ATTACHMENT A

COM-02-673
Revision 0
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Dresden Nuclear Power Station Units 2 & 3
Mark I Plant Unique Analysis Report
Response to NRC Questions

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Question 1

Provide a summary of the analysis with regard to the vacuum breaker piping systems and the vacuum breaker valves; indicate whether they are considered Class 2 components as required by the criteria (1).

Response to Question 1

There are three types of vacuum breaker systems utilized in Dresden Units 2 and 3:

a) The containment-to-atmosphere vacuum breakers are connected to torus attached piping, which is evaluated as Class 2 piping. The results of this evaluation are contained in Volumes 6 and 7 of the PUAR for Dresden Units 2 and 3, respectively.

b) The wetwell-to-drywell vacuum breaker system is classified as an ASME Class 2 system. The vacuum breaker valves are located in a header pipe connecting the suppression chamber to the vent line. A transient analysis of the vacuum breaker header was performed using a beam finite element model. The acceleration time histories from the suppression chamber analysis were input into the model at the header support locations on the suppression chamber to determine the state of stress in the header from these suppression chamber motions. These stresses were combined with the stresses from static loads to calculate the total stress in the header. The loads for analyzing the header supports were also extracted from the computer analysis. A second finite element model was constructed of plate elements to represent the header support pad plates and suppression chamber shell. Loads from the header supports were input into this model to determine the stress in the pad plates and in the suppression chamber shell at the pad plate attachment location.

   An assessment of the wetwell-to-drywell vacuum breakers was performed in 1981 and showed that the as-built 18" externally mounted A&M vacuum breaker valves meet the ASME Code criteria. An overview of the analysis methodology was submitted to the NRC (CECo letter to H. R. Denton from B. Rybak, "Dresden/Quad Cities, Modification of Vacuum Breakers on Mark I Containment, Generic Letter 83-08", dated July 12, 1983).

c) The SRV discharge line vacuum breakers were evaluated for Mark I loads and found to require modification to meet current requirements. Therefore, all SRV discharge line vacuum breaker valves in Dresden Units 2 and 3 were replaced with valves analyzed and fabricated in accordance

with the ASME Code, Section III, Subsection NC, 1977 Edition (including the Summer 1977 addenda). Results of these analyses show that all stresses are within the allowables and the fatigue usage factors for all components are less than 1.0. The SRV discharge lines are classified and analyzed as ASME Class 2 piping. The analysis results are contained in Volume 5 of the Dresden PUAR.

Question 2

Provide a list indicating whether all the piping systems and their supports have been classified as essential or non-essential piping systems.

Response to Question 2

All the large bore and small bore piping systems and their supports addressed in Volumes 6 and 7 of the Dresden Units 2 & 3 PUAR have been conservatively classified as essential.

Question 3

Provide and justify the reasons for not considering a 180° beam model of the torus including columns, saddles and seismic restraints in order to determine the effects of nonsymmetric loads such as SRV and chugging for Dresden Units 2 and 3.

Response to Question 3

As described in PUAR Section 2-2.3.2, the Dresden torus analysis for lateral loads was performed using a 360° beam model which includes the torus, supports and seismic sway rods. This approach results in calculated stresses which envelop those which would be obtained from a 180° beam model. As discussed in PUAR Section 2-2.4.2, an upper bound load was developed for each of the applied lateral loads. These upper bound loads are then applied in the direction producing maximum stress and the results added on an absolute basis regardless of time.

Question 5

Provide calculations demonstrating conformance to the 10% rule of Section 6-3.1 (1) for piping systems in Dresden Units 2 and 3 that were exempted from analysis because of the 10% rule.

Response to Question 5

The following provides a summary description of the methodology for application of the 10% rule as discussed in Section 6-3.1 of Volume 6 of the Dresden 2 PUAR. This description also applies to Section 7-3.1 of Volume 7 of the Dresden 3 PUAR.

1) At the small bore piping attachment point, the stresses in the large bore piping due to combined Mark I loads were calculated.

2) The large bore piping stress combinations for Levels B, C & D were compared against 10% of the respective allowables. Stress Intensification Factor values were also included where applicable.

3) Any small bore piping connected to large bore piping that met the 10% rule at the attachment point were then exempted from further Mark I evaluation.

The stresses in torus attached large bore piping due to Mark I hydrodynamic loaos decrease as the distance from the torus increases. The following table tabulates for Dresden Unit 2 the approximate linear distance along the large bore lines from the torus penetration to the region where these combined stresses have attenuated to 10% of the allowable value for the governing load combination. The tabulation for Dresden Unit 3 would be similar.

DRESDEN UNIT 2

ATTENUATION DISTANCE FOR APPLICATION OF 10% RULE

SYSTEM	PENETRATION NUMBER	DESIGNATION OF LINE ATTACHED TO PENETRATION	ATTENUATION DISTANCE (1) (FT)
ECCS Suction Header	X-303A,B,C,D	2-1501-24"-	N/A
Vacuum Relief	X-304	2-1601-20"-LX	7
LPCI Test Line and Spray Header Discharge from Pumps 2A/2B	X-310A	2-1517-16"-LX	54
	X-311A	2-1516-8"-LX	18
SPCI Test Line and Spray Header Discharge from Pumps 2C/2D	X-310B	2-1522-16-LX	42
	X-311B	2-1521-8"-LX	26
HPCI Turbine Exhaust	X-317	2-2306-16"-LX	10.6
Pressure Suppression	X-318	2-1603-18"-LX	At Penetration
Core Spray 2A Discharge	Connecting to LPCI Test Line with Penetration X-310A	2-1406-8"-LX	42.6
Core Spray 2B Discharge	Connecting to LPCI Test Line with Penetration X-310B	2-1409-8"-LX	58
LPCI Pump 2A/2B Suction	Connecting to ECCS Suction Header	2-1502-24"-LX	Note (2)
LPCI Pump 2C/2D Suction	Connecting to ECCS Suction Header	2-1507-24"-LX	Note (2)

NOTE: (1) Attenuation distance is defined as the approximate linear distance from the torus penetration along the large bore line to that point where the combined stress for the limiting load combination is 10% of the allowable value.

(2) Included in Mark I ECCS Suction Header Model.

DRESDEN UNIT 2

ATTENUATION DISTANCE FOR APPLICATION OF 10% RULE
(Concluded)

SYSTEM	PENETRATION NUMBER	DESIGNATION OF LINE ATTACHED TO PENETRATION	ATTENUATION DISTANCE (FT)
Core Spray 2A Suction	Connecting to ECCS Suction Header	2-1401-16"-LX	Note (2)
Core Spray 2B Suction	" " " "	2-1402-16"-LX	Note (2)
HPCI Pump Suction	" " " "	2-2302-16"-LX	Note (2)

Question 6

Table 2-2.5-3 of Reference 2 indicates that the calculated values of certain stresses are close to the respective allowables. Indicate conservatisms in the analysis to show that these calculated values would not be exceeded if a different analytical approach were to be used.

Response to Question 6

The Code allowable limits are established to provide conservative maximum stress levels to ensure that there are adequate factors of safety to account for variations in loadings, methods of analysis, construction and materials. An examination of the results tabulated in Table 2-2.5-3 shows that there is only a small percentage of the reported stresses which approach Code allowable limits. These values were calculated using a conservative application of Mark I loads and represent peak stress resultants which typically occur over very small areas of the actual structure. PUAR Section 1-1.4 provides a qualitative description of the analytical conservatisms in terms of event sequences and underlying assumptions, describes how loads are conservatively defined based on test results, and discusses the use of conservative load combinations where peak responses are assumed to occur concurrently. The loads, methods and results described in the PUAR demonstrate that the margins of safety which existed for the original design loads have been restored and in many cases increased.

REFERENCES

(1) General Electric Report NEDO-24583-1, "Mark I Containment Program Structural Acceptance Criteria Plant Unique Analysis Application Guide", October 1979

(2) Commonwealth Edison Company," Dresden Nuclear Power Station Units 2 and 3, Plant Unique Analysis Report Volumes 1, 2, 3, 4, 5, 6, and 7 - Revision 0", May 1983

March 20, 1984

ATTACHMENT B

RESPONSES TO NRC REQUEST FOR ADDITIONAL INFORMATION
MARK I CONTAINMENT LONG TERM PROGRAM - PLANT UNIQUE
ANALYSIS REPORT
DRESDEN STATION - UNITS 2 & 3

NRC REQUEST - ITEM 2:

Provide a list indicating whether all the piping systems and their supports have been classified as essential or non-essential piping systems.

S&L RESPONSE:

"Under the Mark I Program, the S&L scope of work is limited to the Main Steam Safety Relief Valve Discharge (SRV) lines, only.

The SRV lines have been classified as essential piping in accordance with the Structural Acceptance Criteria. This classification affects the piping service level limit stress allowables for several load combinations.

Furthermore, the SRV lines in the wetwell were treated as ASME Class 3 piping for the purpose of piping stress calculations in accordance with the code requirements".

NRC REQUEST - ITEM 4:

With respect to Sections 5-3.3 and 5-4.3 of the PUA report (2), show that SRVDL support stresses due to extreme environmental and emergency conditions do not exceed the Service Level C and D Limits specified in the ASME B&PV Code, Section III, Division I, Subsection NF for Class 2 or 3 linear supports.

S&L RESPONSE:

Section III, Division I, Subsection NF, of the ASME B&PV Code is not required for acceptance of the SRVDL supports inside the vent line and the wetwell according to the Mark I Program Structural Acceptance Criteria. However, per NRC request a comparison of the allowable stresses between the AISC Specification and the ASME B&PV Code, Subsection NF has been provided for these supports. The attached tables with the comparisons of the allowable stresses show that the AISC Specification is more conservative than the ASME B&PV Code as was stated in Sections 5-3.3 and 5-4.3 of the Dresden PUAR.

SUPPLEMENT TO TABLE 5-3.5 OF DNPS-MARK I PUAR

MAXIMUM STRESS INTERACTIONS BASED UPON CODE ALLOWABLE STRESSES FOR CRITICAL SUPPORT COMPONENTS

ITEM	MATERIAL	GOVERNING SERVICE LEVEL	MAXIMUM STRESS PER AISC*	MAXIMUM STRESS PER ASME SUBSECTION NF*
SRV Guides in Vent:				
Guide Plate	ASTM A36	D	0.73	0.57
Auxiliary Beam	ASTM A36	B	0.46	0.27
Auxiliary Beam Connection	ASTM A36	D	0.30	0.15

*These values are the result of an interaction equation and must be ≤ 1.00 for acceptance.

SUPPLEMENT TO TABLE 5-4.1 OF DNPS-MARK I PUAR

MAXIMUM AND CODE ALLOWABLE STRESSES FOR CRITICAL SUPPORT COMPONENTS

ITEM	MATERIAL	MAXIMUM STRESS (ksi)	AISC ALLOWABLE STRESS (ksi)	ASME SUBSECTION NF ALLOWABLE STRESS (ksi)	GOVERNING SERVICE LEVEL
T-Quencher Support					
Beam End Connection Bolts	ASTM A325	7.1	16.9	N.A.*	B
Beam End Header Support Plate	ASTM SA516 GR. 70	14.9	22.8	38.3	B
Support Plate Guides	ASTM SA516 GR. 70	23.3	28.5	47.9	B
Support Plate Bolts	ASTM A564; F_u = 190 ksi	39.5	62.7	N.A.*	B
Support Plate Welds (Full Penetration)	ASTM SA516 GR. 70	13.4	22.8	38.3	B
Intermediate Support					
Beam End Connection Bolts	ASTM A325	5.8	15.8	N.A.*	B
Beam End Connection Plates	ASTM SA516 GR. 70	9.2	19.4	32.5	B
Collar Bolts	ASTM A325	3.0	25.8	N.A.*	D
T-Quencher Ramshead Lug Retainer	ASTM SA516 GR. 70	20.9	22.8	38.3	B

*The governing stress values shown for these Friction-Type bolted connections were due to shear load.

By ASME Code Subsection NF-3324.6, Friction Type Joints are not subjected to shear provided the joint does not slip into bearing. These connections meet the ASME requirements for maximum allowable slip resistance and therefore do not slip into bearing.

MAXIMUM STRESS INTERACTIONS BASED UPON CODE ALLOWABLE STRESSES FOR CRITICAL SUPPORT COMPONENTS

ITEM	MATERIAL	MAXIMUM STRESS PER AISC*	MAXIMUM STRESS PER ASME SUBSECTION NF*	GOVERNING SERVICE LEVEL
T-Quencher Support Beam	ASTM A53	0.85	0.68	D
Intermediate Support Beam	ASTM A53	0.74	0.59	D
Collar Support Strut	ASTM A53 GR. B	0.80	0.75	D

*These values are the results of an interaction equation and must be ≤ 1.00 for acceptance.