)

If any questions remain relative to this subject, please contact P. L. Pace at (615)-365-1824.

Very truly yours,

W. J. Museler

William J. Museler

Enclosure
cc: See page 3

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TABLE 3[1]

UNDERCUT ANCHOR INSTALLATION DATA

	ANCHOR SIZE	ANCHOR LENGTH[2]	LENGTH CODE	SLEEVE LENGTH[3]	TYPE	MIN SPAC[8]	EDGE DIST[9]	MAX ATTACH THICK[10]	PROJ
REGULAR EMBEDMENT UC ANCHORS	1/4	4-1/4	None	2-3/4	I	4	3	3/4	1-1/2
	3/8	6	None	4-1/2	I	6	5	3/4	1-1/2
	1/2	14-1/4	8	10	I	6	8-1/2	3	4-1/4
	1/2	14-1/4	8	10	II	6	6-1/2	2	4-1/4
	1/2	14-1/4	8	10	II	6	5	4	4-1/4
	1/2	12-1/4	4	8	I	6	6-1/2	3	4-1/4
	1/2	12-1/4	4	8	II	6	5	2	4-1/4
	1/2	10-1/4	2	6	I	6	5	3	4-1/4
	5/8	17	7	12	I	8	10-1/2	3	5
	5/8	17	7	12	II	8	8-1/2	2	5
	5/8	17	7	12	II	8	6-1/2	4	5
	5/8	15	5	10	I	8	8-1/2	3	5
	5/8	15	5	10	II	8	6-1/2	2	5
	3/4	17-1/2	4	13	I	12	13	3	4-1/2
	3/4	17-1/2	4	13	II	12	11	2	4-1/2
	3/4	17-1/2	4	13	II	12	9	4	4-1/2
	3/4	15-1/2	2	11	I	12	11	3	4-1/2
	3/4	15-1/2	2	11	II	12	9	2	4-1/2
	3/4	13-1/2	INTERNAL HEX	9-1/4	I	12	9	3	4-1/4
	1	23-1/2	7	18	I	12	17	3	5-1/2
	1	21-1/2	5	18	I	12	17	1	3-1/2
	1-1/4	25	5	18	I	24	21	3	7
	1-1/4	23	3	18	I	24	21	1	5
SHALLOW EMBEDMENT UC ANCHORS	1/2	8-1/4	INTERNAL HEX	6-1/4	I	6	6	1	2
	~~1/2~~	~~8-1/4~~	~~INTERNAL HEX~~	~~6-1/4~~	~~II~~	~~6~~	~~6~~	~~0~~	~~2~~ *
	5/8	10	INTERNAL HEX	6-3/4	I	6	6	2	3-1/4
	~~5/8~~	~~10~~	~~INTERNAL HEX~~	~~6-3/4~~	~~II~~	~~6~~	~~6~~	~~0~~	~~3-1/4~~ *
	3/4	11-1/2	2 SQ HEAD	8-3/4	I	6	8-1/2	1-1/2	2-3/4
	~~3/4~~	~~11-1/2~~	~~2 SQ HEAD~~	~~8-3/4~~	~~II~~	~~6~~	~~8-1/2~~	~~3~~	~~2-3/4~~ *
	3/4	10-1/2	3 SQ HEAD	8-1/4	I	6	8	3/4	2-1/4
	~~3/4~~	~~10-1/2~~	~~3 SQ HEAD~~	~~8-1/4~~	~~II~~	~~6~~	~~8~~	~~3~~	~~2-1/4~~ *
	3/4	9-1/2	4 SQ HEAD	6-1/2	I	6	6	1-1/2	3
	~~3/4~~	~~9-1/2~~	~~4 SQ HEAD~~	~~6-1/2~~	~~II~~	~~6~~	~~6~~	~~3~~	~~3~~ *

* HOLD

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TABLE 3[1]

UNDERCUT ANCHOR INSTALLATION DATA

	ANCHOR SIZE	ANCHOR LENGTH[2]	LENGTH CODE	SLEEVE LENGTH[3]	TYPE	MIN SPAC[8]	EDGE DIST[9]	MAX ATTACH THICK[10]	PROJ
REGULAR EMBEDMENT UC ANCHORS	1/4	4-1/4	None	2-3/4	I	4	3	3/4	1-1/2
	3/8	6	None	4-1/2	I	6	5	3/4	1-1/2
	1/2	14-1/4	6	10	I	6	8-1/2	3	4-1/4
	1/2	14-1/4	6	10	II	6	6-1/2	2	4-1/4
	1/2	14-1/4	6	10	II	6	5	4	4-1/4
	1/2	12-1/4	4	8	I	6	6-1/2	3	4-1/4
	1/2	12-1/4	4	8	II	6	5	2	4-1/4
	1/2	10-1/4	2	6	I	6	5	3	4-1/4
	5/8	17	7	12	I	8	10-1/2	3	5
	5/8	17	7	12	II	8	8-1/2	2	5
	5/8	17	7	12	II	8	6-1/2	4	5
	5/8	15	5	10	I	8	8-1/2	3	5
	5/8	15	5	10	II	8	6-1/2	2	5
	3/4	17-1/2	4	13	I	12	13	3	4-1/2
	3/4	17-1/2	4	13	II	12	11	2	4-1/2
	3/4	17-1/2	4	13	II	12	9	4	4-1/2
	3/4	15-1/2	2	11	I	12	11	3	4-1/2
	3/4	15-1/2	2	11	II	12	9	2	4-1/2
	3/4	13-1/2	EXTERNAL HEX	9-1/4	I	12	9	3	4-1/4
	1	23-1/2	7	18	I	12	17	3	5-1/2
	1	21-1/2	5	18	I	12	17	1	3-1/2
	1-1/4	25	5	18	I	24	21	3	7
	1-1/4	23	3	18	I	24	21	1	5
SHALLOW EMBEDMENT UC ANCHORS	1/2	8-1/4	EXTERNAL HEX	6-1/4	I	6	6	1	2
	1/2	8-1/4	EXTERNAL HEX	6-1/4	II	6	6	1-1/2	2
	5/8	10	EXTERNAL HEX	6-3/4	I	6	6	2	3-1/4
	5/8	10	EXTERNAL HEX	6-3/4	II	6	6	1-1/2	3-1/4
	3/4	11-1/2	2 SQ HEAD	8-3/4	I	6	8-1/2	1-1/2	2-3/4
	3/4	11-1/2	2 SQ HEAD	8-3/4	II	6	8-1/2	3	2-3/4
	3/4	10-1/2	3 SQ HEAD	8-1/4	I	6	8	3/4	2-1/4
	3/4	10-1/2	3 SQ HEAD	8-1/4	II	6	8	3	2-1/4
	3/4	9-1/2	4 SQ HEAD	6-1/2	I	6	6	1-1/2	3
	3/4	9-1/2	4 SQ HEAD	6-1/2	II	6	6	1-1/2	3

DSCN-CEB-91-03

Reference Calculation: CSG-91-005

TABLE 3

UNDERCUT ANCHOR INSTALLATION DATA

ANCHOR SIZE	ANCHOR LENGTH	LENGTH CODE	SLEEVE LENGTH	TYPE	MIN SPACING	EDGE DIST	MAX ATTACH THICK	PROJ
REGULAR EMBEDMENT UC ANCHORS								
1/4	4-1/4	None	2-3/4	I	4	3	3/4	1-1/2
3/8	6	None	4-1/2	I	6	5	3/4	1-1/2
1/2	14-1/4	6	10	I	6	8-1/2	3	4-1/4
1/2	14-1/4	6	10	II	6	6-1/2	2	4-1/4
1/2	14-1/4	6	10	II	6	5	4	4-1/4
1/2	12-1/4	4	8	I	6	6-1/2	3	4-1/4
1/2	12-1/4	4	8	II	6	5	2	4-1/4
1/2	10-1/4	2	6	I	6	5	3	4-1/4
5/8	17	7	12	I	8	10-1/2	3	5
5/8	17	7	12	II	8	8-1/2	2	5
5/8	17	7	12	II	8	6-1/2	4	5
5/8	15	5	10	I	8	8-1/2	3	5
5/8	15	5	10	II	8	6-1/2	2	5
3/4	17-1/2	4	13	I	12	13	3	4-1/2
3/4	17-1/2	4	13	II	12	11	2	4-1/2
3/4	17-1/2	4	13	II	12	9	4	4-1/2
3/4	15-1/2	2	11	I	12	11	3	4-1/2
3/4	15-1/2	2	11	II	12	9	2	4-1/2
3/4	13-1/2	internal hex	9-1/4	I	12	9	3	4-1/4
1	23-1/2	7	18	I	12	17	3	5-1/2
1	23-1/2	7	18	II	12	17	3	5-1/2
1	21-1/2	5	18	I	12	17	1	3-1/2
1	21-1/2	5	18	II	12	17	3	3-1/2
1-1/4	25	5	18	I	24	21	3	7
1-1/4	23	3	18	I	24	21	1	5
SHALLOW EMBEDMENT UC ANCHORS[1]								
1/2	8-1/4	internal hex	6-1/4	I	6	6	1	2
1/2	8-1/4	internal hex	6-1/4	II	6	6	1-1/2	2
5/8	10	internal hex	6-3/4	I	6	6	2	3-1/4
5/8	10	internal hex	6-3/4	II	6	6	1-1/2	3-1/4
3/4	**13-1/2**	**internal hex**	**9-1/4**	**II**	**6**	**10**	**2-1/2**	**4-1/4**
3/4	11-1/2	2 sq head	8-3/4	I	6	8-1/2	1-1/2	2-3/4
3/4	11-1/2	2 sq head	8-3/4	II	6	8-1/2	**2**	2-3/4
3/4	10-1/2	3 sq head	8-1/4	I	6	8	3/4	2-1/4
3/4	10-1/2	3 sq head	8-1/4	II	6	8	**1-1/2**	2-1/4
3/4	9-1/2[2]	4 sq head	6-1/2	I	6	6	1-1/2	3

1 Reference Calculation: CSG-91-005

2 **Use of this anchor in Type II installations shall be discontinued upon implementation of DSCN-CEB-92-02**