Consumers Power Company

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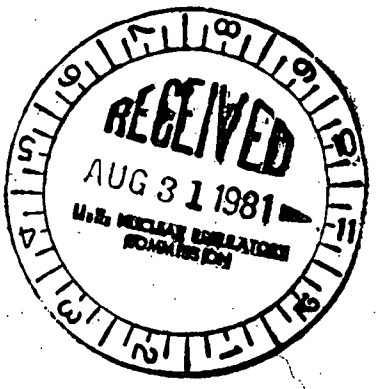
August 25, 1981



Director, Nuclear Reactor Regulation
Att Mr Dennis M Crutchfield, Chief
Operating Reactors Branch No 5
U S Nuclear Regulatory Commission
Washington, DC 20555

DOCKET 50-255 - LICENSE DPR-20 -
PALISADES PLANT - SEP TOPIC III-5.B,
EFFECTS OF PIPE BREAKS ON SYSTEMS,
STRUCTURES AND COMPONENTS OUTSIDE
CONTAINMENT

Attached is the Consumers Power Company evaluation for SEP Topic III-5.B for the Palisades Plant.

This evaluation is based primarily on work performed between approximately 1973 and 1975 and documented in Bechtel Associates Professional Corporation Special Report No 6 for the Palisades Plant. Revision 2 of this report was submitted to the NRC in our letter of July 27, 1973. The report and CPCo actions taken in response to this issue were found acceptable by the NRC in a letter dated August 7, 1973. Since that time a final revision has been made to the report, but not docketed. Included with this letter, therefore, is Special Report No 6, Revision 3, dated June 30, 1975.

Robert A Vincent

Robert A Vincent
Staff Licensing Engineer

CC Director, Region III, USNRC
NRC Resident Inspector - Palisades

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PALISADES PLANT
SEP TOPIC III-5.B
HIGH ENERGY LINE BREAK OUTSIDE CONTAINMENT

I. INTRODUCTION

The safety objective of Systematic Evaluation Program (SEP) Topic III-5.B, "Pipe Break Outside Containment," is to ensure that pipe breaks would not cause the loss of needed functions of safety-related systems, structures, and components and to ensure that the plant can be safely shut down in the event of such breaks. The needed functions of safety-related systems are those functions required to mitigate the effects of the pipe break and safely shut down the reactor plant.

High energy line break (HELB) analysis for piping systems outside containment at the Palisades nuclear plant was furnished in Special Report-6 (SR-6), "Analysis of Postulated High Energy Line Break Outside Containment," Rev. 3, dated June 30, 1975. The high energy lines were identified therein, and the postulated breaks were assumed based on the mechanistic approach outlined in Standard Review Plans (SRPs) 3.6.1, 3.6.2 and their attached Branch Technical Positions (BTPs) APCSB 3-1 and MEB 3-1, dated November 24, 1975. Subsequent to the 1975 HELB analysis report, all safety piping outside containment of the Palisades nuclear plant was reanalyzed and modifications (mainly to pipe supports) were made from 1979 through 1981.

This evaluation includes the following:

a. A review of the analytical results recorded in SR-6.

b. A comparison of the criteria used in SR-6 with current HELB criteria.

c. The effect of reanalysis on break points selected by the mechanistic stress criteria and an evaluation of break points determined by stresses if the break points differ from SR-6.

II. CURRENT REVIEW CRITERIA

a. US NRC, SRP 3.6.1 and 3.6.2 and their companion BTPs, APCSB 3-1 and MEB 3-1, dated November 24, 1975.

III. RELATED SAFETY TOPICS AND INTERFACES

a. SEP Topic III-4C, "Internally Generated Missiles (Outside Containment)"

b. SEP Topic III-12, "Environmental Qualification of Safety-Related Equipment"

c. Palisades FSAR Volume III, Appendix A, (revised October 24, 1980)

d. Palisades Plant Special Report-6, "Analysis of Postulated High Energy Line Break Outside Containment," Rev. 3, June 30, 1975.

e. NRC IE Bulletin 79-14.

f. NUREG 0737

IV. EVALUATION

a. Analytical results recorded in SR-6.

The criteria used in SR-6 is given on page 1-2 of the report. Based on the criteria, the report defines safety systems (see page 5-1) and evaluates the results of high energy line breaks outside containment with respect to plant safety. The report (page 9-1) concluded that modifications to the plant were desirable, and these modifications were incorporated in the 1975 time frame. In addition a program was initiated for augmented ISI of selected lines for which modifications were impractical.

In general, the safety equipment required for safe shutdown listed by SR-6 (table 4-1) is still valid, ie, no significant modifications have been made to the plant in this area since 1975. Also, the lines evaluated in SR-6 appears valid for the criteria used at the time.

b. Criteria

A review of the criteria used in SR-6 versus the criteria given by SRP 3.6.1 shows that the criteria used by SR-6 is the same as current criteria except as follows:

i. SR-6 (page 1-2) considered that temperature must exceed 200°F and pressure must exceed 275 psig if a line is to be classified as high energy. SRP 3.6.1 defines a line as high energy if either the pressure or the temperature values are exceeded. Two systems which were excluded from consideration by the earlier criteria would now be considered as high energy systems by current criteria. These systems include the reactor coolant let down piping (see page 6-3 of SR-6) and the heating steam and condensate system.

With respect to the let down piping, the effects of a break in this 2" line would not be considered significant under the size and/or location criteria as discussed on page 7-1 of SR-6.

With respect to the heating steam system, a discussion of pipe break effects is provided as Attachment I. In general, the energy contained within this system is insufficient to produce unacceptable consequences.

ii. Breaks in portions of the auxiliary feedwater system were deemed not credible because of low usage (see page 7-3 of SR-6) whereas footnote 6, page 14 of SRP 3.6.2 specifically notes that the auxiliary feedwater system is a high energy system. Significant modifications are being made to the system in response to NUREG 0737 commitments. HELB considerations for this system are being addressed as part of the system design.

iii. Breaks selected on stress points.

Certain high energy line breaks were postulated by SR-6 based on calculated stresses. Breaks were assumed in a pipe run at two intermediate locations of highest combined stresses. Breaks were also assumed when calculated stresses exceeded 0.8 (Sh + SA) or the expansion stresses exceeded 0.8 SA. Subsequent to completion of SR-6, large bore safety piping at Palisades was re-analyzed based on "as-built" data collected in 1978 and 1980. As a result of this reanalysis, some points of highest combined stresses changed from those points considered by SR-6. The high stress point relocations have been reviewed on a sample basis. The relocations are small and are not significant with respect to installed restraints, ie, the relocations do not invalidate SR-6 results.

SR-6 postulated no breaks based on the 0.8 (Sh + SA) or 0.8 SA criteria (see tables 7-1, 7-2 and 7-3 of SR-6). While the reanalysis performed in the 1979-1981 period resulted in changes to the calculated pipe stress values, none exceeded the criteria except for point 9 of the main steam dump line. Since calculated stresses exceed 0.8 (Sh + SA) by only 2.3%, this value can be neglected. See attached tables 1, 2 and 3 for recalculated stress values which may be compared with those of SR-6.

V. CONCLUSION

Based on the evaluation performed per SR-6 and the above discussions, reasonable certainty exists that the Palisades plant meets the intent of SRP 3.6.1 and SRP 3.6.2, with the single exception of auxiliary feedwater system which is being modified per NUREG 0737. Since these modifications include HELB considerations, no additional actions are required with respect to SEP Topic III-5.B.

TABLE 1

CONSUMERS POWER COMPANY
PALISADES NUCLEAR PLANT

HIGH ENERGY PIPE FAILURES OUTSIDE CONTAINMENT - SUMMARY OF OPERATING STRESSES (Calculated 1979-1981)

System: MAIN STEAM (EB-1-36", EB-1-26")

Point No.	Pressure Stress, P	Weight Stress, W	P + W	S_h (1)	Seismic Stress, S	P+W+S	$1.2S_h$ (2)	Expansion Stress, T	S_A (3)	P+W+S+T	$0.8(S_h+S_A)$ (4)
1	6,459	1,325	7,784	17,500	6,660	14,444	21,000	2,994	26,250	17,438	35,000
2	6,459	3,399	9,858	17,500	3,913	13,771	21,000	6,115	26,250	19,886	35,000
3	6,459	2,992	9,451	17,500	3,865	13,316	21,000	5,336	26,250	18,652	35,000
4	6,459	748	7,207	17,500	3,873	11,080	21,000	3,782	26,250	14,862	35,000
5	6,459	875	7,334	17,500	3,479	10,813	21,000	4,592	26,250	15,405	35,000
6	6,459	1,099	7,558	17,500	3,425	10,983	21,000	2,876	26,250	13,859	35,000
7	8,210	1,111	9,321	17,500	7,261	16,582	21,000	5,903	26,250	22,485	35,000
8	8,210	1,089	9,299	17,500	5,785	15,084	21,000	7,519	26,250	22,063	35,000
9	8,210	321	8,531	17,500	5,831	14,362	21,000	6,754	26,250	21,116	35,000
10	8,210	321	8,531	17,500	5,831	14,362	21,000	6,754	26,250	21,116	35,000
11	8,210	228	8,438	17,500	5,313	13,751	21,000	5,975	26,250	19,726	35,000
12	8,210	1,459	9,669	17,500	5,320	14,989	21,000	6,026	26,250	21,015	35,000
13	8,210	2,557	10,767	17,500	5,481	16,248	21,000	7,084	26,250	23,332	35,000
14	8,210	3,372	11,582	17,500	7,353	18,935	21,000	7,590	26,250	26,525	35,000
15	8,210	3,459	11,669	17,500	9,872	21,541	21,000	9,901	26,250	31,442	35,000
16	5,457	1,016	6,473	17,500	3,372	9,845	21,000	3,450	26,250	13,295	35,000
17	8,210	1,717	9,927	17,500	10,479	20,406	21,000	7,091	26,250	27,497	35,000
18	8,210	941	9,151	17,500	9,567	18,718	21,000	6,602	26,250	25,320	35,000
19	8,210	2,253	10,463	17,500	5,655	16,118	21,000	4,509	26,250	20,627	35,000
20	8,210	3,243	11,453	17,500	5,224	16,677	21,000	3,812	26,250	20,489	35,000
21	8,210	2,973	11,183	17,500	6,520	17,703	21,000	7,886	26,250	25,589	35,000
22	8,210	2,949	11,159	17,500	9,429	20,588	21,000	11,016	26,250	31,604	35,000
23	5,457	912	6,369	17,500	3,333	9,702	21,000	3,600	26,250	13,302	35,000
24	6,459	1,981	8,440	17,500	3,326	11,766	21,000	2,546	26,250	14,312	35,000
25	6,459	4,532	10,991	17,500	3,509	14,500	21,000	4,941	26,250	19,441	35,000
26	6,459	4,872	11,331	17,500	4,020	15,351	21,000	5,561	26,250	20,912	35,000
27	6,459	1,049	7,508	17,500	3,344	10,852	21,000	4,047	26,250	14,899	35,000
28	6,459	1,007	7,466	17,500	3,795	11,261	21,000	3,458	26,250	14,719	35,000
29	6,459	883	7,342	17,500	2,309	9,651	21,000	1,133	26,250	10,784	35,000
30	8,212	911	9,123	17,500	4,441	13,564	21,000	6,266	26,250	19,830	35,000
31	8,212	424	8,636	17,500	4,539	13,175	21,000	7,005	26,250	20,180	35,000
32	8,212	424	8,636	17,500	4,539	13,175	21,000	7,005	26,250	20,180	35,000
33	8,212	865	9,077	17,500	4,108	13,185	21,000	6,291	26,250	19,476	35,000
34	8,212	1,591	9,803	17,500	4,641	14,444	21,000	6,807	26,250	21,251	35,000
35	8,212	1,288	9,500	17,500	3,843	13,343	21,000	5,822	26,250	19,165	35,000

TABLE 1 (Continued)

CONSUMERS POWER COMPANY
PALISADES NUCLEAR PLANT

HIGH ENERGY PIPE FAILURES OUTSIDE CONTAINMENT - SUMMARY OF OPERATING STRESSES (Calculated 1979-1981)

System: MAIN STEAM (EB-1-36", EB-1-26")

Point No.	Pressure Stress, P	Weight Stress, W	P + W	S_h (1)	Seismic Stress, S	P+W+S	$1.2S_h$ (2)	Expansion Stress, T	S_A (3)	P+W+S+T	$0.8(S_h+S_A)$ (4)
36	8,212	1,519	9,731	17,500	5,881	15,612	21,000	2,325	26,250	17,937	35,000
37	8,212	2,472	10,684	17,500	6,373	17,057	21,000	4,403	26,250	21,460	35,000
38	5,457	2,432	7,889	17,500	8,292	16,181	21,000	8,548	26,250	24,729	35,000
39	5,457	1,041	6,498	17,500	4,305	10,803	21,000	4,320	26,250	15,123	35,000
40	8,212	1,124	9,336	17,500	7,476	16,812	21,000	4,519	26,250	21,331	35,000
41	8,212	623	8,835	17,500	6,816	15,651	21,000	3,976	26,250	19,627	35,000
42	8,212	2,765	10,977	17,500	4,968	15,945	21,000	1,736	26,250	17,681	35,000
43	8,212	2,321	10,533	17,500	3,995	14,528	21,000	1,621	26,250	16,149	35,000
44	8,212	809	9,021	17,500	3,299	12,320	21,000	2,609	26,250	14,929	35,000
45	8,212	1,476	9,688	17,500	4,605	14,293	21,000	3,899	26,250	18,192	35,000
46	5,457	3,223	11,435	17,500	8,136	24,212	21,000	5,555	26,250	29,767	35,000
47	5,457	1,469	9,681	17,500	3,982	13,663	21,000	2,687	26,250	16,350	35,000

NOTES:

1. S_h = Allowable Limit of P + W per Applicable Code
2. $1.2S_h$ = Allowable Limit of P + W + S per Applicable Code
3. S_A = Allowable Limit of T per Applicable Code
4. $0.8(S_h + S_A)$ = Threshold of Stress for Mandatory Break Location in this Study, AEC

TABLE 2

CONSUMERS POWER COMPANY
PALISADES PLANT

HIGH ENERGY PIPE FAILURES OUTSIDE CONTAINMENT - SUMMARY OF OPERATING STRESSES (Calculated 1979-1981)

System: FEEDWATER (DB-1-18" & EB-9-18", DB-1-12")

POINT NO.	PRESSURE STRESS, P	WEIGHT STRESS, W	P + W	S_h (1)	SEISMIC STRESS, S	P+W+S	$1.2S_h$ (2)	EXPANSION STRESS, T	S_A (3)	P+W+S+T	$0.8(S_h+S_A)$ (4)
1	5,787	247	6,034	15,000	3,194	9,228	18,000	6,123	22,500	15,351	30,000
2	5,787	125	5,912	15,000	710	6,622	18,000	801	22,500	7,423	30,000
3	5,787	250	6,037	15,000	172	6,209	18,000	493	22,500	6,702	30,000
4	5,787	280	6,067	15,000	2,215	8,282	18,000	10,523	22,500	18,805	30,000
5	5,787	769	6,556	15,000	2,585	9,141	18,000	10,893	22,500	20,034	30,000
6	5,787	516	6,303	15,000	1,800	8,103	18,000	10,191	22,500	18,294	30,000
7	5,787	740	6,527	15,000	1,533	8,060	18,000	8,385	22,500	16,445	30,000
8	5,787	571	6,358	15,000	1,648	8,006	18,000	4,182	22,500	12,188	30,000
9	5,787	337	6,124	15,000	2,072	8,196	18,000	3,123	22,500	11,319	30,000
10	5,787	273	6,060	15,000	2,171	8,231	18,000	4,060	22,500	12,291	30,000
11	5,787	25	5,812	15,000	1,937	7,749	18,000	2,733	22,500	10,482	30,000
12	5,787	567	6,354	15,000	1,924	8,278	18,000	1,508	22,500	9,786	30,000
13	5,787	1,065	6,852	15,000	3,683	10,535	18,000	6,841	22,500	17,376	30,000
14	5,787	745	6,532	15,000	2,907	9,439	18,000	5,112	22,500	14,551	30,000
15	-	-	-	-	-	-	-	-	-	-	-
16	5,787	377	6,164	15,000	1,844	8,008	18,000	3,222	22,500	11,230	30,000
17	5,896	903	6,690	15,000	2,011	8,701	18,000	2,604	22,500	11,305	30,000
18	5,896	1,009	6,905	15,000	3,423	10,328	18,000	2,154	22,500	12,482	30,000
19	5,896	302	6,198	15,000	1,115	7,313	18,000	641	22,500	7,954	30,000
20	5,896	218	6,114	15,000	1,013	7,127	18,000	856	22,500	7,983	30,000
21	5,787	773	6,560	15,000	3,255	9,815	18,000	842	22,500	10,657	30,000
22	5,787	632	6,419	15,000	2,278	8,697	18,000	2,323	22,500	11,020	30,000
23	5,787	387	6,174	15,000	3,880	10,054	18,000	3,950	22,500	14,004	30,000
24	5,787	126	5,913	15,000	1,897	7,810	18,000	1,682	22,500	9,492	30,000
25	5,991	487	6,478	15,000	3,512	9,990	18,000	2,516	22,500	12,506	30,000
26	5,991	345	6,336	15,000	1,713	8,049	18,000	806	22,500	8,855	30,000
27	5,787	1,395	7,182	15,000	5,165	12,347	18,000	4,477	22,500	16,824	30,000
28	5,787	1,459	7,246	15,000	3,960	11,206	18,000	3,272	22,500	14,478	30,000
29	5,787	1,375	7,162	15,000	3,828	10,990	18,000	2,651	22,500	13,641	30,000
30	5,787	1,056	6,843	15,000	3,892	10,735	18,000	2,114	22,500	12,849	30,000
30A	5,787	1,087	6,874	15,000	1,490	8,364	18,000	1,364	22,500	9,728	30,000
31	5,787	1,167	6,954	15,000	3,208	10,162	18,000	3,952	22,500	14,114	30,000

TABLE 2 (Continued)

CONSUMERS POWER COMPANY
PALISADES PLANT

HIGH ENERGY PIPE FAILURES OUTSIDE CONTAINMENT - SUMMARY OF OPERATING STRESSES (Calculated 1979-1981)

System: FEEDWATER (DB-1-18" & EB-9-18", DB-1-12")

POINT NO.	PRESSURE STRESS, P	WEIGHT STRESS, W	P + W	S_h (1)	SEISMIC STRESS, S	P+W+S	$1.2S_h$ (2)	EXPANSION STRESS, T	S_A (3)	P+W+S+T	$0.8(S_h+S_A)$ (4)
32	5,787	808	6,595	15,000	3,195	9,790	18,000	4,756	22,500	14,546	30,000
32A	5,787	759	6,546	15,000	3,893	10,439	18,000	4,900	22,500	15,339	30,000
33	5,787	644	6,431	15,000	4,465	10,896	18,000	5,783	22,500	16,679	30,000
34	5,787	557	6,344	15,000	4,720	11,064	18,000	4,995	22,500	16,059	30,000
34A	5,787	1,132	6,919	15,000	6,663	13,582	18,000	6,399	22,500	19,981	30,000
35	5,787	2,401	8,188	15,000	7,345	15,533	18,000	7,898	22,500	23,431	30,000
36	4,587	490	5,077	15,000	1,635	6,712	18,000	1,458	22,500	8,170	30,000
37	4,587	855	5,442	15,000	3,660	9,102	18,000	2,679	22,500	11,781	30,000
38	5,680	1,128	6,808	15,000	3,695	10,503	18,000	3,695	22,500	14,198	30,000
39	5,680	1,170	6,850	15,000	4,244	11,094	18,000	5,916	22,500	17,010	30,000
40	5,680	3,843	9,523	15,000	8,123	17,646	18,000	10,622	22,500	28,268	30,000
41	4,587	858	5,445	15,000	2,616	8,061	18,000	4,114	22,500	12,175	30,000
42	4,587	632	5,219	15,000	3,468	8,687	18,000	4,325	22,500	13,012	30,000
43	4,587	613	5,200	15,000	3,603	8,803	18,000	4,317	22,500	13,120	30,000
44	4,587	391	4,978	15,000	1,942	6,920	18,000	2,264	22,500	9,184	30,000
45	4,587	69	4,656	15,000	3,812	8,468	18,000	5,780	22,500	14,248	30,000
46	5,699	1,382	7,081	15,000	10,205	17,286	18,000	10,760	22,500	28,046	30,000
47	5,680	888	6,568	15,000	5,104	11,672	18,000	2,961	22,500	14,633	30,000
48	5,680	768	6,448	15,000	4,187	10,635	18,000	2,018	22,500	12,653	30,000
49	5,680	785	6,465	15,000	5,393	11,858	18,000	2,376	22,500	14,234	30,000
50	5,680	509	6,189	15,000	5,396	11,585	18,000	2,861	22,500	14,446	30,000
51	5,680	220	5,900	15,000	4,398	10,289	18,000	2,712	22,500	13,001	30,000
52	5,680	795	6,475	15,000	5,074	11,549	18,000	1,037	22,500	12,586	30,000
53	5,680	188	5,868	15,000	6,155	12,023	18,000	1,695	22,500	13,718	30,000
54	5,680	196	5,876	15,000	6,872	12,748	18,000	1,224	22,500	13,972	30,000
55	5,680	140	5,820	15,000	6,380	12,200	18,000	337	22,500	12,537	30,000
56	5,680	212	5,892	15,000	9,705	15,597	18,000	3,310	22,500	18,907	30,000
57	5,680	401	6,081	15,000	9,248	15,329	18,000	3,919	22,500	19,248	30,000
58	5,680	549	6,229	15,000	4,916	11,145	18,000	3,503	22,500	14,648	30,000
59	5,680	509	6,189	15,000	9,023	15,212	18,000	2,723	22,500	17,935	30,000
60	5,680	348	6,028	15,000	6,801	12,829	18,000	3,815	22,500	16,644	30,000

TABLE 2 (Continued)

CONSUMERS POWER COMPANY
PALISADES PLANT

HIGH ENERGY PIPE FAILURES OUTSIDE CONTAINMENT - SUMMARY OF OPERATING STRESSES (Calculated 1979-1981)

System: FEEDWATER (DB-1-18" & EB-9-18", DB-1-12")

POINT NO.	PRESSURE STRESS, P	WEIGHT STRESS, W	P + W	S_h (1)	SEISMIC STRESS, S	P+W+S	$1.2S_h$ (2)	EXPANSION STRESS, T	S_A (3)	P+W+S+T	$0.8(S_h+S_A)$ (4)
61	5,680	271	5,951	15,000	7,357	13,308	18,000	4,333	22,500	17,641	30,000
62	-	-	-	-	-	-	-	-	-	-	-
63	5,680	472	6,152	15,000	8,015	14,167	18,000	6,236	22,500	20,403	30,000
64	5,680	162	5,842	15,000	4,259	10,101	18,000	3,078	22,500	13,179	30,000
65	4,587	124	4,711	15,000	1,119	5,830	18,000	1,218	22,500	7,048	30,000
66	4,587	268	4,855	15,000	3,949	8,804	18,000	1,967	22,500	10,771	30,000
67	5,699	1,475	7,174	15,000	8,302	15,476	18,000	4,386	22,500	19,862	30,000
68	5,680	538	6,218	15,000	3,774	9,992	18,000	3,947	22,500	13,939	30,000
69	5,680	333	6,013	15,000	1,865	7,878	18,000	2,020	22,500	9,898	30,000
70	5,680	332	6,012	15,000	1,765	7,777	18,000	1,516	22,500	9,293	30,000
71	4,587	2,077	6,664	15,000	5,363	12,027	18,000	2,171	22,500	14,198	30,000
72	4,587	683	5,270	15,000	930	6,200	18,000	679	22,500	6,879	30,000
73	5,787	441	6,228	15,000	147	6,375	18,000	535	22,500	6,910	30,000
74	5,787	1,293	7,080	15,000	5,111	12,191	18,000	4,914	22,500	17,105	30,000
75	5,787	1,103	6,890	15,000	5,624	12,514	18,000	5,308	22,500	17,822	30,000
76	5,787	399	6,186	15,000	3,012	9,198	18,000	3,525	22,500	12,723	30,000
77	5,787	665	6,452	15,000	3,041	9,493	18,000	4,577	22,500	14,070	30,000
78	5,787	620	6,407	15,000	2,840	9,247	18,000	4,693	22,500	13,940	30,000
79	5,787	663	6,450	15,000	2,191	8,641	18,000	3,845	22,500	12,486	30,000
80	5,787	341	6,128	15,000	1,860	7,988	18,000	319	22,500	8,307	30,000
81	5,787	310	6,097	15,000	1,500	7,597	18,000	336	22,500	7,933	30,000
82	5,787	626	6,413	15,000	1,209	7,622	18,000	1,110	22,500	8,732	30,000
83	5,787	1,700	7,487	15,000	5,035	12,522	18,000	4,280	22,500	16,802	30,000
83A	5,787	2,364	8,151	15,000	6,817	14,968	18,000	5,543	22,500	20,511	30,000
84	5,787	2,467	8,254	15,000	7,077	15,331	18,000	4,876	22,500	20,207	30,000
85	5,991	1,056	12,404	15,000	3,321	15,725	18,000	1,363	22,500	17,088	30,000
86	5,991	804	6,795	15,000	2,212	9,007	18,000	952	22,500	9,959	30,000
87	5,896	453	6,349	15,000	1,010	7,359	18,000	1,047	22,500	8,406	30,000
88	5,896	334	6,230	15,000	523	6,753	18,000	474	22,500	7,227	30,000
89	5,896	1,497	7,393	15,000	4,707	12,100	18,000	1,734	22,500	13,834	30,000

TABLE 2 (Continued)

CONSUMERS POWER COMPANY
PALISADES PLANT

HIGH ENERGY PIPE FAILURES OUTSIDE CONTAINMENT - SUMMARY OF OPERATING STRESSES (Calculated 1979-1981)

System: FEEDWATER (DB-1-18" & EB-9-18", DB-1-12")

POINT NO.	PRESSURE STRESS, P	WEIGHT STRESS, W	P + W	S_h (1)	SEISMIC STRESS, S	P+W+S	$1.2S_h$ (2)	EXPANSION STRESS, T	S_A (3)	P+W+S+T	$0.8(S_h+S_A)$ (4)
90	5,896	1,077	6,973	15,000	4,720	11,693	18,000	2,819	22,500	14,512	30,000
91	5,787	900	6,687	15,000	4,129	10,816	18,000	5,967	22,500	16,783	30,000
92	5,787	1,724	7,511	15,000	3,523	11,034	18,000	6,410	22,500	17,444	30,000
93	5,787	1,784	7,571	15,000	2,593	10,164	18,000	2,988	22,500	13,152	30,000
94	5,787	1,801	7,588	15,000	2,950	10,538	18,000	2,387	22,500	12,925	30,000
95	5,787	2,467	8,254	15,000	2,935	11,189	18,000	6,255	22,500	17,444	30,000
96	5,787	759	6,546	15,000	2,429	8,975	18,000	8,353	22,500	17,328	30,000
97	5,787	1,365	7,152	15,000	2,515	9,667	18,000	7,197	22,500	16,864	30,000
98	5,787	1,431	7,218	15,000	2,585	9,803	18,000	6,398	22,500	16,201	30,000
99	5,787	1,081	6,868	15,000	2,955	9,823	18,000	5,212	22,500	15,035	30,000
100	4,475	576	5,051	15,000	1,188	6,239	18,000	1,430	22,500	7,669	30,000
101	4,475	734	5,209	15,000	7,007	12,216	18,000	8,434	22,500	20,650	30,000
102	5,787	1,393	7,180	15,000	2,728	9,908	18,000	2,056	22,500	11,964	30,000
103	5,787	1,425	7,212	15,000	2,083	9,295	18,000	1,786	22,500	11,081	30,000
104	5,787	1,275	7,062	15,000	2,171	9,233	18,000	835	22,500	10,068	30,000
105	5,787	1,155	6,942	15,000	2,176	9,118	18,000	1,116	22,500	10,234	30,000
106	5,787	1,996	7,783	15,000	2,873	10,656	18,000	1,465	22,500	12,121	30,000
107	5,787	362	6,149	15,000	942	7,091	18,000	402	22,500	7,493	30,000
108	5,787	825	6,612	15,000	8,121	14,733	18,000	2,597	22,500	17,330	30,000
109	5,787	825	6,612	15,000	8,121	14,733	18,000	2,597	22,500	17,330	30,000
110	5,787	283	6,070	15,000	4,924	10,994	18,000	1,342	22,500	12,336	30,000

NOTES:

1. S_h = Allowable Limit of P + W per Applicable Code
2. $1.2S_h$ = Allowable Limit of P + W + S per Applicable Code
3. S_A = Allowable Limit of T per Applicable Code
4. $0.8(S_h + S_A)$ = Threshold of Stress for Mandatory Break Location in this study, AEC

TABLE 3

CONSUMERS POWER COMPANY
PALISADES PLANT

HIGH ENERGY PIPE FAILURES OUTSIDE CONTAINMENT - SUMMARY OF OPERATING STRESSES (Calculated 1979-1981)

System: MAIN STEAM DUMP (EB-1-8", GB-19-8")

POINT NO.	PRESSURE STRESS, P	WEIGHT STRESS, W	P + W	S_h (1)	SEISMIC STRESS, S	P+W+S	$1.2S_h$ (2)	EXPANSION STRESS, T	S_A (3)	P+W+S+T	$0.8(S_h+S_A)$ (4)
1	2,680	9	2,689	15,000	1,639	4,328	18,000	833	22,500	5,161	30,000
2	2,680	927	3,607	15,000	2,110	5,717	18,000	1,130	22,500	6,847	30,000
3	5,956	225	6,181	15,000	1,091	7,272	18,000	2,610	22,500	9,882	30,000
4	5,956	1,577	7,533	15,000	2,377	9,910	18,000	5,397	22,500	15,307	30,000
5	5,956	932	6,888	15,000	1,113	8,001	18,000	15,565	22,500	23,566	30,000
6	5,956	1,204	7,160	15,000	1,159	8,319	18,000	15,559	22,500	23,878	30,000
7	5,956	1,705	7,661	15,000	1,679	9,340	18,000	9,157	22,500	18,497	30,000
8	5,956	1,868	7,824	15,000	1,784	18,322	18,000	9,687	22,500	28,009	30,000
9	5,956	1,857	7,813	15,000	1,848	17,261	18,000	13,441	22,500	30,702	30,000

NOTES:

1) S_h = Allowable limit of P+W per Applicable Code

2) $1.2S_h$ = Allowable limit of P+W+S per Applicable Code

3) S_A = Allowable limit of T per Applicable Code

4) $0.8(S_h+S_A)$ = Threshold of Stress for Mandatory Break Location in this Study, AEC Criteria

ATTACHMENT I

HIGH ENERGY LINE BREAK EVALUATION
PLANT HEATING SYSTEM

Steam from the heating boiler (M-8), and steam extracted from the LP turbine provide plant heating to auxiliary building, turbine building, reactor building as well as process heat to the heat exchangers of safety injection and recirculating water (SIRW) tank, condensate tank, primary makeup tank, and domestic water tank (Figure 1). The plant heating system is designed for the maximum service conditions of steam at 15 psig and 250°F. The system meets the criteria defined in APCSB 3-1 of SRP 3.6.1, for high energy fluid system. The safety evaluation of high energy line breaks (HELB) pertaining to the system, as discussed herein, is based on the mechanistic approach outlined in SRP 3.6.2 and BTP MEB 3-1, dated November 24, 1975.

Branch 1, (JB-11-10") from the heating boiler (M-8), supplies heating steam to the following auxiliary facilities and areas located in the auxiliary building:

1. New and spent fuel handling, storage and shipment areas
2. Control room
3. Radwaste, chemical and volume control equipment
4. Emergency diesel generators and related auxiliary areas
5. Safety injection system
6. Containment spray system
7. Component cooling system

Branch 1 (JB-11-10"), in part, and branch 2 (JB-11-8") from the heating boiler (M-8), in conjunction with steam extracted from the LP turbine provide plant heating steam to the following areas located in the turbine building.

1. Turbine building auxiliary feed pump room
2. Containment electrical penetration area
3. Service water pump area
4. Diesel fire pump area

These auxiliary facilities housed in the auxiliary building and the turbine building are located within reinforced concrete enclosures, designed and constructed to Seismic Class 1 Standards. The low pressure heating steam lines are physically separated from other safety-related structures, systems, and components in the auxiliary building and the turbine building. The piping is designed and fabricated in accordance with USAS B31.1.0, 1967. Any break along the high energy plant heating lines will not produce adverse environmental condition in the auxiliary facilities areas. Compartment pressurization due to anticipated breaks will be insignificant.

Jet impingement reactions on the structures, systems and components in the vicinity are avoided by their physical separation from the plant heating steam lines. Fluid thrust due to a broken line is insignificant because of low enthalpy of the fluid in the piping, and it does not affect the safety function of any critical system components. Portions of the plant heating lines pass through the main steam penetration room and main feedwater penetration room enclosed in a section of the auxiliary building. Main steam

lines and main feedwater lines are restrained by structural steel whipping frames and concrete enclosures and low pressure plant heating steam line breaks have no affect on their functional integrity. Also, due to the low fluid enthalpy a low pressure plant heating steam line break will not create pipe whipping.

The energy release due to full circumferential break of branch 1 (JB-11-10"), providing heating steam to auxiliary building heating units, part of turbine building heating units, and process steam to SIRW tank will be 877 BTU/sec. Similarly, the energy release due to a full circumferential break of branch 2 (JB-11-8") of the heating boiler line, which supplies heating steam conjointly with steam extracted from the LP turbine to heating units in the turbine building, and process steam to the condensate heat exchanger, primary makeup system heat exchanger and domestic water heat exchanger, will be 832 BTU/sec. These energy releases will be dispersed through relatively large volumes within the auxiliary building and turbine building, respectively, creating no consequential adverse environmental effect on the safety-related structures, systems and components.

It is concluded that the low pressure plant heating steam line break outside containment will not hamper the normal plant operation.

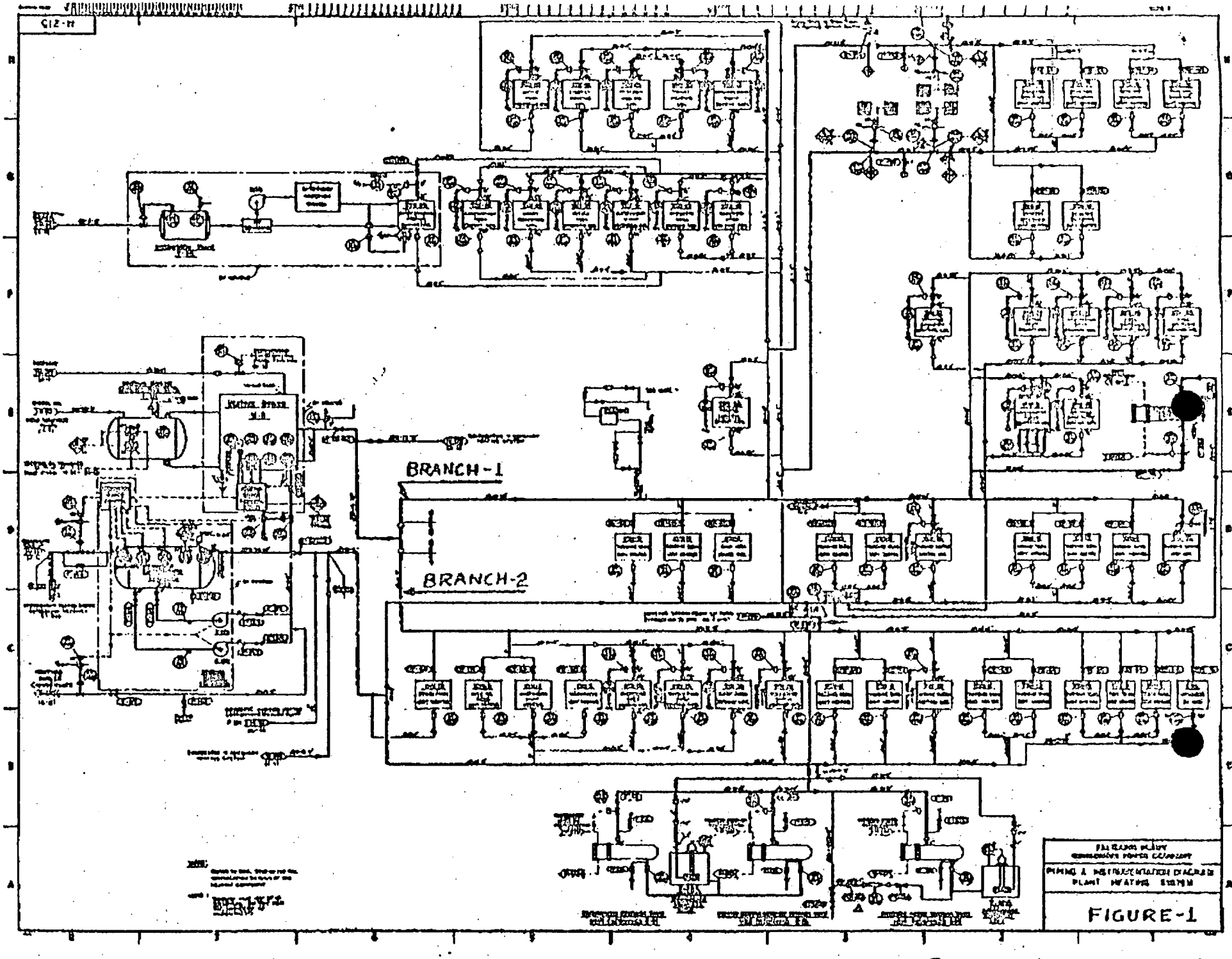

FIGURE-1

EXTRACT - P&ID M-215