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TEXAS UTILITIES GENERATING COMPANY

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May 2, 1985

JOHN W. BECK
MANAGER-LICENSING

Director of Nuclear Reactor Regulation
Attention: Mr. Vincent S. Noonan, Director
Comanche Peak Project
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION
DOCKET NOS. 50-445 AND 50-446
ARBITRARY INTERMEDIATE PIPE BREAKS

Dear Mr. Noonan:

Texas Utilities Generating Company (TUGCO) has followed closely the recent activities of the Nuclear Regulatory Commission (NRC) staff and the nuclear industry related to the treatment of design basis pipe breaks (arbitrary intermediate pipe breaks) in high energy piping. TUGCO understands that applications to eliminate arbitrary breaks will be permitted prior to the NRC completing all of the changes in regulatory requirements. TUGCO has determined that considerable benefit can be achieved by eliminating arbitrary intermediate breaks at Comanche Peak Steam Electric Station (CPSES) while improving overall safety and piping system reliability.

The break postulation criteria currently followed by TUGCO for CPSES is taken from NRC Standard Review Plan Sections 3.6.1 and 3.6.2 and their associated Branch Technical Positions ASB 3-1 and MEB 3-1 respectively, as described in section 3.6B of the CPSES Final Safety Analysis Report (FSAR). These documents require that pipe breaks be postulated at terminal ends and at intermediate points where stresses or cumulative usage factors exceed specified limits in stress analyzed piping. In addition if two intermediate locations cannot be postulated based on the above, then the two highest stress locations are selected as the arbitrary intermediate breaks.

In order to adequately address the secondary effects of pipe breaks, (i.e., minimize safety related components affected by the break) the break points must be identified early in the design of the plant. However, consideration of the two arbitrary breaks is particularly difficult because the location of the high stress points may move several times as the piping stress analysis is finalized. This results in additional analyses to determine the safety related components affected by the new breaks followed by the installation of additional pipe whip restraints and the elimination of restraints at the deleted break points.

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The benefits which can be realized by eliminating arbitrary intermediate pipe breaks are summarized in Attachment A and technical justification for this action is provided in Attachment B.

For CPSES, TUGCO requests NRC approval for the application of alternative pipe break criteria (excluding the RCS primary loop) as follows:

1. Arbitrary intermediate pipe breaks in all high energy piping systems be eliminated from the structural design basis. Intermediate breaks will be assumed when the following criteria are satisified:

    a. The stress criteria in CPSES FSAR Section 3.6B.2 are exceeded.

    b. The usage factors in CPSES FSAR Section 3.6B.2 are exceeded (Class 1 piping systems only).

2. The dynamic effects (pipe whip, jet impingement, and compartment pressurization loads) associated with arbitrary intermediate pipe breaks be excluded from the plant design basis.

3. The requirement for pipe whip restraints and jet shields associated with previously postulated arbitrary intermediate pipe breaks be eliminated.

Environmental analysis for equipment qualification will not be affected by the elimination of arbitrary intermediate breaks.

To make it possible for TUGCO to realize the maximum benefits afforded by this proposed change in the pipe break criteria, expeditious attention by the NRC is requested.

Should you have any questions in this matter, please contact this office.

Sincerely,

John W. Beck

J. W. Beck

BSD/grr
Attachments

ATTACHMENT A

SUMMARY OF BENEFITS FROM THE ELIMINATION OF ARBITRARY INTERMEDIATE PIPE BREAK ON CPSES UNITS 1 AND 2

1. Access during plant operation for maintenance and inservice inspection is improved due to the elimination of congestion created by the pipe whip restraints and jet shields associated with arbitrary breaks. In addition to the decrease in maintenance effort, a significant reduction in man-rem exposure can be realized through fewer manhours spent in radiation areas. (96 man-rem)

2. The need to measure and verify cold and hot gaps between pipes and whip restraints during hot functional testing can be eliminated.

3. Design, material and construction costs associated with 82 pipe whip restraints. (2 million dollars)*

4. Design material and construction costs associated with 24 jet shields ($350,000)*

5. Decrease in man-rem exposure can be realized due to the deletion of maintenance requirements for 82 pipe whip restraints and 24 jet shields. (not quantified)

6. Reduction in piping heat loss at pi whip restraint locations. (not quantified)

7. Improvement in overall plant saf y as described in NUREG/CR-2136. (not quantified)

* Figures shown are for both U and the majority of the estimated cost has already been spent.

ATTACHMENT B

TECHNICAL JUSTIFICATION FOR ELIMINATIONS OF ARBITRARY INTERMEDIATE PIPE BREAK POSTULATION

The following items provide generic technical justification for the elimination of arbitrary intermediate pipe breaks required by Standard Review Plans 3.6.1 and 3.6.2:

1. Arbitrary intermediate breaks are postulated at locations in the piping system where pipe stresses are well below ASME code allowables. For Class 1 piping, the allowable cumulative usage factor for pipe rupture postulation is 0.1; the 1974 ASME Code allowable is 1.0. The stress limit for pipe rupture for all nuclear class piping is 80% of the 1974 ASME Code stress allowables and arbitrary intermediate breaks stresses are below this level. Hence a large conservatism exists. In addition in many arbitrary break cases the stresses may be within a few percent of the stress levels at other points in the same system. As a result, large numbers of protective features (e.g., pipe whip restraints and jet impingement shields) are provided for specific break locations in piping systems while these specific locations are not significantly more likely to break than many other locations.

2. The additional pipe rupture devices resulting from arbitrary intermediate pipe breaks may actually reduce rather than improve plant safety. This has been demonstrated in "Effects of Postulated Event Devices on Normal Operation of Piping Systems in Nuclear Power Plants," NUREG/CR-2136, Teledyne Services, 1981.

3. The pipe breaks and whip restraints which are not being eliminated, provide an adequate level of protection in areas containing high energy lines.

4. Pipe rupture is recognized in Branch Technical Position MEB 3-1 as being a "rare event which may only occur under unanticipated conditions."

5. Arbitrary intermediate breaks are only postulated to provide an additional layer of conservatism in the design. There is no technical justification for postulating these breaks.

6. Environmental qualification analyses of high energy pipe breaks will not be affected by the elimination of arbitrary intermediate pipe breaks, as explained in Attachment B-1.

7. Due to system design, testing and operation procedures at CPSES the probability of stress corrosion, thermal and vibrational fatigue, or water hammer in the arbitrary intermediate break lines is not significant, as explained in Attachments B-2, B-3 and B-4.

ATTACHMENT B-1

ENVIRONMENTAL QUALIFICATION ANALYSES ASSOCIATED WITH THE ELIMINATION OF ARBITRARY INTERMEDIATE PIPE BREAKS

There will be no change in the results of the high energy environmental analyses for equipment qualification for CPSES due to the elimination of arbitrary intermediate pipe breaks. In the environmental analyses the governing cases for each room were analyzed to determine the worst environmental parameters for the equipment qualification. These governing cases will not change due to the elimination of arbitrary intermediate pipe breaks.

ATTACHMENT B-2

STRESS CORROSION CRACKING ASSOCIATED WITH ELIMINATION OF ARBITRARY INTERMEDIATE PIPE BREAKS

In order for stress corrosion cracking to occur in piping the following conditions must exist simultaneously: high tensile stresses, susceptible piping material, and a corrosive environment (NUREG-0691). Although any carbon or stainless steel piping will exhibit some residual stresses and material susceptability, TUGCO minimizes the potential for stress corrosion by preventing the occurrence of a corrosive environment and by choosing piping material with low susceptibility to stress corrosion.

Table 1 shows all the piping involved in the elimination of arbitrary intermediate pipe breaks for Unit 1 (Unit 2 will be similar). As shown in the table all the piping is either austenitic stainless steel or carbon steel.

Carbon steel pipes have been found not to be susceptible to stress corrosion cracking. The likelihood of stress corrosion cracking in stainless steel increases with carbon content. Only low carbon content stainless steel pipes (0.08 percent by weight maximum) of types 304 or 316 have been used.

The environments known to increase the susceptibility of austenitic stainless steel to stress corrosion are controlled by the implementation of numerous cleanliness requirements during the construction, startup and operation phases of the plant. These include:

1. Separation of stainless steel piping materials to prevent contamination,

2. Separation of tools used on stainless steel,

3. Prohibition of contact with low melting point metals and leachable chlorides and fluorides,

4. Stringent water chemistry requirements placed on the effluent of the water flush performed prior to system service.

5. Stringent chemistry control of primary and secondary side water during plant operations to maintain contaminant concentrations below thresholds known to be conducive to stress corrosion cracking.

In addition, as noted in Table 1, many of the stainless steel lines have operating temperatures below 130^{o}F. Any stress corrosion at these low temperatures would be extremely slow which is consistent with the industry-wide assumption that stress corrosion is not a problem at low temperatures. For the reasons given above, stress corrosion is not a problem in piping where elimination of arbitrary intermediate breaks is requested.

TABLE 1
ARBITRARY INTERMEDIATE BREAKS FOR CPSES UNIT 1
(Sheet 1 of 3)

Problem #	Line #	# of ARB.	Notes
1-1	32-MS-1-01-1303-2	2	carbon steel
1-2	32-MS-1-02-1303-2	2	carbon steel
1-3	32-MS-1-03-1303-2	2	carbon steel
1-4	32-MS-1-04-1303-2	2	carbon steel
1-5	18-FW-1-19-1303-2	2	carbon steel
1-6	18-FW-1-18-1303-2	2	carbon steel
1-7	18-FW-1-17-1303-2	2	carbon steel
1-8	18-FW-1-20-1303-2	2	carbon steel
1-10A	4-AF-1-98-2003-3	1	carbon steel
	3-AF-1-68-2002-3	1	carbon steel
	3-AF-1-80-2002-3	1	carbon steel
1-10B	4-AF-1-111-2003-3	1	carbon steel
	4-AF-1-102-2003-3	2	carbon steel
	4-AF-1-103-2003-3	1	carbon steel
1-10C	4-AF-1-097-2003-3	2	carbon steel
	4-AF-1-096-2003-3	2	carbon steel
1-12A	6-AF-1-36-2002-3	1	carbon steel
	6-AF-1-10-2003-3	1	carbon steel
1-12B	4-AF-1-51-2002-3	1	carbon steel
	4-AF-1-97-2002-3	1	carbon steel
1-12D	3-AF-1-69-2002-3	1	carbon steel
	4-AF-1-98-2003-3	2	carbon steel
	4-AF-1-99-2003-3	1	carbon steel
1-12E	4-AF-1-101-2003-3	2	carbon steel
	4-AF-1-100-2003-3	2	carbon steel
	4-AF-1-109-2003-3	1	carbon steel
1-13A	6-RC-1-008-25-1R-1	4	stainless steel
1-13B	6-RC-1-070-2501R-1	4	stainless steel
1-14A	6-RC-1-029-2501R-1	2	stainless steel
	6-RC-1-046-2501R-1	2	stainless steel

TABLE 1

Problem #	Line #	# of ARB.	Notes
1-25	14-RC-1-135-2501R-1	2	stainless steel
1-40	3-CS-1-077-2501R-2	2	stainless steel
1-43B&C	2-CS-1-111-2501R-2	1	stainless steel, (130^{o}F)
1-45D	2-CS-1-107-2501R-1	2	stainless steel, (130^{o}F)
1-46B	3-CS-1-014-601R-2	3	stainless steel
1-51A	2-CS-1-345-2501R-2	1	stainless steel, (130^{o}F)
	2-CS-1-945-2501R-2	1	stainless steel, (130^{o}F)
1-51B	2-CS-1-338-2501R-2	1	stainless steel, (130^{o}F)
	3-CS-1-075-2501R-2	1	stainless steel, (130^{o}F)
1-51C	3-CS-1-074-2501R-2	2	stainless steel, (130^{o}F)
1-51D	2-CS-1-087-2501R-2	3	stainless steel, (130^{o}F)
1-52X	2-CS-1-089-2501R-2	2	stainless steel, (130^{o}F)
1-52Y	2-CS-1-093-2501R-2	1	stainless steel, (130^{o}F)
	2-CS-1-089-2501R-2	1	stainless steel, (130^{o}F)
1-52Z	2-CS-1-099-2501R-2	1	stainless steel, (130^{o}F)
	2-CS-1-096-2501R-2	2	stainless steel, (130^{o}F)
1-75	2-MS-1-341-1303-2	3	carbon steel
	2-MS-1-342-1303-2	1	carbon steel
	2-MS-1-206-1303-2	1	carbon steel
1-76B	3-MS-1-075-1303-2	1	carbon steel
	4-MS-1-151-1303-2	2	carbon steel
1-77	4-MS-1-150-1303-2	2	carbon steel
1-78	2-MS-1-218-1303-2	1	carbon steel
1-135A	10-SA-X-19-152-5	2	carbon steel
1-135B	06-SA-X-18-152-5	2	carbon steel
1-135C	2-SA-X-42-152-5	1	carbon steel
	6-SA-X-39-152-5	1	carbon steel
1-135D	6-SA-X-18-152-5	2	carbon steel
	2-SA-X-59-152-5	1	carbon steel
1-135F	2-SA-X-63-152-5	4	carbon steel

TABLE 1

Problem #	Line #	# of ARB.	Notes
1-147A	1½-SA-X-74-152-5	3	carbon steel
1-147B	2-SA-X-52-152-5	1	carbon steel
	1½-SA-X-65-152-5	2	carbon steel
1-147C	2-SA-X-93-152-5	4	carbon steel
1-147D	1½-SA-X-84-152-5	2	carbon steel
1-147E	2-SA-X-129-152-5	2	carbon steel
1-152	6-FW-1-95-1303-2	4	carbon steel
1-153	6-FW-1-96-1303-2	2	carbon steel
1-154	6-FW-1-97-1303-2	2	carbon steel
1-155	6-FW-1-98-1303-2	2	carbon steel

ATTACHMENT B-3

THERMAL AND VIBRATIONAL FATIGUE ASSOCIATED WITH ARBITRARY INTERMEDIATE PIPE BREAKS

For CPSES Class 1 lines, fatigue considerations are addressed by the ASME Code limit for the Cumulative Usage Factor (CUF) of 1.0. This assures that pipe failures will not occur. The pipe break postulation limit is 10% of this number thus by definition, all arbitrary intermediate break locations in Class 1 piping have CUFs below 0.1.

For Class 2 and 3 piping components, fatigue is provided for in the allowable stress range check for thermal expansion stresses. This stress is included in the stress value used to determine break locations. By definition all arbitrary intermediate breaks have stresses less than 80% of the code allowables. The Code design allowables are intended to prevent fatigue failure.

A number of instances of pipe cracks due to thermal fatigue in PWR systems were reported in NUREG-0691. All cases involved either feedwater or auxiliary feedwater piping and occurred in the vicinity of steam generator nozzles. The cracking was attributed to cyclic thermal stresses on horizontal runs at the nozzles.

Cyclic thermal stresses are minimized in the main and auxiliary feedwater piping as described in CPSES FSAR Section 10.4.7 and 10.4.9 respectively. For the remaining systems where arbitrary breaks are postulated, cyclic thermal stress is prevented by maintaining uniform temperatures with no mixing.

The potential for vibration fatigue in CPSES piping systems is minimized by design and verified through pre-operational vibration testing. Table 14.2-2 sheet 57 of the CPSES FSAR describes the Pre-operational Vibration Testing. In addition, Section 3.9B.2 of the CPSES FSAR describes the dynamic testing and analyses performed on those systems subject to dynamic vibration and thermal expansion.

Based on the information presented in this attachment and the referenced CPSES FSAR sections, thermal and vibrational fatigue are not expected to be problems at CPSES.

ATTACHMENT B-4

WATER HAMMER ASSOCIATED WITH ELIMINATION OF ARBITRARY INTERMEDIATE PIPE BREAKS

Systems within Westinghouse scope of supply are not, in general, susceptible to water hammer. The reactor coolant, chemical and volume control, and residual heat removal systems have been specifically designed to preclude water hammer. Preoperational testing and operating experience have verified the Westinghouse design approach and furthermore, have indicated that significant water hammer events have usually been initiated in secondary systems within the Balance of Plant (BOP) scope of supply. Westinghouse has conducted a number of investigations into the causes and consequences of water hammer events. The results of these investigations have been reported to Westinghouse operating plant customers and have been reflected in design interface requirements to the BOP designer for plants under construction, to assure that water hammer events initiated in the secondary systems do not compromise the performance of the Westinghouse supplied safety-related systems and components.

The potential for water hammer may exist in some of the lines where arbitrary intermediate breaks are being eliminated. However, system design and operating requirements have been implemented to minimize the probability of significant water hammer occurring in these lines. Water hammer in each of the systems involved in elimination of arbitrary intermediate breaks is discussed below:

1. Main Steam

The primary cause of water hammer in steam lines is the collection of condensate water pockets at system low points. The main steam piping from the restraints just outside safeguards to the main turbine is sloped to assure proper drainage. The drain system removes accumulated condensate from the main steam lines. The branch lines that branch from the main steam lines are also designed to eliminate condensate-drain water pockets collecting at low points or in pipe loops.

2. Feedwater

The CPSES feedwater systems (main and auxiliary) have been designed, and operating procedures have been implemented to minimize the potential for water hammer. A detailed description of these design features and operating requirements are discussed in CPSES FSAR Sections 10.4.7.2.2, 10.4.7.3, and 10.4.9. In addition, pre-operational testing, as described in FSAR Table 14.2-2, Sheet 51, has been successfully performed to demonstrate that no damaging water hammer occurs while restoring steam generator level after a low-level transient using the Auxiliary Feedwater System.

3. Reactor Coolant

There is a low potential for water hammer in the reactor coolant system, because it is designed to preclude steam void formation. Preoperational testing and operating experience have verified the Westinghouse design approach.

4. Chemical and Volume Control System (CVCS)

In the low temperature lines water hammer would not be expected because of the small probability of steam void formation. In the high temperature lines, the piping has been designed to maintain water solid conditions during normal operation to minimize the possibility of water hammer.

5. Steam Generator Blowdown

Blowdown flows from the steam generators is normally two-phase and 0-10 percent quality. The piping layout is routed to prevent formation of water pockets from the steam generator nozzles to the containment penetrations thus minimizing the probability of water hammer. All the arbitrary intermediate breaks being eliminated in this system are inside containment.

6. Auxiliary Steam

Drain pots are provided at the low points to remove any condensate in the steam lines during startup and normal operations to prevent water hammer in the auxiliary steam system.