CRITERIA FOR DETERMINING JUSTIFICATION FOR CONTINUED OPERATION OF SAFETY RELATED PIPING WHEN CALCULATED STRESSES EXCEED USAR ALLOWABLES

JANUARY 5, 1989

WISCONSIN PUBLIC SERVICE CORPORATION
KEWAUNEE NUCLEAR POWER PLANT

TABLE OF CONTENTS

SECTION	DESCRIPTION	PAGE
1.0	INTRODUCTION & SCOPE	1
2.0	CRITERIA	1
3.0	CONCLUSION	4
4.0	REFERENCES	5

1.0 INTRODUCTION & SCOPE

These criteria are intended to assure the operability requirements of safety related piping and associated supports if it is determined that stresses exceed allowables presented in the Kewaunee Nuclear Power Plant (KNPP) USAR. These criteria permit operation for an interim period only. Modifications will be made which return the system to within USAR allowables by the end of next refueling outage or sooner if modification permits during operation of the plant.

These criteria are intended to expeditiously perform necessary evaluations to determine interim operability and not to delay appropriate actions.

For cases involving safety related components where USAR allowables are exceeded, WPSC shall be notified upon discovery and WPSC shall evaluate reportability requirements per 10CFR50.

2.0 CRITERIA

2.1. Piping Operability Criteria

The piping analysis shall be in accordance with ANSI B31.1.0 - 1967, and the stress limits are in accordance with ASME, Section III NC-3600 service level D limits (Ref. 1). The design loading conditions to be applied in the analysis shall include the DBE earthquake.

Following is the pipe stress criteria for justifying continued operation of the plant:

$S_{LP} + S_{WT} + S_{DBE} \leq 2.0$ Sy (Reference 5, Appendix B)

Where: S_{LP} = Longitudinal Pressure Stress

S_{WT} = Longitudinal Dead Weight Stress

S_{DBE} = Longitudinal Stresses Resulting From Design Basis Earthquake

S_Y = Material Yield Stress (B31.1.0 - 1967)

Code Case N-411 allows for increased damping values, independent of pipe diameter, for seismic analysis. Therefore, increased damping values, in accordance with Reference 2, will be acceptable when performing these analyses to meet operability. Should the piping stress analysis exceed the value of 2.0 SY, or pipe supports do not meet their operable limits (see Section 2.2), then additional analysis of the piping may be required. The iterative analysis may use the knowledge that a support is not capable of withstanding the loads, and can be removed from the analysis. Where feasible, the actual support stiffness may be included in the iterative analysis, along with other refinements.

For cases where piping secondary stresses are determined to exceed twice USAR allowables (or 2.0 SY, whichever is less), a specific case-by-case approach will be used to determine interim operability.

2.2 Pipe Support And Hanger Operability Criteria

As a first step in evaluating the support, a linear elastic analysis method will be used to determine the stress in the support members. In addition to the loading in Section 2.1, the support loads must

include loads due to thermal expansion and displacement of anchors. Supports will be analyzed using the allowables listed below to meet operability requirements.

Structural Steel

Tension	F_t = 1.20 Sy but $\leq$ 0.70 Su
Bending	F_b = 1.20 Sy but $\leq$ 0.70 Su
Shear	F_v = 0.72 Sy but $\leq$ 0.42 Su
Compression	$F_a < F_t$ but not to exceed 2/3 Pcr
Combined Stress	For axial compression and bending or axial tension and bending, use Reference 6.
Web Crippling	= 1.0 Sy
Weld Stress	F_w = 0.42 Su (of weld material)
Anchor Bolts	Use Factor of Safety of 2 against ultimate tension and shear values.
Hydraulic Snubbers	Load < manufacturers one time load capacity. Movement < total travel
Springs	Load within catalog range without bottoming or topping out unless otherwise justified.
Struts	FS = 2 and < 2/3 Pcr
All Remaining Catalog Items	Use manufacturers published faulted load rating. Where level D allowables are not given, and the factor of safety is specified in the catalog, use design allowables but with FS = 2. (Typical catalog FS = 5; therefore, use 2.5 x catalog capacity).

Where: F_t = Allowable Tensile Stress

F_b = Allowable Bending Stress

F_v = Allowable Shear Stress

F_a = Allowable Axial Compressive Stress

F_w = Allowable Weld Stress

Pcr = Maximum Strength of Axially Loaded Compression Member

Sy = Specified Minimum Yield Strength at Temperature (See Note 1)

Su = Specified Minimum Tensile Strength at Temperature

FS = Factor of Safety

NOTE 1: Actual yield strength may be used where CMTR's are available for the material.

If a support fails using the linear elastic method, then a more refined analysis may be performed using plastic analysis techniques. The plastic analysis will follow the design rules of ASME Section III, Appendix F (Ref. 1).

If the factor of safety of two is not met for catalog components, then a detailed analysis may be performed to show that the component meets the operability stress limit criteria.

3.0 CONCLUSION

If the above criteria cannot be met, reportability per 10 CFR 50 must be evaluated and system operability requirements per Plant Technical Specifications must be evaluated and appropriate actions taken.

4.0 REFERENCES

1. American Society of Mechanical Engineers, Boiler and Pressure Vessel Codes, Section III, 1983 Edition, through Winter 1985 Addenda.

2. American Society of Mechanical Engineers, Boiler and Pressure Vessel Codes, Case N-411, Dated 9/17/84.

3. NRC-IE Bulletin 79 02, "Pipe Support Base Plate Designs Using Concrete Expansion Anchor Bolts," Revision No. 2, dated 11-8-1979.

4. USAS B31.1.0 - 1967, Power Piping Code.

5. Updated Safety Evaluation Report for Kewaunee Nuclear Power Plant.

6. Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, AICE, Sixth Edition, 1963 printing.