U- 0700
0210
B50-84(03-12)-L

ILLINOIS POWER COMPANY

CLINTON POWER STATION, P.O. BOX 678, CLINTON, ILLINOIS 61727

March 12, 1984

Docket No. 50-461

Director of Nuclear Reactor Regulation
Attention: Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: Clinton Power Station Unit 1
HVAC DUCTWORK

Illinois Power Company responses to the NRC Mechanical Engineering Branch Questions #210.05 and #210.06 are attached for review. The questions were generated as a result of Mr. D. Terao's visits on December 8 & 9, 1983, to the Sargent & Lundy offices in Chicago and the Clinton Power Station site. The design and installation of the HVAC ductwork and supporting members were examined during those visits.

Illinois Power Company plans to incorporate its responses into the FSAR at the next available opportunity.

Sincerely yours,

Daniel I. Herborn
Director - Nuclear Licensing
and Configuration
Nuclear Station Engineering

Attachments

RWW/lam

cc: G. A. Harrison, NRC Clinton Licensing Project Manager
D. Terao, NRC MEB
NRC Resident Office
Illinois Department of Nuclear Safety

A001
1/1

QUESTION 210.05

In our review of your HVAC design criteria, "Design Criteria for Design Verification of Structures and Components in Category I Buildings," (DC-ME-16-CP) Revision 0 dated 10/24/80, the staff noted that the HVAC ductwork allowable stress for the faulted condition was given as 1.5 Sy (membrane + bending). The staff's position is that the HVAC ductwork stress shall not exceed 0.9 Sy for the faulted condition. Furthermore, your FSAR does not provide the design limits used for seismic Category I HVAC components.

Provide in your FSAR the design stress limits used for the HVAC components. In addition, provide the basis for allowing HVAC ductwork stresses to reach a 1.5 Sy limit (unless it can be demonstrated that the staff acceptance criteria has been met).

RESPONSE 210.05

We plan to meet the intent of your position on the HVAC ductwork stress for the faulted condition in accordance with the agreement on an Sy factor of 0.95 reached during the NRC audit meeting held at Sargent & Lundy offices on 12/8/83.

These stress limits for ductwork and duct supports will be included in a new FSAR paragraph 3.9.3.5 and Table 3.9-14. The ductwork and duct support stress limits for the faulted condition to be provided in Table 3.9-14 is 0.95 Sy. S&L's "Design Criteria for Design Verification of Structures and Components in Category I Buildings" will be revised to specify 0.95 Sy instead of 1.5 Sy as the allowable stress limit for the faulted condition.

The requested stress limits for HVAC components are in FSAR Table A3.9-5, titled "Load Combinations and Allowable Stress Limits for BOP Equipment." The existing Table A3.9-5 served as a design reference, but the new Table 3.9-14 shows the actual design basis for HVAC ductwork and supports.

(See new subsection 3.9.3.5 and new Table 3.9-14)

Table 3.9-14
Stress Limits for Ductwork and Duct Supports

Load Combination	Stress Limits		Plant Condition
	Duct Supports (Hangers)	Ductwork	
1. Normal (N) (Weight + Pressure + Thermal)	AISC Allowable Values	$\sigma_m = 0.6\ S_y$	Normal
2. Load Cases 2 & 3 from Table A3.9-6	33% Increase in AISC Allowable Values	$\sigma_m = 0.6\ S_y$ $\sigma_t = 0.95\ S_y$	Upset
3. Load Cases 4 through 15 from Table A3.9-6	$0.95\ S_y$	$\sigma_m = 0.95\ S_y$ $\sigma_t = 0.95 S_y$	Faulted

σ_m - Membrane Stress

σ_t - (Membrane + Bending) Stress

S_y - Yield Stress at Corresponding Temperature

2% - Damping values for OBE and pool dynamic loads

4% - Damping values for SSE and pool dynamic loads

3.9.3.5 HVAC Ductwork and Duct Support Structures

HVAC ductwork and duct supports are designed using a frequency controlled design approach. By using a frequency controlled design, the ductwork and duct supports are effectively decoupled and each component is designed in the rigid frequency range of the appropriate floor response spectra. The qualification is done independently for the ductwork and the duct supports.

For the ductwork support evaluation it is assumed that all HVAC ductwork and accessory tributory weights are transferred to the supporting structure. The stresses in the ductwork support structures are limited to the AISC Specifications, Part I, for the loading combinations specified in Tables A3.9-6 and A3.9-7 and the Stress Limits shown in Table 3.9-14

The evaluation of the HVAC ductwork stresses is done for both local and gross effects. The design rules of AISI (Cold-Formed Steel Design Manual - Part 1) are used with the stresses limited to those shown in Table 3.9-14 for the loading combinations specified in Tables A3.9-6 and A3.9-7.

QUESTION 210.06

In reviewing your HVAC ductwork design, the staff noted that, in several cases, a single support at the top of long vertical duct risers was provided for weight and seismic loadings. In reviewing your HVAC ductwork design calculation, it was not evident that the localized buckling of the duct sheet metal near the HVAC support members was considered in the design. Provide the basis for assuring that the HVAC duct sheet metal is capable of withstanding the localized buckling stresses induced in the ductwork by the HVAC supports for weight and seismic loadings.

RESPONSE 210.06

During the NRC site inspection, two vertical duct risers were discovered to contain buckled portions near the top-most supports.

A subsequent investigation revealed that an inadequate duct gauge thickness combined with a non-optimum installation sequence caused the buckled conditions.

The two long vertical duct risers were constructed of 22 gauge material instead of 18 gauge as designed. They were constructed from the top end downward.

Sargent & Lundy evaluated the stress in the two ducts and found that buckling of the 22 gauge material was expected. However, the analysis disclosed that the buckled 22 gauge ductwork would not have failed under design dynamic loads. The calculations also showed that buckling of the specified 18 gauge material under similar construction methods would not occur.

In its review of the design calculations for the two HVAC risers, Sargent & Lundy verified that the ductwork can withstand all normal and seismic forces, including the normal weight loads experienced during the construction of long vertical duct risers.

A program has been initiated to replace the buckled 22 gauge portions of the two ducts with 18 gauge material. Also, all vertical risers are being reviewed for proper material gauge.