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TILLER,R.E. Region 3, Chicago, Office of the Director

SUBJECT: Documents reevalution of potential stream generator water hammer in subj facilities.Forwards table of operating experience & feedwater piping configurations.Water hammer not likely to occur under any conditions.

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Mr. R. E. Tiller, Director
Reactor Operations and Programs Division
Idaho Operations Office - DOE
Idaho Falls, ID 83401

REEVALUATION OF STEAM GENERATOR WATER HAMMER FOR POINT BEACH UNITS 1 and 2, PRAIRIE ISLAND UNITS 1 and 2, and KEWAUNEE - JAD-162-79

Ref: (a) J. A. Dearien Ltr to R. E. Tiller, JAD-128-79, Point Beach Unit Nos. 1 and 2 Steam Generator Water Hammer Technical Evaluation (A6257), June 12, 1979
(b) J. A. Dearien Ltr to R. E. Tiller, JAD-129-79, Kewaunee Power Station Steam Generator Water Hammer Technical Evaluation (A6257), June 12, 1979
(c) J. A. Dearien Ltr to R. E. Tiller, JAD-135-79, Prairie Island Power Station Steam Generator Water Hammer Technical Evaluation (A6257), June 27, 1979

Dear Mr. Tiller:

This letter documents the reevaluation of the potential for steam generator water hammer in the five subject power plants. The initial evaluations for the plants are documented by the referenced letters. Generic similarities in design and construction of these 2-loop Westinghouse facilities permit a concurrent reevaluation.

The reevaluation is based upon information received from the NRC (Memo of Conversation, D. D. Christensen and Sam MacKay, July 26, 1979). The information shows that although the feedwater systems have been subjected many times to conditions considered most conducive to water hammer, no water hammer has been experienced at any of the plants. A possible explanation for the lack of water hammer is a common feedwater piping geometry in which auxiliary feedwater is admitted to the main feedwater piping at a point close to the entrance to the steam generators.

Attachment 1 shows the number of automatic scrams (reactor trips) and loss of feedwater events that have occurred at the plants since their initial startups. The attachment also presents pertinent dimensions that show the generic similarities in feedwater piping geometry among the plants.

Each automatic scram (from nominal power) experienced at the plants would have typically resulted in uncovery and drainage of the steam generator feedrings due to steam generator water level shrinkage. The shrinkage in level is the result of interrupted power production causing collapse of steam voids within the secondary side of the steam generators.

None

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Conditions conducive to water hammer result when feedwater to refill the steam generators comes into contact with steam that has entered the drained feedrings and associated feedwater piping. These conditions would also be experienced during events such as loss of feedwater, loss of offsite power, steam line break, or loss-of-coolant accident.

A comparison of the geometry of the feedwater piping for pressurized water reactors leads to a possible explanation for the absence of water hammer in the five operating plants considered here. In most plants the auxiliary feedwater is pumped into the main feedwater pipe at a point far upstream of the steam generator, usually just outside of the containment building. In these five plants the auxiliary feedwater is pumped into the main feedwater pipe adjacent to the steam generator. The three-inch horizontal auxiliary feedwater pipe connects at a right angle into the center of the 16 inch horizontal main feedwater pipe within a few feet of the steam generator (see Attachment 1). Thus when the main feedwater line is drained, the auxiliary feedwater injects directly into the steam in the feedwater pipe. This geometry may permit better mixing of the incoming feedwater with the steam thereby precluding two-phase instabilities conducive to water hammer that may appear in plants without this geometry.

In the 5 plants under discussion, the piping geometry apparently reduces the potential for water hammer to such a low value that in over 60 steam generator years of operation (10 steam generators operated an average of 6 years) no steam generator water hammer problems have occurred. Based on this record, we conclude that steam generator water hammer is not likely to occur at these plants during any normal or transient operating conditions. We therefore recommend that installation of top discharge feedrings in the steam generators to avoid steam generator water hammer is not necessary for continued safe operation of Point Beach Units 1 and 2, Prairie Island Units 1 and 2, and Kewaunee. Also, in view of past operating experience, we conclude that the test program recommended in the initial evaluations is not necessary.

Very truly yours,

J. A. Dearien, Manager
Code Assessment and
Applications Program

DDC:tn

Attachment: Operating Experience and
Feedwater Piping Configurations

cc: S. D. MacKay, NRC-DOR
R. W. Kiehn, EG&G Idaho, w/o Attach.

OPERATING EXPERIENCE AND FEEDWATER PIPING CONFIGURATIONS

	KEWAUNEE	PRAIRIE ISLAND 1	PRAIRIE ISLAND 2	POINT BEACH 1	POINT BEACH 2
Operating Experience - Calendar Years	5.0	5.5	4.5	8.5	6.7
Transient Experience -					
Number of Automatic Scrams*	38	27	32	7	8
Number of Loss of Feedwater Events	2	1	2	0	0
Main Feedpipe Diameter - Inches	16	16	16	16	16
Auxiliary Feedpipe Diameter - Inches	3	3	3	3	3
Main Feedpipe Horizontal Length-Feet					
Steam Generator A	10.7	3.9	8.5	6.7	5.9
Steam Generator B	5.8	3.5	7.8	6.7	6.2
Auxiliary Feedpipe Connection Distance to Steam Generator - Feet					
Steam Generator A	4.1	3.5	6.5	2.7	2.7
Steam Generator B	3.2	3.7	6.8	2.7	2.7

*Automatic Scrams for scheduled maintenance or testing have been excluded.