

2002

1400

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The feasibility study of OBE elimination in Main Feed water piping stress analysis for APR 1400

1400 (SSE, 0.3g) 1/3 ASME Class 1&2 (OBE, 0.1g) ()

1400 (ASME Class 2 piping) OBE

B 1/3 Service Level D 가 Service Level OBE

6.7% 가 OBE

4.8% OBE

1.

1973 12 (OBE)

1973 12 (OBE) (SSE) 1/2

(EPRI)

(US

NRC) 1/3 가 1/3

1/3 System 80+ USNRC

OBE 가 1/2 SSE
 OBE OBE SSE
 1/3 OBE
 (KINS) OBE 가
 1400 가 OBE
 Class 2 가 ASME Safety
 OBE
 OBE
 2.
 가.

1400

1400

1

Economizer

1

24 Seamless Ferritic Alloy-Steel Pipe SA 335
 460° F 1100 psi

1.

1400

NODE POINTS		LINE NUMBER	PIPE O.D. (in)	SCH. NO.	WALL THICK. (in)	PDI NO.	MATERIAL		DESIGN		MAX. OPER.	
From	To						SPEC. NO.	TYPE/GR	PRESS (psi)	TEMP (°F)	PRESS (psi)	TEMP (°F)
5	50	EW006EA-24"	24.0	120	1.812	926-B	SA335	Gr. P22	1250	570	1100	460
50	55	EW006GA-24"	24.0	120	1.812	926-B	SA335	Gr. P22	1250	570	1100	460
215	370	EW045AA-14"	14.0	80	0.75	926-B	SA335	Gr. P22	1250	570	1100	460
55	210	EW045AC-14"	14.0	80	0.75	926-B	SA335	Gr. P22	1250	570	1100	460

NODE POINTS		LINE NUMBER	INSULATION		WEIGHT (LBS/FT)					
From	To		TYPE	THICK (in)	PIPE (1)	FLUID (2)	INSUL (3)	TOTAL (1+2+3)	WATER (4)	HYDRO (1+4)
5	50	EW006EA-24"	F	2.5	429.39	141.37	23.97	594.73		
50	55	EW006GA-24"	F	2.5	429.39	141.37	23.97	594.73		
215	370	EW045AA-14"	F	2.5	106.13	53.20	15.04	174.38		
55	210	EW045AC-14"	F	2.5	106.13	53.20	15.04	174.38		

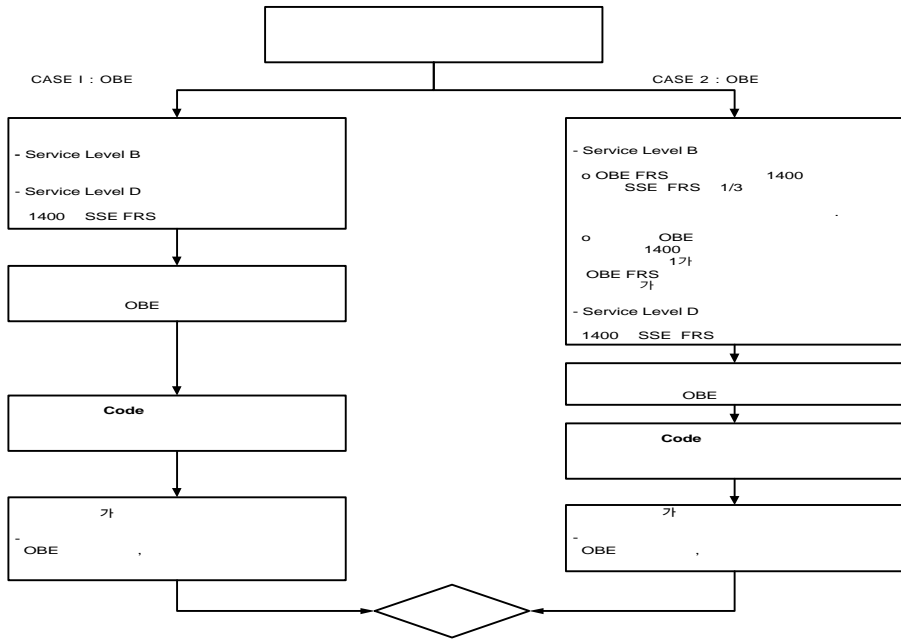
1)

Service Level B OBE
 , OBE
 OBE
 FRS(Floor Response Spectrum)가 1400 OBE
 FRS 가 SSE OBE
 OBE FRS FRS
 ASME Code
 , 가 (Licensing Requirement) 가

2)

PIPSIS . PIPSIS 3
 . PIPSIS
 ASME NB/NC/ND
 B31.1 Code 가, 가,
 가 가

3)



1)

Service Level B OBE
 OBE
 FRS(Floor Response Spectrum) 1400 SSE FRS
 OBE FRS 2
 FRS
 SSE OBE 1400
 SSE FRS 1/3 OBE FRS
 (Wall Slab OBE 3Hz) 30% 가
 Base Rock Base Soil
 Soil Case , 8 가
 Case FRS
 OBE FRS

2)

0

가 (Live weight)
 (Dead weight)
 가
 가
 0 (SD)가
 0 (OBE, SSE) 가
 가
 가
 Code

0 (SAM)

D)가

Branch

3

(S

가

가

. SAM

0

(Pump Trip)

가

0

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Plant Condition		Service Level								비고
		OBE하중 배제 경우				OBE하중 포함 경우				
Load		A	B	C	D	A	B	C	D	
Pressure		○	○		○	○	○		○	
Weight		○	○		○	○	○		○	
Thermal		○	○		○	○	○		○	
Seismic	OBE						○			
	SSE				○				○	
FW Pump Trip			○		○		○		○	
Postulated Line Break in FW System					○				○	
RCS Branch Line Pipe Break					○				○	

3)

Code
(SAR)

가

1400

2.

ASME Code Eq. No.	Load Combination		비고
	OBE하중 배제 경우	OBE하중 포함 경우	
8	DPRS+WGHT	DPRS+WGHT	
9b	PPRS+WGHT+FPTR	PPRS+WGHT+[FPTR ² +OBE ²] ^{1/2}	
9d	PPRS+WGHT+[FPTR ² +SSE ² +FWLB ² +BLPB ²] ^{1/2}	PPRS+WGHT+[FPTR ² +SSE ² +FWLB ² +BLPB ²] ^{1/2}	
10	THER	TRER+SAM(OBE)	
10b	THER+SAM(SSE)	-	
11	DPRS+WGHT+THER	DPRS+WGHT+THER+SAM(OBE)	

DPRS: Design Pressure, PPRS: Peak Pressure, OBE: Operating Basis Earthquake, SSE: Safe Shutdown Earthquake, WGHT: Weight, SAM: Seismic Anchor Motion, FPTR: Feed Water Pump Trip, BLPB: RCS Branch Line Pipe Break Motion

1) (Code)

(Node)

ASME Code

3.

3. ()

Code Eq.	Node	Code Allowable	OBE 하중 배제 경우		OBE 하중 포함 경우	
			Pipe Stress	% of Allow	Pipe Stress	% of Allow
8	215	22500	13300	59.1	13300	59.1
9b	215	27000	15800	58.5	17600	65.2
9d	215	45000	38300	85.1	38300	85.1
10	355	22500	24100	107.1 ^(주)	25300	112.4 ^(주)
10b	365	45000	39400	65.7	-	-
11	365	37500	30000	80.0 ^(주)	30900	82.4 ^(주)

주) A와 B급 운전한계를 지정한 운전하중은 Eq.10 또는 Eq.11 요건을 만족해야 한다. (NC-3653.2)

3

Code

Level D가 Level B

Eq.9b

OBE

6.7%, Eq.11

SAM

2.4%

2) 가 (가)

“가

” 가

Subsystem Code 9B 10

Node Point

가

4

4. 가

					% of Allow	Node Point
	Eq.9B	Eq. 10	Eq.9b+Eq.10			
OBE	15,800	19,700	35,500	39,600	89.6	215
OBE	17,600	19,800	37,400		94.4	

4. subsystem

가
(Node 215)
4.8%

가

3.

1400 OBE

Service Level D 가 Service Level B

(Node 215)

OBE

6.7%

Service Level D

Service Level B

Service Level D

가

, [Eq.9B+Eq.10]

OBE

가

4.8%

Service Level B

OBE

(

) Service Level B

Service Level D

OBE 가 SSE 1/3

1

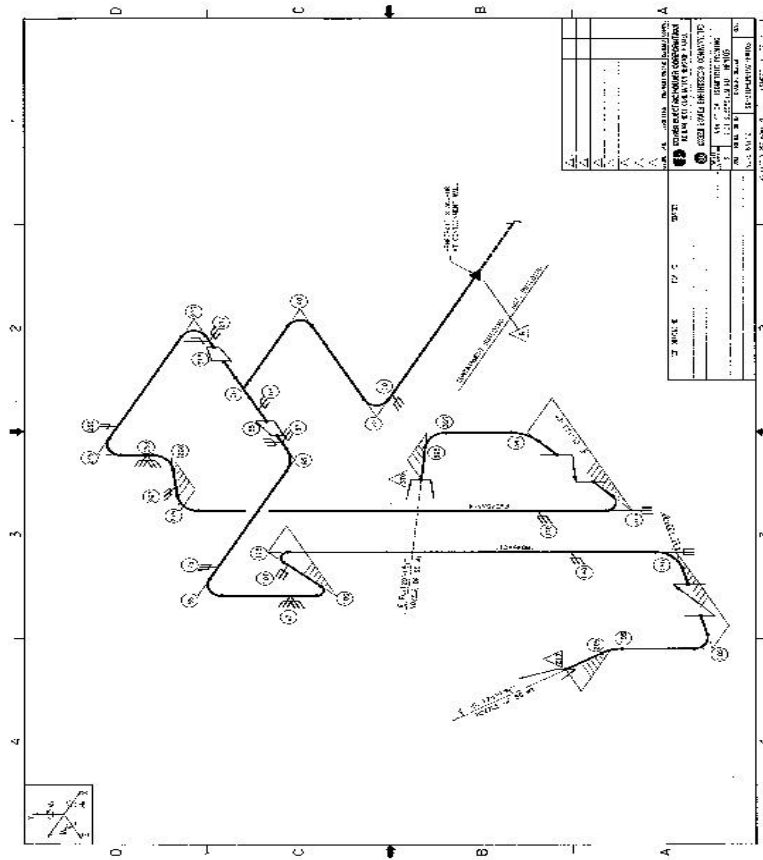
SSE 가

OBE

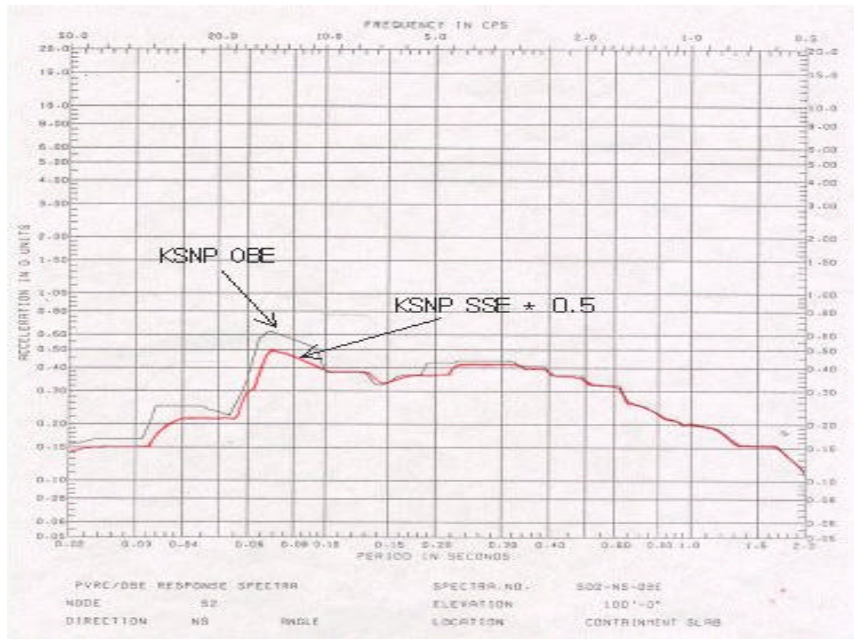
- 1) PIPSYS Program, Sargent & Lundy Prog. No. PIP037026230, Version 3.0
- 2) ASME Boiler and Pressure Vessel Code, Section , 1992 Edition with 1992 and 1993 Addenda.
- 3) Federal Register, Vol. 64, No. 183, 10CFR50.55a "Final Rule", Sep. 22, 1999
- 4) KNGR General Piping System Design Specification N-001-END407-001 Rev.0 dated 04/30/98
- 5) KNGR FW Piping System Design Specification N-541-END407-001, Rev.A
- 6) KNGR Piping Design Table and Standard Details, N-001-END443-001, Rev.0
- 7) KNGR 3D Piping Drawings N-313-END193-103FW
- 8) NRC Policy Issue, SECY-93-087, April 2, 1993

- 9) "Postulated Rupture Locations in Fluid System Piping Inside and Outside Containment" MEB 3-1 of SRP 3.6.2, Rev. 1 dated July 1981
- 10) "Postulated Rupture Locations in Fluid System Piping Inside and Outside Containment" MEB 3-1 of SRP 3.6.2, Rev. 2 dated June 1987
- 11) NUREG-1061, Evaluation of Seismic Designs, April 1985
- 12) NUREG-1367, Functional Capability of Piping System: Nov.1992
- 13) NUREG-1462, Vol. 1, FSER Related to the Certification of the System 80+ Design, Docket No. 52-001, August 1994
- 14) (2001.12)

가



1.



2. KSNP OBE - 1/2*SSE