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April 14, 1980

United States Nuclear Regulatory Commission
Office of Inspection and Enforcement
Attn: Boyce H. Grier, Regional Director
Region I
631 Park Avenue
King of Prussia, Pennsylvania 19406

Reference: Beaver Valley Power Station, Unit No. 1
Docket No. 50-334, License No. DPR-66
Interim Status Report, IE Bulletin 79-02

Dear Mr. Grier:

In response to a commitment in Inspection Report No. 50-334/79-27, an interim status report covering work being performed to satisfy the requirements of Bulletin 79-02, is forwarded herewith. This report addresses the concerns expressed by the NRC Resident Inspector associated with pipe supports located on block walls. This report also describes in detail the statistical methods used to select the anchors to be tested and to determine whether the various classes of anchors meet the acceptance criteria stated in the Bulletin.

The work associated with the sampling and testing of anchors is nearly complete, and the required baseplate modifications resulting from analysis will be issued to the field by April 25, 1980. This detailed report of the work performed under Bulletin 79-02 is forwarded for your prompt review so that any questions you may have can be brought to a satisfactory resolution prior to station startup, anticipated to occur in July, 1980.

Very truly yours,

C. N. Dunn
Vice President, Operations

cc: U. S. Nuclear Regulatory Commission
Office of Inspection and Enforcement
Washington, D. C. 20555

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The following is provided as an update to our response (dated December 6, 1979) to Revision 2 to IE Bulletin 79-02 as applicable to Item 5 of the Bulletin and to the inspection and testing of concrete expansion anchors in baseplates for Seismic Category I large bore and small bore (2 1/2 inches in diameter or less) pipe supports.

Item 5 of the Bulletin addresses pipe supports on concrete block walls. A field inspection of all the block walls in Beaver Valley, Unit 1 has shown that the following supports are located entirely on block walls.

Size-System-Line No.	Hanger
3-CH-7	H-63
4-CH-80	H-49
4-SI-75	H-67
4-SI-75	H-68
6-WR-55	H-139
6-WR-43	H-140
6-WR-181	H-89
6-WR-182	H-82
3-WR-57	H-157
*3-WR-57	H-160A

CH = Charging and Volume Control System

SI = Safety Injection System

WR = River Water System

*Incorrectly given in the December 6, 1979 response as 3-WR-44 (H161A)

The following supports are on block walls in part. The rest of the support is on reinforced concrete.

Size-System-Line No.	Hanger
**8-SI-2	H-14

**6-WR-43	H-91
6-WR-55	H-84
6-WR-55	H-73
6-WR-55	H-86
24-WR-20	H-61

** Not identified in the December 6, 1979 response.

Hangers H-61, H-91 and H-84 have been reanalyzed and it has been determined that the concrete anchors for these supports which are in reinforced concrete are capable of withstanding the total support loads. We anticipate no modification of these supports.

It has been determined at this time to attempt to remove the support loads from the block walls for the remainder of the supports listed above. Preliminary field inspection indicates that this is feasible for supports H-157 H-73, H-86, H-139, H-140, H-82 and H-89 and H-160A. Support H-14 will require additional field review as will supports H-49, H-63, H-67 and H-68 which are in the blender cubicle of the Auxiliary Building.

This part of the report addresses supports for Seismic Category I Piping Systems larger than 2 1/2 inches in diameter and which use concrete expansion anchor bolts.

To date, approximately 1,600 plates have been identified as being applicable under the above stated criteria. Approximately 1450 plates have been inspected for as-built configuration and approximately 1230 plates have been tested for adequacy of the concrete expansion anchors. Over 99% of the anchors tested to date have been the Phillips Red Head Self-Drilling Anchors. Other anchors encountered to date are external wedge and drop-in shell anchors.

The anchor testing program is comprised of either the application of torque or the application of direct tension to the anchor bolts. Direct tension is applied to the anchor bolts from a hydraulic ram. This method is primarily used for testing anchor bolts installed in the floor. Prior to performing this test, grout is removed from around each anchor and any levelling nuts are run down from the bottom of the plate. The testing method using the application of torque to an anchor bolt is primarily used for wall and ceiling anchors and requires removing the bolt or stud from the anchor shell, visually verifying that the shell is not touching the back of the baseplate, installing the bolt or stud, applying the specified torque, again removing the bolt or stud, visually reverifying the positon of the shell and reinstalling the bolt or stud to the specified torque. Prior to testing

those anchors which are initially touching the back of the baseplate, the anchor shells are either driven further into the concrete until the shell is no longer touching the plate or else the baseplate hole is drilled oversize so that the shell is no longer in contact with the baseplate.

An anchor failure is defined as any shell which fails to develop the specified torque, rotates in the hole, moves to the back of the plate or moves more than 1/16" after application of the specified torque or the specified tension.

The concrete anchors are tested one at a time and anchor failures are repaired prior to testing the next anchor on a plate.

The initial testing program was conducted from June 6, 1979 to August 8, 1979. The purpose of the testing was to collect data from which to form a base for later testing, and to verify the adequacy of the anchors to permit interim startup. Tests were conducted on wall and ceiling mounted baseplate anchors in an effort to expose any problem areas early in the testing program. It was anticipated at that time that the floor grouted baseplate anchors would be of better quality based on the relative ease with which the installations could be made.

The current testing program was started in October, 1979 and has continued to the present time. Based upon the data collected during the initial testing program and the data collected early in the current testing program, and the above stated assumption regarding the floor grouted anchors, it was felt that a sampling procedure could be adopted for further testing. The sampling procedure, issued in November, 1979 was based on the recommendations of IE Bulletin 79-02 Revision 2 and was as follows:

1. A statistical sample of anchors on floor grouted baseplates would be tested in an attempt to provide a 95% confidence that there would be less than 5% failed anchors. Given that result, further testing of grouted baseplates would be discontinued.

2. On all accessible baseplates, excluding floor grouted plates and plates requiring scaffolding for access, one randomly selected anchor on a baseplate would be tested. Failure of the test anchor would result in testing of the remaining anchors on that baseplate.

3. On baseplates where scaffolding was required for access, all anchors would be tested.

As this testing program progressed, it became evident that a high failure rate (16%) was developing for floor grouted baseplate anchors, and that a revision to the sampling procedure issued in November, was required.

In mid-November instructions were given to test all anchors on all floor grouted baseplates and the sampling procedure was subsequently revised such that:

1. On all accessible baseplates, excluding floor-grouted baseplates and baseplates requiring scaffolding for access, one randomly selected anchor on a baseplate would be tested. Failure of the test anchor would result in testing the remaining anchors on that baseplate.

2. On floor grouted baseplates and baseplates where scaffolding was required for access, all anchors would be tested.

A summary of test results to date shows that the anchor failure rate for wall, ceiling and floor mounted (not grouted) baseplates has remained stable at 3.2% overall and that the anchor failure rate for floor grouted baseplates has lessened to 11.9% overall.

A preliminary statistical analysis, by system, was made of all available test data for wall, ceiling and floor mounted (not grouted) baseplates. Data for floor grouted baseplates was excluded from this analysis. As a result of the high failure rate for anchors on floor grouted baseplates we have determined that it is necessary to test all anchors on all floor grouted baseplates.

Attachment A is a summary of the test results and analysis for the wall ceiling and floor mounted (not grouted) baseplates. Attachment B is a summary of the test results for floor grouted baseplates.

The results of the analysis of the test data as shown on Attachment "A" for wall, ceiling and floor mounted (not grouted) baseplates is as follows:

1. Testing has been completed on 13 of the 28 systems (BR, CV, CVP, CW, DG, GW, NSL, OL, PG, SAE, VG, VS, WGCB).

2. Those systems with less than ten (10) plates not tested to date shall have the remaining plates tested in accordance with the current testing program. This involves 6 systems (AJA, FC, SDHV, WAPD, WD, WFPD).

3. Testing shall be discontinued on those systems with more than ten (10) plates not tested to date and with test results which provide at least a 95 percent confidence level that less than 5 percent of the anchors are defective. This involves 5 systems (QS, RC, RH, RS, SI).

4. Systems which do not meet the criteria stated in item 3. above shall have the remaining plates tested. This involves 4 systems (CC, CH, SHP, WR).

The sampling method described in item 3. above is that stated in IE Bulletin 79-02 Appendix A Part b., "Randomly select and test a statistical sample of the bolts to provide a 95 percent confidence level that less than 5 percent defective anchors are installed in any one seismic Category I system. The sampling program should be done on a system by system basis."

This has been interpreted as a binomial statement, implying that the consumers risk, the probability of accepting a "bad" lot (set at 5 percent or greater), be limited to 5 percent and that lots with 5 percent or greater defectives be rejected 95 percent of the time.

This smallest sample size that will satisfy the above constraints (95% confidence, 5% defective) is 58, obtained by solving the binomial expression for 0 rejects. For samples already taken, the estimate of the population percent defective was computed using the standard error of the percentage formula using 95 percent confidence limits. The results were then evaluated, using the criteria that the upper limit must be less than 5 percent.

As stated above, floor grouted baseplates are not included in the above analysis. The results of the testing of this type of plate is shown on Attachment B. These plates are excluded from the above analysis on the basis that the test results for grouted plates consistently indicate a higher failure rate than for non-grouted baseplates. Exclusion from the above analysis was further justified with the decision to test all bolts on all grouted baseplates.

The results of the testing to date indicates that the main reason for shell-type anchor failure is installation of the shell in an oversized hole. It appears that carbide drills were used occasionally for installation of self-drilling anchors and are the main reason for oversized holes.

It has been observed that in most cases, <u>all</u> of the anchor bolts in grouted baseplates are installed with levelling nuts, so that when a grouted support is being installed initially, it will rest on the levelling nuts and subsequent hanger dead load will not cause any "failure type" or tension load on the anchors. With the levelling nuts touching the back of the plate, the anchor nut on top of the plate can be installed and torqued without producing tension in the anchor and with no indication of actual or potential failure of the anchor. This is believed to be the reason for the high failure rate for floor mounted grouted anchors.

It can be reasoned that oversizing of the holes could occur equally on all types of plates. All hangers installed without levelling nuts (wall, ceiling and floor mounted - not grouted) have the anchors stressed when the

plates are mounted either from hanger dead load or bolt installation torque. Therefore, actual or potential failures would have been revealed at the time the hanger was installed. It is believed that anchors for these installations which showed any indication of actual or potential failure during initial installation of the hanger were reinstalled properly prior to final installation of the hanger.

The results of the anchor bolt testing for the large bore (larger than 2 1/2 inches in diameter) hangers were used as the basis for the testing program developed and now being conducted for the Seismic Category I Piping Systems 2 1/2 inches in diameter and smaller.

The testing program described earlier in this report for testing concrete expansion anchors for the large bore piping supports was expanded initially to encompass a random sampling of the anchors for small bore piping supports. The random selection of anchors included anchors from all small bore systems. The test results for this initial sampling has been and will be used to determine the requirements for further testing.

Initial results from testing anchors in floor grouted baseplates indicate a failure rate of 9.1 percent (5 failures in 55 anchors tested). As a result of this data, it has been decided at this time to continue testing all the anchors on all the floor grouted baseplates for the Seismic Category I small bore piping systems.

Initial results from testing anchors in wall, ceiling, and floor mounted (not grouted) baseplates for small bore piping indicate a failure rate of 3.2 percent (4 failures in 153 anchors tested). The total sample selected is 156 anchors. It is anticipated that further testing for anchors on these plates will not be necessary if the failure rate remains such that a 95% - 5% confidence level is achieved.

ATTACHMENT A

SYSTEM		TOTAL SYSTEM		WALL, CEILING & FLOOR MOUNTED (NOT GROUTED) BASEPLATES										
				POPULATION		TEST RESULTS			BS. NOT TESTED HIGH RADIATION	PLATES NOT TESTED TO LATE				REMARKS
		PLATES	BOLTS	PLATES	BOLTS	PLATES	BOLTS	BOLTS FAILED						
AIR EJECTOR DISCH.	AJA	12	65	12	65	8	36	1	0	4				
BORON RECOVERY	BR	5	14	1	4	1	4	0	0	0				
COMPONENT COOLING	CC	355	1936	259	1370	211 *	1036	51	3	55				
CHG. & VOL. CONTROL	CH	161	130	139	560	102 *	[illegible]	15	7	31				
CONTAIN. VACUUM	CV	4	52	4	52	4	52	0	0	0				
CONTAIN. VENT & PRESS.	CVP	8	32	8	32	8	30	0	0	0				
CHILLED WATER	CW	5	40	3	28	3	18	0	0	0				
COOL. SYS. LOOP DRAINS	DG	2	8	0	0	0	0	0	0	0				
FUEL POOL & PURIF.	FC	57	274	52	238	47	185	5	0	5				
GAS WASTE	GW	3	14	3	14	3	12	0	0	0				
NEUT. SH. TK. COOL.	NSL	12	54	10	46	6	15	0	4	0				
DIESEL GEN. OIL	OL	11	48	10	40	10	40	5	0	0				
PURGE GAS	PG	1	8	1	8	1	8	0	0	0				
QUENCH SPRAY	QS	95	522	81	428	49	267	0	0	32				>95% CONF. LEVEL
REACTOR COOLANT	RC	84	411	75	365	37	163	2	13	25				>95% CONF. LEVEL
RESIDUAL HEAT	RH	92	627	72	403	45 *	254	5	0	29				>95% CONF. LEVEL
RECIRC. SPRAY	RS	73	691	61	596	32 *	294	7	0	24				>95% CONF. LEVEL
	SAE	7	54	7	54	7	58	3	0	0				
STM. DELAY HEAT	SDHV	2	8	2	8	0	0	0	0	2				
HIGH PRESS. STEAM	SHP	22	104	17	82	6	35	3	0	11				
SAFETY INJ.	SI	228	1223	184	1046	117 *	574	17	2	72				>95% CONF. LEVEL
HYDROGENATED VENTS	VG	21	86	21	86	21	85	0	0	0				
CONTROL ROOM VENTIL.	VS	6	27	6	27	6	27	0	0	0				
ST. GEN AUX. F.W. PUMP DISCH.	WAPD	29	147	22	111	15 *	92	2	0	1				
DEMINERALIZED WATER	WD	37	158	31	130	30 *	115	0	0	2				
ST. GEN. F.W. PUMP DISCH.	WFPD	8	97	7	91	8 *	49	0	0	3				
GENERATOR WTR BLWDN.	WGLB	20	112	9	54	9	49	1	0	0				
RIVER WATER	WR	245	1729	167	1066	158 *	766	22	3	30				
TOTAL		1605	9242	1271	7019	958 *	4655	150	32	276	144	182	--	
						* INDICATES ADDITIONAL [illegible]								

ATTACHMENT B

SYSTEM		TOTAL SYSTEM		FLOOR GROUTED BASEPLATES							
				POPULATION		TEST RESULTS			PLATES NOT TESTED HIGH RADIATION	PLATES REMAIN. TO TEST	REMARKS
		PLATES	BOLTS	PLATES	BOLTS	PLATES	BOLTS	BOLTS FAILED			
AIR EJECTOR DISCH.	AJA	12	65	0	0	0	0	0		0	
BORON RECOVERY	BR	5	14	4	10	3	8	0		1	
COMPONENT COOLING	CC	355	1936	96	566	83 *	441	88		15	
CHG. & VOL. CONTROL	CH	161	620	72	70	71 *	55	1		8	
CONTAIN. VACUUM	CV	4	52	0	0	0	0	0		0	
CONTAIN. VENT & PRESS.	CVP	8	32	0	0	0	0	0		0	
CHILLED WATER	CW	5	40	2	12	2	12	5		0	
COOL. SYS. LOOP DRAINS	DG	2	8	2	8	2	8	3		0	
FUEL POOL & PURIF.	FC	57	274	5	36	4	27	0		1	
GAS WASTE	GW	3	14	0	0	0	0	0		0	
NEUT. SH. TK. COOL.	NSL	12	54	2	8	0	0	0		2	
DIESEL GEN. OIL	OL	11	48	1	8	1	8	0		0	
PURGE GAS	PG	1	2	0	0	0	0	0		0	
QUENCH SPRAY	QS	95	528	14	90	12	76	0		2	
REACTOR COOLANT	RC	84	411	9	46	5	20	1		4	
RESIDUAL HEAT	RH	92	627	19	224	7	114	11		12	
RECIRC. SPRAY	RS	73	691	12	95	9	86	11		3	
	SAE	7	59	0	0	0	0	0		0	
STM. DELAY HEAT	SDHV	2	8	0	0	0	0	0		0	
HIGH PRESS. STEAM	SHP	22	104	5	22	5	24	8		0	
SAFETY INJ.	SI	228	1283	29	237	26 *	120	1		16	
HYDROGENATED VENTS	VG	21	86	0	0	0	0	0		0	
CONTROL ROOM VENTIL.	VS	6	27	0	0	0	0	0		0	
ST. GEN AUX. F.W. PUMP DISCH.	WADD	29	1147	6	36	6	32	0		0	
DEMINERALIZED WATER	WD	37	158	6	28	6	24	2		0	
ST. GEN. F.W. PUMP DISCH.	WFPD	8	97	1	6	0	0	0		1	
GENERATOR WTR BLWDN.	WGLB	20	112	11	68	11	56	1		0	
RIVER WATER	WR	245	1729	72	662	61 *	661	61		6	
TOTAL		1605	9242	324	2775	284 *	1782	213		11	

* INDICATES ADDITIONAL PLATES IN SPECIFIED VICINITY TESTED