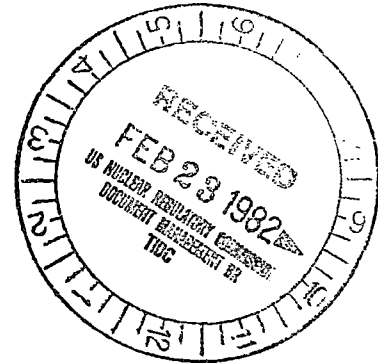


February 19, 1982

Docket No. 50-255  
LS05-82- 02-078



Mr. David J. Vandewalle  
Nuclear Licensing Administrator  
Consumers Power Company  
1945 W. Parnall Road  
Jackson, Michigan 49201

Dear Mr. Vandewalle:

SUBJECT: PALISADES - SEP TOPIC III-5.1<sup>A</sup>, PIPE BREAK OUTSIDE CONTAINMENT

On December 23, 1981, we transmitted the draft safety evaluation for this topic based on your safety assessment report of August 25, 1981. By letter dated December 30, 1981, you provided Revision 1 to your assessment, your letter of February 9, 1982 provided additional information.

Based on the information provided by the above references, we have issued the enclosed final topic evaluation. This topic is now complete.

Thomas V. Wambach, Project Manager  
Operating Reactors Branch No. 5  
Division of Licensing

Enclosure:  
Asstated

cc w/enclosure:  
See next page

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ADD:  
G. Staley  
T. Michaels

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RHermann/SEPB  
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DATE	2/17/82	2/17/82	2/17/82	2/17/82	2/17/82	2/17/82	

Mr. David J. Vandewalle

cc

M. I. Miller, Esquire  
Isham, Lincoln & Beale  
Suite 4200  
One First National Plaza  
Chicago, Illinois 60670

Mr. Paul A. Perry, Secretary  
Consumers Power Company  
212 West Michigan Avenue  
Jackson, Michigan 49201

Judd L. Bacon, Esquire  
Consumers Power Company  
212 West Michigan Avenue  
Jackson, Michigan 49201

Myron M. Cherry, Esquire  
Suite 4501  
One IBM Plaza  
Chicago, Illinois 60611

Ms. Mary P. Sinclair  
Great Lakes Energy Alliance  
5711 Summerset Drive  
Midland, Michigan 48640

Kalamazoo Public Library  
315 South Rose Street  
Kalamazoo, Michigan 49006

Township Supervisor  
Covert Townshi  
Route 1, Box 10  
Van Buren County, Michigan 49043

Office of the Governor (2)  
Room 1 - Capitol Building  
Lansing, Michigan 48913

William J. Scanlon, Esquire  
2034 Pauline Boulevard  
Ann Arbor, Michigan 48103

Palisades Plant  
ATTN: Mr. Robert Montross  
Plant Manager  
Covert, Michigan 49043

U. S. Environmental Protection  
Agency  
Federal Activities Branch  
Region V Office  
ATTN: Regional Radiation Representative  
230 South Dearborn Street  
Chicago, Illinois 60604

Charles Bechhoefer, Esq., Chairman  
Atomic Safety and Licensing Board  
Panel  
U. S. Nuclear Regulatory Commission  
Washington, D. C. 20555

Dr. George C. Anderson  
Department of Oceanography  
University of Washington  
Seattle, Washington 98195

Dr. M. Stanley Livingston  
1005 Calle Largo  
Santa Fe, New Mexico 87501

Resident Inspector  
c/o U. S. NRC  
Palisades Plant  
Route 2, P. O. Box 155  
Covert, Michigan 49043

James G. Keppler, Regional Administrator  
Nuclear Regulatory Commission, Region III  
Office of Inspection and Enforcement  
799 Roosevelt Road  
Glen Ellyn, Illinois 60137

SEP EVALUATION  
OF  
PIPE BREAK  
OUTSIDE CONTAINMENT  
TOPIC III-5.B  
FOR  
PALISADES NUCLEAR POWER PLANT  
FEBRUARY 1982

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## I. INTRODUCTION

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

## II. REVIEW CRITERIA

General Design Criteria 4 (Appendix A to 10 CFR Part 50) requires in part that structures, systems and components important to safety be appropriately protected against dynamic effects, such as pipe whip and discharging fluids, that may result from equipment failures.

The current criteria for review of pipe breaks outside containment are contained in Standard Review Plan 3.6.1, "Postulated Piping Failures in Fluid Systems Outside of Containment", including its attached Branch Technical Position, Auxiliary System Branch 3-1 (BTP ASB 3-1) and Standard Review Plan 3.6.2, "Determination of Break Locations and Dynamic Effects Associated with the Postulated Rupture of Piping", including its attached Branch Technical Position, Mechanical Engineering Branch 3-1 (BTP MEB 3-1).

## III. RELATED SAFETY TOPICS AND INTERFACES

1. This review complements that of SEP Topic VII-3, "Systems Required for Safe Shutdown".
2. The environmental effects of pressure, temperature, humidity and flooding due to postulated pipe breaks are evaluated under Unresolved Safety Issue A-24, "Qualification of Class IE Safety-Related Equipment".
3. The effects of potential missiles generated by fluid system ruptures and rotating machinery where also considered and are evaluated under SEP Topic III-4.C, "Internally Generated Missiles".
4. The original plant design in the areas of seismic input, analysis and design criteria are evaluated under SEP Topic III-6, "Seismic Design Considerations".
5. NRC IE Bulletin 79-14, "SEISMIC ANALYSIS FOR AS-BUILT SAFETY-RELATED PIPING SYSTEMS".
6. NUREG-0737 Item II.E.1.1, "AUXILIARY FEEDWATER SYSTEM EVALUATION"
7. Multi-plant Issue B-11, "SUSCEPTIBILITY OF SAFETY-RELATED SYSTEMS TO FLOODING FROM FAILURE OF NON-CATEGORY I SYSTEMS".

#### IV. REVIEW GUIDELINES

The licensee's break location criteria and methods of analysis for evaluating postulated breaks in high energy piping systems outside containment have been compared with the currently accepted review criteria as described in Section II above. The review relied upon information submitted by the licensee Consumers Power Company (CPCo), in References 1, 2, 3, 4, 5, 11 and 12.

The scope of review under this topic was limited to avoid duplication of effort since some aspects of the topic were previously reviewed by the staff or are included under other SEP topics (see III above).

When deviations from the review criteria are identified, engineering judgement is utilized to evaluate the consequences of postulated pipe breaks to assure that the pipe break would not cause the loss of the required functions of "safety-related" systems, structures and components and to assure that the plant can be safely shutdown in the event of such a break.

#### V. EVALUATION

##### A. BACKGROUND

In December 1972, the staff sent letters (Reference 6) to all power reactor licensees requesting an analysis of the effects of postulated failures of high energy lines outside of containment. In response to our letter, the licensee submitted earlier revisions of Special Report No. 6 (SR-6) dated May 1, 1973, July 13, 1973 and July 27, 1973 (Reference 1, 2 and 3). The staff letters of August 7, 1973 (Reference 7) and October 9, 1973 (Reference 8) to CPCo approved the licensee's program including facility modifications and the augmented inservice inspection programs of selected locations for which modifications were impractical. Since that time, a final revision (Reference 4) has been made to the SR-6 report which summarized the work performed between 1973 and 1975. In the licensee's response to IE Bulletin 79-14 (Reference 9), all safety piping outside containment of the Palisades nuclear plant was reanalyzed (as-built) and modifications (mainly to pipe supports) were made from 1979 through 1981. The licensee's SEP reevaluation of pipe break outside containment (Reference 5), therefore, includes the following:

- a. A comparison of the criteria used in SR-6 with current HELB criteria.
- b. The effect of piping reanalysis on postulated break points and an evaluation of break points which differ from SR-6.

B. COMPARISON OF THE CRITERIA USED IN SPECIAL REPORT-6 WITH CURRENT REVIEW CRITERIA

A review of the criteria used in SR-6 versus the currently accepted review criteria described in Section II shows that the criteria used by SR-6 is the same as current criteria except as follows:

1. In SR-6, the licensee has classified high energy fluid systems as those that are maintained under conditions where both the maximum operating temperature and pressure exceed 200°F and 275 psig respectively. Current criteria define a line as a high energy system if either the pressure or the temperature value is exceeded. The licensee's SEP reevaluation identified two systems which were excluded from consideration by the earlier criteria that would now be considered as high energy systems by current criteria. These systems are the 2" reactor coolant letdown piping (normal temperature 120°, pressure 470 psig) and two branches (10" and 8") of the heating steam and condensate piping, which is designed for maximum service conditions of steam at 15 psig and 250°F. The licensee's assessment of the effects of postulated pipe breaks in these two systems concluded that the effects were not significant.

The licensee's assessment of the effects of a break in the letdown piping is provided in reference 11.

Conduits running to some containment isolation valves are located in the vicinity of this line. The valves fail-safe (closed) on loss of power. Failure of any piping located in this area that could be a target for the letdown piping would not impair the plant's ability to shutdown. Therefore, the effects of a letdown line break are not considered to be significant.

With respect to the heating steam system, a discussion of pipe break effects was provided in attachment I of Reference 11. The licensee has concluded that breaks in the heating steam line will not prevent safe shutdown. This was based on a review of the potential consequences of flooding, jet impingement, compartment pressurization and environmental conditions. The effect of heating steam line failure on ventilation equipment was also considered. Based on a review of the information submitted, we have determined that the licensee has provided a valid basis for their conclusion.

2. In SR-6, the licensee did not evaluate the effect of postulated breaks in the auxiliary feedwater system because of low usage of the system. However, SRP 3.6.2 specifically notes that this piping system is a high energy system. As addressed in Reference 5, significant modifications are being made to the system in the licensee's response to NUREG-0737, items II.E.1.1. A high-energy line break (HELB) analysis of this system will be included as part of the design and analysis effort associated with these modifications.

3. In SR-6, the licensee's pipe whip and jet impingement analyses were based on Bechtel Topical Report, BN-TOP-2 Revision 1, dated September 1973. However, it should be noted that the jet expansion model for calculating the impingement forces as described in BN-TOP-2 Revision 1 is only applicable to steam or water-steam blowdown. For water or sub-cooled water blowdown, the current acceptable criteria for jet expansion model is a half angle not exceeding 10 degrees. This difference of jet expansion model may result in a non-conservative calculation of the jet impingement force from water or sub-cooled water blowdown on a nearby target. Further discussion with the licensee, as indicated in Reference 12, found that the model actually used by the licensee in their analysis used a half angle of 10 degrees for sub-cooled water blowdown, which is in conformance with current criteria. Therefore, this item is resolved.
4. Current criteria also require that through-wall leakage cracks be postulated in moderate-energy line piping (<200°F and <275 psig). The effects of failure in non-Category I moderate energy lines (MEL) were reviewed by the staff under Multiplant Issue B-11 in Reference 10.

The effects of moderate-energy Seismic Category I pipe failures are addressed in Reference 11. The service water and component cooling systems were evaluated to determine whether safety-related equipment could be affected by flooding or spray from failures in these lines. The only area where wetting of equipment could affect redundant equipment is in the intake structure. Although the three service water pumps would not be flooded by pipe failure, they have open dripproof enclosures that would not protect them from direct spray. It should be noted that the effect of failures of the circulating water system on service water pumps will be addressed under Topic IX-3, "Station Service and Cooling Water Systems". The need for design changes to protect the service water pumps from spray will be evaluated in the integrated plant safety assessment.

In summary, based on the information submitted in References 4, 5, 11 and 12, we have determined that the criteria used in the licensee's SEP reevaluation are in accordance with currently accepted standards.



C. THE EFFECT OF 1979-1981 PIPING REANALYSIS ON POSTULATED BREAK EVALUATION

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 performed in the 1979-1981 period, some points of highest combined stresses changed from those points considered by SR-6. The high stress point relocations have been reviewed by the licensee on a sample basis and found not to be significant, i.e., the reanalyses do not invalidate SR-6 results. Our comparison of the recalculated stress values as listed in Tables 1, 2 and 3 of Reference 5 with those of SR-6, indicates significant differences in four points of high stress in the feedwater piping system, i.e., node points 35, 40, 56 and 47 (Table 2 of Reference 5). These four node points, which were not considered as break locations by SR-6, would now be considered as postulated break locations. However, it is noted that all of the four locations are in the turbine building, which is of sufficient size to dissipate any energy release without significant pressurization or other adverse environmental effects. In addition, there are no critical structures or components in the proximity of these locations and, consequently, no further analysis is required. In summary, based on the information submitted, we have determined that the effect of piping reanalyses on postulated break evaluations is not significant and the reanalyses do not invalidate SR-6 results.

VI. CONCLUSION

In References 7 and 8, the staff previously approved the information submitted in References 1, 2 and 3. As part of the topic evaluation, we have reviewed References 4, 5, 11 and 12, in which the licensee compares the criteria in the above references with current criteria. In addition, we have reviewed the effects of postulated pipe breaks in two systems, i.e., reactor coolant letdown and heating steam systems which were excluded from high energy system consideration by the licensee's criteria used in SR-6. We have also reviewed the effect of piping reanalyses on postulated break evaluations.

We have concluded that the licensee's criteria for postulating pipe breaks and its method for evaluating postulated breaks in high energy piping outside containment are, in general, in accordance with currently accepted standards.

It should be noted that the licensee has not addressed the effect of postulated breaks in the auxiliary feedwater system in its SEP evaluation. A high energy line break analysis of this system will be included in the licensee's response to NUREG-0737, item II.E.1.1, "Auxiliary Feedwater System Evaluation". The effects of wetting or flooding of service water pumps from failures in piping in the intake structure are being addressed under Topic IX-3. The need for additional protection for the service water pumps from spray effects will be addressed in the integrated assessment.

## REFERENCES

1. Special Report-6, "ANALYSIS OF POSTULATED HIGH ENERGY LINE BREAK OUTSIDE CONTAINMENT", Consumer Power Company, dated May 1, 1973.
2. Revision 1 to Report above, July 13, 1973.
3. Revision 2 to Report above, July 27, 1973.
4. Revision 3 to Report above, June 30, 1975.
5. Report, "PALISADES PLANT SEP TOPIC III-5.B HIGH ENERGY LINE BREAK OUTSIDE CONTAINMENT", Consumer Power Company, dated August 25, 1981.
6. Letter, A. Giambusso (NRC) to CPCo, "GENERAL INFORMATION REQUIRED OF THE EFFECTS OF A PIPING SYSTEM BREAK OUTSIDE CONTAINMENT", dated December 15, 1972.
7. Letter, D. Skovholt (NRC) to R. Youngdahl (CPCo) on Review of CPCo Special Report-6, dated August 7, 1973.
8. Letter, D. Skovholt (NRC) to R. Haueter (CPCo) on Augmented Inservice Inspection Program for High Energy Lines Outside of Containment, dated October 9, 1973.
9. NRC IE Bulletin 79-14, "SEISMIC ANALYSES FOR AS-BUILT SAFETY-RELATED PIPING SYSTEMS", July 2, 1979.
10. Letter, D.M. Crutchfield (NRC) to D.P. Hoffman (CPCo), dated April 30, 1981.
11. Letter, R.A. Vincent (CPCo) to D. Crutchfield (NRC), dated December 30, 1981.
12. Letter, R.A. Vincent (CPCo) to D. Crutchfield (NRC), dated February 9, 1982.