

NUCLEAR ENGINEERING DEPARTMENT

Calculation Cover Sheet
Cook Nuclear Plant

NEMD/NESD SECTION

SHEET 1 OF 7

CALCULATION No.	<u>DC-D-01-MSC-66</u>	INDIANA MICHIGAN POWER COMPANY
SAFETY RELATED	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	UNIT No. <u>1</u>
SYSTEM	<u>MAIN STEAM</u>	CALCULATED BY: <u>AMITYA K. DEY</u> <i>AKD</i> <u>4-297</u>
TITLE	<u>HOOP STRESSES IN THE SWEEP BEND</u>	DATE
RFC/MM/PM/PR/CR/TM No.	<u> </u>	VERIFIED BY: <u>J. H. Cummings</u> <u>4-297</u>
FILE LOCATION	<u> </u>	DATE
		APPROVED BY: <u>P. Mangun</u> <u>4/3/97</u>
		DATE

CALCULATION DESCRIPTION: UT MEASUREMENTS TAKEN ON THE 30" SWEEP BEND
(12'-6" Radius) AS PART OF THE FLOW ACCELERATED CORROSION (FAC)
PROGRAM INDICATED WALL THICKNESS ON EXTRADOS OF THE BEND DID NOT
MEET MINIMUM WALL THICKNESS REQUIREMENTS OF ANSI B31.1. THIS
CALCULATION IS PERFORMED TO VERIFY STRUCTURAL INTEGRITY OF THE
BEND AND TO CONFIRM FUNCTIONAL CAPABILITY OF THIS COMPONENT.

METHOD OF VERIFICATION: ALTERNATE CALCULATION _____ DESIGN REVIEW ☒

[illegible]

STRUCTURAL & ANALYTICAL DESIGN
AMERICAN ELECTRIC POWER SERVICE CORP.
† RIVERSIDE PLAZA
COLUMBUS, OHIO

SHEET _____ OF _____
DATE 4-2-97 BY AND CK JHC
COMPANY 1 Po. Co. _____
PLANT D.C. COOK NUCLEAR PLANT
RFC DC - _____ 1 _____ MM/PM _____

Calculation No. DC-D-01-MSC-66

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7.0	TYPE OF ANALYSIS. (Hand Calculation)	5 thru 7
8.0	SUMMARY OF MAXIMUM STRESSES	N/A
9.0	VALVE INFORMATION	
10.0	SEISMIC ACCELERATION OF VALVES.	
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ATTACHMENT	SEE SECTION 5.0	

MECHANICAL DESIGN SECTION
AMERICAN ELECTRIC POWER

SHEET 34 OF 7
CALC. BY A. K. Dey DATE 4.2.97
CHK. BY AK DATE 4-2-97
PLANT COOK NUCLEAR UNIT NO. 1

CALCULATION NO. DC-D-01-MS-C-66

PURPOSE

The purpose of this calculation is to verify adequacy of the Main Steam (MS) piping system and, specifically, the component 1-MS-1-M-9E (Attachment 1, Sheet 1 of 11), a 12'-6" R pipe bend which has been found to have lower-than-minimum wall thickness at certain sections of the bend.

1.0 DESCRIPTION

During this outage (U1R97), the sweep bend 1-MS-1-M-9E was inspected for flow accelerated corrosion (FAC). The sweep bend is welded to a vertical 30", 90° elbow at one end and to a 30" straight piece of approximately 2' 1-5/16" length at the other end.

During the 1995 inspection, UT was performed on the vertical elbow and at two extension locations. These extensions were 1" and 4" respectively from the weld at the elbow and the sweep bend interface (see Attachment 1, Sheet 4 of 11).

The UT data on the elbow was acceptable, however, one node (2I) on the second extension line was found to have wall thickness of 0.893" which was less than the minimum wall thickness t_{min} of 0.907" computed with the specified system design pressure P_d of 1085 PSIG. The grid pattern for this measurement was 4" x 4". In order to obtain additional information in this area, 1" x 1" grid pattern was developed and a new set of UT measurements were recorded for an area of 21" (circumferential) x 32" (axial). Some of these grid points, mostly within columns J through S were found to have wall thickness less than t_{min} of 0.907". The piping system analysis was reviewed with these lower values, and the piping system shown in Isometric 1-MS-1 was found to meet ANSI B31.1 requirements for the longitudinal stresses. Hoop stress check was not made and an acceptance memo was issued by Nuclear Engineering (Ref. 3).

The same 21" x 32" grid area was UT'd during this outage. The measured thicknesses show almost an identical pattern as that of 1995. A comparison of the 1995 and 1997 data confirm that there is no FAC problem in this system. An engineering review is performed in this calculation to determine the effects of lower than t_{min} wall thickness on this MS piping system.

2.0 ASSUMPTIONS

There are no assumptions made which require further verifications.

3.0 COMPUTER I.D.

Hand calculations have been performed herein. Computer data from calculation #DC-D-01-MS-C-65 have been used as supporting information.

MECHANICAL DESIGN SECTION
AMERICAN ELECTRIC POWER

SHEET 4 OF 7
CALC. BY A. K. Dey DATE 4-2-97
CHK. BY AKC DATE 4-2-97
PLANT COOK NUCLEAR UNIT NO. 1

CALCULATION NO. DC-D-01-MS-C-66

4.0 CONCLUSION

FAC is not indicated in 1-MS-1 Main Steam piping. The measured wall thickness in one strip in the sweep bend (component # 1-MS-1-9E) does not meet the minimum wall thickness requirement based on the specified design pressure.

The minimum wall thickness requirements, however, are met based on the actual minimum tensile strength of the material as shown in the mill test report. The minimum wall thickness requirements are also met when evaluated with the stress-intensity limits and actual system operational data.

The sweep bend therefore meets the design intent and/or requirements of the ANSI B31.1 and ASME Section III.

5.0 REFERENCES

1. ANSI (USAS) B31.1.0 - 1967, Power Piping Code.
2. ASME Section III B&PV Code Appendices, 1989.
3. Memo dated September 8, 1995, from A. J. Lewandowski to E. R. Anderson.
4. Piping Specification ES-PIPE.-1013-QCN.
5. Pipe Stress Calculation No. DC-D-01-MS-C-65.

Attachments:

1. UT data on the Sweep Bend (total 11 pages).
2. TUBECO shop drawing for the Sweep Bend (total 1 page).
3. Mill test report for the Sweep Bend material (total 4 pages).
4. Tech. Spec. Table 4.7-1 for Steam Line Safety Valves per Loop, Amendment No. 182, page 3/4 7-4 (total 1 page).
5. E-mail from Dave Turner to A. K. Dey dated March 25, 1997 (total 1 page).

6.0 PIPING INPUT DATA

None.

MECHANICAL DESIGN SECTION
AMERICAN ELECTRIC POWER

SHEET 7 OF 7
CALC. BY A. K. Dev DATE 4.2.97
CHK. BY AC DATE 4.2.97
PLANT COOK NUCLEAR UNIT NO. 1

CALCULATION NO. DC-D-01-MS-C-66

7.0 CALCULATIONS

The following calculations are performed to evaluate code compatibility and to determine structural significance of the wall thickness deficiency.

NOTE: The longitudinal stresses in this piping system are well within the ANSI B31.1 allowable for Pressure, Dead Wt., Thermal & Seismic loading (Ref. Calc. DC-D-01-MS-C-65) and, as such, the calculations below will primarily address stresses in the circumferential direction (hoop stresses).

Pipe Isometric: 1-MS-1, Rev. 15
Pipe Spec: ES-PIPE-1013-QCN, Class J-14
Pipe Mat: 30" o.d x 1" wall A106 GR.C
Design Press Pd = 1085 PSIG, Design Temp Td = 600°F
Normal Op. Press Po = 728 PSIG, Op. Temp To = 570°F
ANSI B31.1 Piping Matl. Allowable SE = 17,500 PSI @ 600°F

(A) Minimum Wall Thickness Required Per ANSI B31.1.

$$\begin{aligned} \text{Min}^n \text{ thickness } t_{\min} &= \frac{P_d (D_o)}{2(SE + P_d Y)} + A && \text{Ref. (1)} \\ &= \frac{(1085)(30)}{2(17,500 + (1085)(.4))} = 0.907'' \end{aligned}$$

A = 0 (FAC measurements are done and also for no expected FAC).
Y = 0.4 for ferritic steel.

At one of the worse locations of the 21" x 32" grid data (Attachment 1), the following actual wall thicknesses (ta) have been noted during UT:

MEASURED WALL THICKNESS ta (inch):

Row #	COLUMN #		
	P	Q	R
13	0.860	0.851	0.857
14	0.851	0.843	0.864
15	0.851	0.859	0.860
ta average = 0.855" (ta average is less than the Min ⁿ wall of 0.907")			

The actual hoop stress using the above equation

$$s = \frac{(P_d)(D_o)}{2t_a} - P_d Y = \frac{(1085)(30)}{2(0.855)} - (1085)(.4) = 18,601 \text{ psi}$$

The actual hoop stress is 6.3% larger than the allowable stress of 17,500 psi.

MECHANICAL DESIGN SECTION
AMERICAN ELECTRIC POWER

SHEET 6 OF 7
CALC. BY A. K. Dey DATE 4.2.97
CHK. BY AKC DATE 4.2.97
PLANT COOK NUCLEAR UNIT NO. 1

CALCULATION NO. _____

Yield stress (Sy) at 600°F (design temp) = 29,600 psi

(Ref. 2)

Although the calculated hoop stress exceeds B31.1 stress allowable (SE), it is however well below the yield stress at design temperature and, as such, the piping system will remain functional and there is no safety concern.

- (B) The allowable stress of 17.5 ksi for SA 106 GR.C is controlled by the material minimum tensile strength (Su) of 70 ksi (Ref. 1 & 2). The allowable stress is $1/4$ Su.

The actual mill test data (see Attachment-3) show that the minimum tensile strength for this specific piping is 76.8 ksi. The allowable stress based on this actual data, therefore, should be $1/4$ (76.8) or 19.2 ksi.

The minimum wall based on the SE = 19,200 psi

$$t_{min} = \frac{1085 (30)}{2 (19,200 + 1085 (.4))} = 0.828$$

which is smaller than actual wall t_a of 0.843.

Therefore, the Main Steam piping system meets the code intended allowable stress limits.

- (C) Wall Thickness Requirement based on System Operation.

The design pressure and the operating pressure for this Main Steam piping system are 1085 psig and 728 psig, respectively (Ref. 4). Since the operating pressure is small as compared to the design pressure, the operational data was reviewed to determine the percentage of time the piping system operated above 1000 psig during the last two cycles. The value of 1000 psig was selected for convenience.

ANSI B31.1 (Ref. 1), article 101.2.2 states that the Internal Design Pressure shall not be less than the maximum sustained fluid Operating Pressure and shall include allowance for pressure surges except for the occasional short period operation at higher than the design pressure.

Attachment-5 shows that the system operates only for 5.6% of the time above 1000 psig which can be considered as the short period pressure surges above 1000 psig.

Based on the system operational data, if we redefine the design pressure as 1000 psig purely from an engineering and system operation standpoint, the intent of Ref. 1, article 101.2.2 is still met.

CALCULATION NO. _____

Therefore, for the newly defined design pressure of 1000 psig, the Main Steam piping will meet the minimum wall thickness requirement (by comparison with the page 5 calculation).

The magnitude of maximum pressure during a pressure surge is limited by the safety valve setting of 1065 + 3% or 1097 psig max. (Attachment-4).

The minimum wall thickness needed for this short duration operation (5.6% time between 1000 psig to 1097 psig) is:

$$t_{min} = \frac{(1097)(30)}{2[(17,500)(1.15) + (1097)(.4)]} = 0.800''$$

where the factor 1.15 is the 15% increase in the allowable per Ref. 1, article 102.2.4.

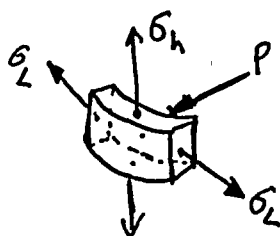
Therefore, from actual system operation condition also, the Main Steam piping system will remain functional, meet the intent of the code, and have no safety concern.

(D) Stress Intensity

As stated before, the pipe stress analysis (calculation #DC-D-01-MSC-65) confirmed that the piping system as depicted in piping isometric 1-MS-01 meets ANSI B31.1 code allowables for all required load combinations for Pressure, Dead Wt., Thermal, and Seismic loads. The maximum interaction ratio is 0.7198.

For sustained load combination (load set 31.1-3), maximum longitudinal stress is 10106. The shear stresses are insignificant.

Therefore, an element in the pipe bend during a sustained load condition will have stresses as shown below:



σ_L = Longitudinal stresses due to = 10106 psi
pressure & dead wt.

σ_h = Hoop stress (@ design pressure 1085 psig) = 18,601 psi
(Page -

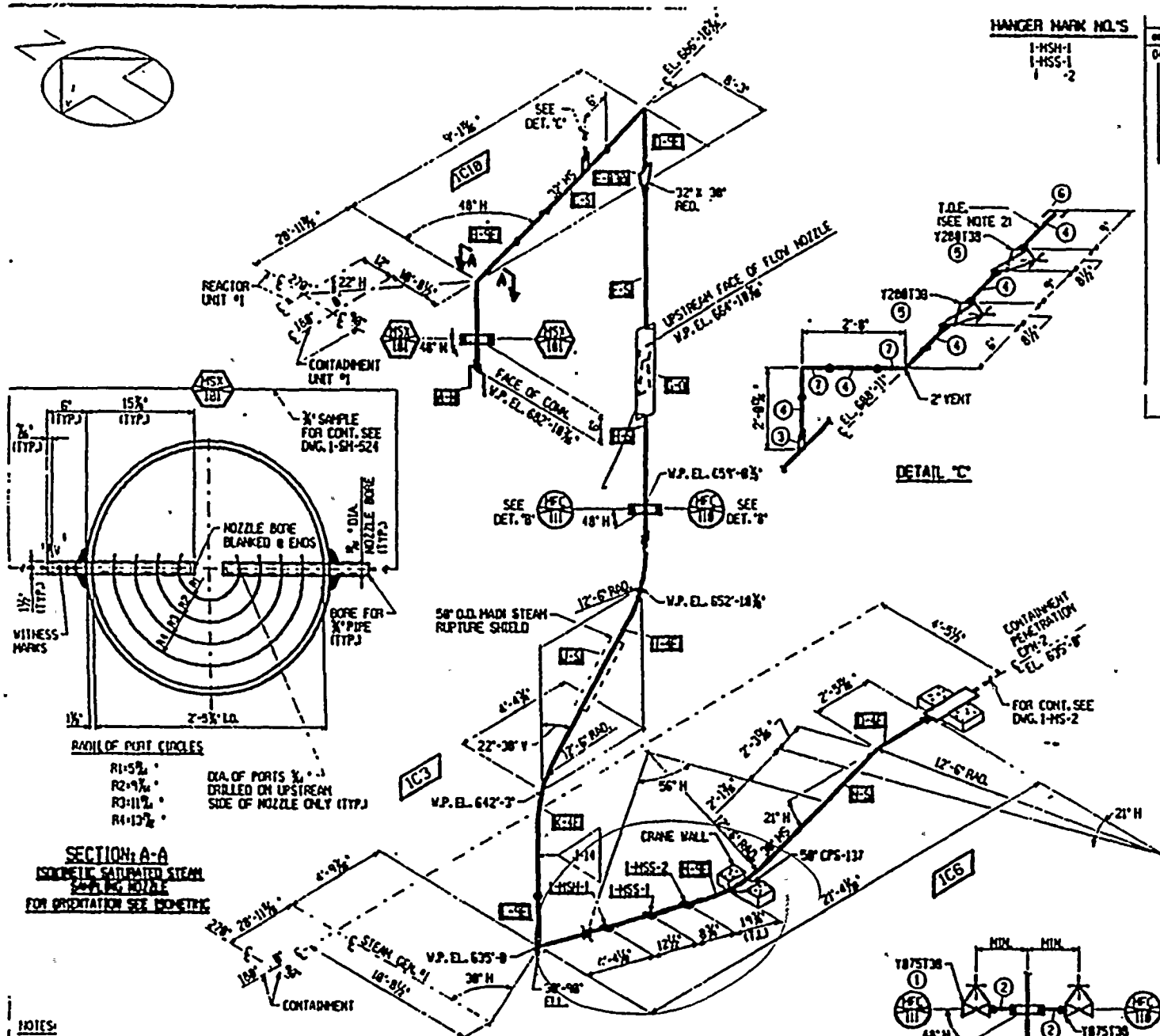
p = 1085 psi

Therefore, the maximum stress intensity is:

$$S = \sigma_h - P = 18601 - (-1085) = 19,686 < 19,700 \text{ psi}$$

where $S_m = 19,700$ ALLOWABLE STRESS INTENSITY (REF. 2)

Therefore, the sweep bend meets the code stress-intensity limits and, as such, will perform its designed function.



SECTION: A-A
ISOTHERM SATURATED STEAM
240.00 PSIA
FOR ORIENTATION SEE ISOTHERM

- NOTES:**
1. TESTING PROCEDURE:
BUTT WELDS 100% R.T.
SOCKET WELDS M.T.P.T. 100%.
 2. USE CRANE 425A COMPOUND ON ALL
THREADED CONFS.
 3. PPE SHALL FOLLOW:
32" O.D. X 125" H.W.
30" O.D. X 10" H.W.
A-10% CR. C. SALS. ON
A-15% CR. KC-70 CLASS 1 WELDED
24" O.D. & SMALLER.
A-10% CR. B. SCH. 80 SALS.

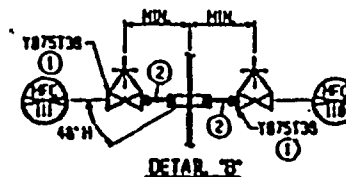
⊗ INDICATES LOCATION OF PIPE
SUPPORT AND SUPPORT DETAIL
NUMBER

SUPPORT MARK NUMBERS
SHOWN ARE FOR
GENERAL AND SEQUENTIAL LOCATION
OF SUPPORTS ONLY
FOR EXACT LOCATIONS SEE PIPE
SUPPORT DETAIL

[illegible]

QID	ITEM	QTY	SIZE	DESCRIPTION	THE NO. IN MATERIAL
04	1	2	1"	1500# GLOBE VALVE S.W.	7075138
	2	1	1"	PPE ISOM. BOI S.W. S. C.S.	A-126 CR. B
	3	1	2"	3000# S.W. CR.C.	A-125 CR. B
	4	1	2"	PPE ISOM. BOI C.S.	A-126 CR. B
	5	2	2"	1500# GLOBE VALVE S.W.	7208136
	6	1	2"	3000# THRO. CAP	A-125 CR. B
	7	2	2"	3000# 90° ELB'S S.W.	A-125 CR. B

ATTACHMENT- I
Swt. 1 of 11



16			
REF.	DATE	DESCRIPTION	PREPARED BY
FOUR/20/68		FLYING BOATMAN	ESDS
			ALL 24
SECRET OFFICE OF THE DIRECTOR OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION WASHINGTON, D. C. 20546		AMERICAN ELECTRIC POWER BOWLING GREEN NUCLEAR PLANT	
		DATE REC'D TIME REC'D BY	CONTAINER NO. DATE REC'D BY
		DATE REC'D TIME REC'D BY	CONTAINER NO. DATE REC'D BY
		DATE REC'D TIME REC'D BY	CONTAINER NO. DATE REC'D BY

Plant : D.C.Cook


Unit : 1

CHECKWORKS FAC Version 1.0D

DB Name : COOK1

1.5 pipe diameter
We work 0"

*** UT Matrix ***

LINE NAME : 1-MS-001-1
COMPONENT NAME : 1-MS-001-1-L-9E
OUTAGE NAME : U1 R95
SECTION : U/S Main
Tnom = 1.000 (in), Tscreen = 0.907 (in)
[Grid data]
Color 
Max. 0.454 0.907 0.700 0.875 1.000 1.250

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Min	Max	Del	Ave
1	1.367	1.354	1.367	1.385	1.377	1.409	1.394	1.420	1.404	1.436	1.432	1.422	1.401	1.393	1.388	1.400	1.429	1.405	1.397	1.386	1.389	1.382	1.345	1.389	1.345	1.436	0.091	1.395
2	1.399	1.386	1.417	1.401	1.403	1.387	1.384	1.381	1.386	1.381	1.387	1.377	1.421	1.366	1.394	1.403	1.413	1.379	1.387	1.390	1.401	1.394	1.403	1.385	1.366	1.421	0.055	1.393
3	1.372	1.375	1.388	1.403	1.401	1.394	1.377	1.383	1.381	1.369	1.367	1.396	1.377	1.398	1.354	1.370	1.368	1.379	1.378	1.383	1.402	1.405	1.396	1.368	1.354	1.405	0.051	1.393
4	1.362	1.343	1.389	1.433	1.408	1.396	1.400	1.374	1.372	1.363	1.370	1.379	1.405	1.383	1.376	1.358	1.360	1.398	1.379	1.398	1.405	1.407	1.394	1.347	1.343	1.433	0.090	1.383
5	1.327	1.330	1.388	1.405	1.428	1.400	1.377	1.372	1.370	1.355	1.360	1.401	1.377	1.376	1.376	1.363	1.359	1.397	1.388	1.400	1.411	1.408	1.397	1.343	1.327	1.428	0.101	1.380
6	1.356	1.320	1.386	1.403	1.432	1.428	1.401	1.378	1.369	1.359	1.358	1.398	1.445	1.400	1.375	1.383	1.369	1.398	1.387	1.442	1.408	1.407	1.392	1.335	1.320	1.445	0.125	1.389
7	1.292	1.333	1.379	1.406	1.408	1.393	1.408	1.374	1.362	1.364	1.368	1.367	1.397	1.388	1.401	1.392	1.366	1.403	1.393	1.406	1.416	1.410	1.409	1.335	1.274	1.417	0.143	1.382
8	1.274	1.333	1.383	1.401	1.406	1.417	1.411	1.374	1.362	1.364	1.368	1.367	1.397	1.388	1.401	1.392	1.366	1.403	1.393	1.406	1.416	1.410	1.409	1.335	1.274	1.417	0.143	1.382
9	1.378	1.343	1.387	1.401	1.402	1.396	1.389	1.378	1.396	1.362	1.361	1.385	1.371	1.378	1.391	1.384	1.368	1.396	1.398	1.404	1.420	1.417	1.402	1.361	1.328	1.420	0.092	1.384
10	1.328	1.351	1.390	1.400	1.400	1.393	1.413	1.376	1.365	1.360	1.371	1.362	1.374	1.374	1.400	1.360	1.366	1.395	1.402	1.404	1.417	1.411	1.404	1.372	1.328	1.417	0.089	1.383
11	1.336	1.394	1.385	1.402	1.400	1.390	1.383	1.375	1.373	1.384	1.403	1.411	1.383	1.374	1.387	1.360	1.363	1.391	1.397	1.433	1.407	1.408	1.333	1.376	1.336	1.433	0.097	1.388
12	1.333	1.372	1.377	1.393	1.403	1.392	1.380	1.369	1.357	1.354	1.362	1.412	1.345	1.382	1.366	1.364	1.358	1.370	1.383	1.399	1.410	1.438	1.391	1.387	1.333	1.438	0.105	1.379
13				1.385	1.395	1.387	1.382	1.367	1.390	1.364	1.368	1.355	1.402	1.386	1.369	1.364	1.362	1.376	1.379	1.400	1.408	1.392	1.374	1.387	1.355	1.408	0.053	1.381
14				1.402	1.393	1.385	1.375	1.373	1.369	1.360	1.362	1.375	1.382	1.384	1.375	1.360	1.361	1.354	1.378	1.402	1.397	1.384			1.354	1.402	0.048	1.377
15					1.387	1.388	1.380	1.372	1.374	1.365	1.363	1.397	1.425	1.378	1.401	1.362	1.366	1.392	1.381	1.397	1.388				1.362	1.425	0.063	1.384
16						1.388	1.375	1.367	1.361	1.352	1.369	1.374	1.412	1.372	1.386	1.369	1.362	1.370	1.380	1.393					1.352	1.412	0.060	1.375
17							1.380	1.373	1.362	1.350	1.372	1.377	1.400	1.374	1.387	1.359	1.365	1.415	1.386	1.387					1.350	1.415	0.065	1.376
18							1.388	1.375	1.368	1.375	1.370	1.370	1.350	1.366	1.388	1.358	1.370	1.408	1.432						1.350	1.432	0.082	1.380
19								1.391	1.378	1.377	1.367	1.377	1.407	1.375	1.386	1.357	1.377	1.391							1.357	1.407	0.050	1.378
20								1.393	1.390	1.372	1.362	1.364	1.356	1.401	1.387	1.368	1.391	1.407							1.356	1.407	0.051	1.379
21									1.404	1.404	1.363	1.363	1.348	1.370	1.366	1.409	1.419								1.348	1.419	0.071	1.383
22										1.426	1.377	1.366	1.402	1.375	1.409	1.415									1.366	1.426	0.060	1.396
23											1.394	1.401	1.377	1.407	1.412										1.377	1.412	0.035	1.398
24												1.423	1.427	1.395											1.395	1.427	0.032	1.415
Min	1.274	1.320	1.367	1.385	1.377	1.385	1.375	1.367	1.357	1.350	1.358	1.355	1.345	1.366	1.354	1.357	1.358	1.354	1.378	1.386	1.388	1.382	1.345	1.330				
Max	1.399	1.394	1.417	1.433	1.432	1.428	1.413	1.420	1.404	1.436	1.432	1.423	1.445	1.407	1.412	1.415	1.429	1.415	1.432	1.442	1.420	1.438	1.409	1.399				
Del	0.125	0.074	0.050	0.048	0.055	0.043	0.038	0.053	0.047	0.086	0.074	0.068	0.100	0.041	0.058	0.058	0.071	0.061	0.054	0.056	0.032	0.056	0.064	0.069				
Ave	1.340	1.353	1.388	1.401	1.403	1.396	1.389	1.378	1.377	1.374	1.373	1.385	1.392	1.382	1.382	1.374	1.375	1.391	1.390	1.402	1.406	1.405	1.392	1.363				
Dev	0.035	0.024	0.012	0.011	0.014	0.012	0.013	0.012	0.014	0.023	0.017	0.020	0.027	0.012	0.016	0.018	0.021	0.015	0.013	0.015	0.009	0.014	0.017	0.023				

SECTION SUMMARY

Minimum Thickness = 1.274 Minimum at 8,A
Maximum Thickness = 1.445 Maximum at 6,M
Delta = 0.171
Average Thickness = 1.384
Standard Deviation = 0.022

ATTACHMENT # 1
Sht. 2 of 11

	Dev
1	0.023
2	0.013
3	0.014
4	0.022
5	0.026
6	0.031
7	0.030
8	0.033
9	0.022
10	0.023
11	0.020
12	0.024
13	0.015
14	0.014
15	0.016
16	0.015
17	0.017
18	0.022
19	0.014
20	0.018
21	0.026
22	0.023
23	0.014
24	0.017

Attachment - 1
Sht. # 3 of 11

 *** UT Matrix ***

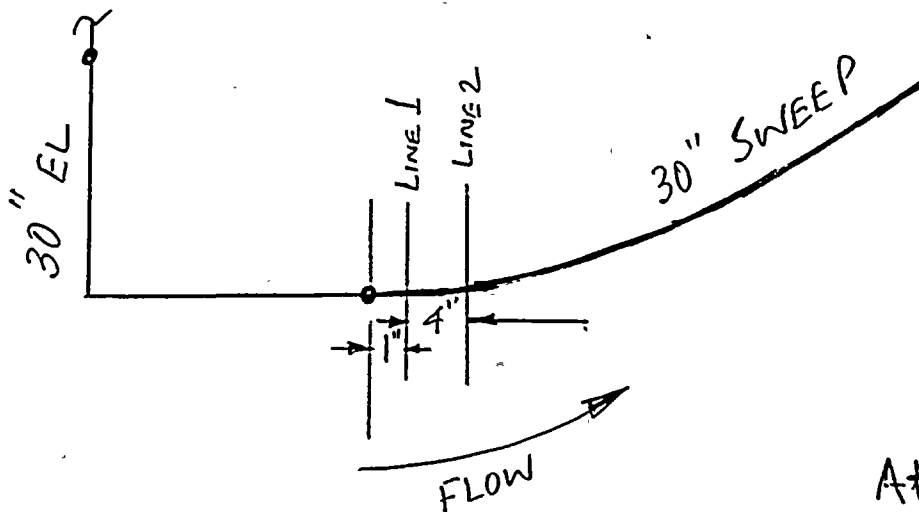
LINE NAME : 1-MS-001-1
 COMPONENT NAME : 1-MS-001-1-L-9E
 OUTAGE NAME : U1 R95
 SECTION : D/S Ext.
 Tnom = 1.000 (in), Tscreen = 0.907 (in)
 [Grid data]

Color [REDACTED]
 Max. 0.454 0.907 0.700 0.875 1.000 1.250

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Min	Max	Del	Ave
1	1.232	1.193	1.181	1.082	1.049	1.034	0.992	0.909	0.907	0.945	0.970	0.936	0.987	1.066	1.141	1.245	1.244	1.265	1.356	1.341	1.398	1.395	1.359	1.273	0.907	1.398	0.491	1.146
2	1.257	1.236	1.129	1.053	0.989	0.957	0.953	0.907	0.893	0.924	0.929				1.131	1.177	1.232	1.238	1.343	1.408	1.438	1.419	1.380	1.307	0.893	1.438	0.545	
Min	1.232	1.193	1.129	1.053	0.989	0.957	0.953	0.907	0.893	0.924	0.929	0.936	0.987	1.066	1.131	1.177	1.232	1.238	1.343	1.341	1.398	1.395	1.359	1.273				
Max	1.257	1.236	1.181	1.082	1.049	1.034	0.992	0.909	0.907	0.945	0.970	0.936	0.987	1.066	1.141	1.245	1.244	1.265	1.356	1.408	1.438	1.419	1.380	1.307				
Del	0.025	0.043	0.052	0.029	0.060	0.077	0.039	0.002	0.014	0.021	0.041	0.000	0.000	0.000	0.010	0.068	0.012	0.027	0.013	0.067	0.040	0.024	0.021	0.034				
Ave	1.245	1.215	1.155	1.068	1.019	0.996	0.973	0.908	0.900	0.935	0.950	0.936	0.987	1.066	1.136	1.211	1.238	1.252	1.350	1.375	1.418	1.407	1.370	1.290				
Dev	0.018	0.030	0.037	0.021	0.042	0.054	0.028	0.001	0.010	0.015	0.029	0.000	0.000	0.000	0.007	0.048	0.008	0.019	0.009	0.047	0.028	0.017	0.015	0.024				

SECTION SUMMARY

Minimum Thickness = 0.893 Minimum at 2,I
 Maximum Thickness = 1.438 Maximum at 2,U
 Delta = 0.545
 Average Thickness = 1.151
 Standard Deviation = 0.174



Attachment - 1
 Sht. 4 of 11

EXTENSION

	Dev
1	0.165
2	0.188

Attachment - 1
Sht. 5 of 11

Plant : D.C.Cook

Unit : 1

CHECKWORKS FAC Version 1.0D

DB Name : COOK1

 *** UT Matrix ***

LINE NAME : 1-MS-001-1

COMPONENT NAME : 1-MS-001-1-M-9E

OUTAGE NAME : U1 R95

SECTION : U/S Main

Tnom = 1.000 (in), Tscreen = 0.907 (in)

[Grid data]

Color XXXXXXXXXX
 Max. 0.454 0.907 0.700 0.875 1.000 1.250

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	Min	Max	Del	Ave	Dev
1	1.021	0.993	0.999	0.989	0.951	0.946	0.936	0.970	0.962	0.924	0.912	0.909	0.928	0.921	0.919	0.924	0.966	1.002	0.993	0.924	0.970	0.909	1.021	0.112	0.955	0.034
2	0.954	0.947	0.940	0.933	0.926	0.901	0.902	0.890	0.913	0.888	0.905	0.896	0.891	0.895	0.879	0.873	0.897	0.917	0.956	0.931	0.923	0.873	0.956	0.083	0.912	0.024
3	0.990	0.953	0.953	0.951	0.939	0.924	0.911	0.906	0.902	0.901	0.897	0.886	0.905	0.904	0.914	0.908	0.892	0.909	0.925	0.933	0.925	0.886	0.990	0.104	0.920	0.025
4	0.954	0.950	0.949	0.984	0.938	0.926	0.921	0.902	0.906	0.904	0.910	0.890	0.894	0.888	0.885	0.890	0.900	0.916	0.934	0.943	0.949	0.885	0.984	0.099	0.921	0.027
5	0.953	0.956	0.955	0.950	0.940	0.933	0.932	0.938	0.913	0.920	0.918	0.930	0.903	0.888	0.884	0.889	0.892	0.913	0.926	0.941	0.938	0.884	0.956	0.072	0.924	0.023
6	0.957	0.953	0.955	0.949	0.955	0.932	0.929	0.930	0.938	0.913	0.935	0.899	0.898	0.883	0.889	0.892	0.898	0.917	0.942	0.932	0.928	0.883	0.957	0.074	0.925	0.024
7	0.960	0.959	0.955	0.946	0.944	0.954	0.929	0.919	0.949	0.905	0.904	0.889	0.907	0.883	0.881	0.892	0.899	0.919	0.923	0.933	0.935	0.881	0.960	0.079	0.923	0.026
8	0.971	0.955	0.956	0.940	0.943	0.942	0.920	0.936	0.902	0.899	0.899	0.888	0.896	0.882	0.885	0.885	0.893	0.906	0.916	0.919	0.937	0.882	0.971	0.089	0.918	0.027
9	0.972	0.961	0.949	0.940	0.938	0.942	0.919	0.915	0.903	0.903	0.920	0.885	0.884	0.876	0.873	0.878	0.896	0.899	0.901	0.932	0.924	0.873	0.962	0.089	0.914	0.028
10	0.968	0.968	0.956	0.943	0.941	0.931	0.922	0.901	0.903	0.899	0.890	0.908	0.883	0.872	0.870	0.878	0.882	0.894	0.894	0.900	0.920	0.870	0.968	0.098	0.911	0.030
11	0.972	0.964	0.962	0.947	0.934	0.924	0.906	0.903	0.892	0.891	0.888	0.904	0.871	0.891	0.863	0.869	0.879	0.882	0.885	0.900	0.914	0.863	0.972	0.109	0.907	0.032
12	0.971	0.957	0.943	0.943	0.921	0.917	0.910	0.899	0.918	0.894	0.879	0.865	0.871	0.864	0.853	0.860	0.873	0.871	0.874	0.878	0.925	0.853	0.971	0.118	0.899	0.035
13	0.967	0.949	0.936	0.930	0.921	0.917	0.908	0.889	0.894	0.890	0.908	0.882	0.885	0.861	0.854	0.849	0.857	0.859	0.861	0.879	0.917	0.849	0.967	0.118	0.894	0.035
14	0.962	0.945	0.934	0.923	0.910	0.908	0.896	0.888	0.890	0.889	0.887	0.865	0.866	0.864	0.853	0.847	0.844	0.850	0.860	0.875	0.912	0.844	0.962	0.118	0.889	0.033
15	0.966	0.953	0.939	0.918	0.912	0.916	0.897	0.894	0.903	0.899	0.875	0.866	0.869	0.863	0.858	0.851	0.875	0.856	0.866	0.875	0.908	0.851	0.966	0.115	0.893	0.033
16	0.963	0.943	0.929	0.922	0.922	0.918	0.907	0.897	0.924	0.889	0.878	0.859	0.895	0.861	0.852	0.854	0.857	0.861	0.869	0.882	0.909	0.852	0.963	0.111	0.895	0.032
17	0.957	0.936	0.914	0.913	0.909	0.923	0.900	0.891	0.888	0.892	0.885	0.892	0.867	0.859	0.858	0.858	0.865	0.868	0.869	0.888	0.903	0.858	0.957	0.099	0.892	0.027
18	0.941	0.913	0.899	0.894	0.887	0.910	0.918	0.895	0.892	0.897	0.884	0.865	0.884	0.869	0.868	0.867	0.876	0.875	0.875	0.883	0.907	0.865	0.941	0.076	0.890	0.020
19	0.934	0.906	0.896	0.892	0.906	0.917	0.913	0.901	0.895	0.901	0.902	0.888	0.880	0.875	0.870	0.876	0.879	0.884	0.878	0.885	0.887	0.870	0.934	0.064	0.894	0.016
20	0.932	0.914	0.907	0.906	0.919	0.922	0.914	0.902	0.899	0.902	0.894	0.883	0.876	0.869	0.887	0.873	0.878	0.886	0.872	0.885	0.892	0.869	0.932	0.063	0.896	0.018
21	0.942	0.929	0.920	0.913	0.920	0.918	0.922	0.905	0.899	0.895	0.888	0.869	0.884	0.871	0.867	0.880	0.888	0.890	0.877	0.886	0.905	0.867	0.942	0.075	0.898	0.021
22	0.949	0.939	0.927	0.930	0.932	0.926	0.922	0.905	0.899	0.903	0.923	0.876	0.894	0.867	0.884	0.887	0.885	0.879	0.876	0.885	0.928	0.867	0.949	0.082	0.906	0.024
23	0.960	0.948	0.938	0.931	0.939	0.934	0.952	0.935	0.918	0.913	0.920	0.884	0.917	0.907	0.885	0.884	0.886	0.882	0.882	0.887	0.898	0.882	0.960	0.078	0.914	0.026
24	0.972	0.957	0.951	0.940	0.943	0.938	0.925	0.943	0.912	0.910	0.925	0.884	0.896	0.882	0.881	0.893	0.883	0.880	0.882	0.880	0.923	0.880	0.972	0.092	0.914	0.030
25	0.980	0.964	0.958	0.952	0.951	0.939	0.933	0.911	0.915	0.906	0.898	0.881	0.883	0.885	0.877	0.881	0.882	0.891	0.874	0.875	0.891	0.874	0.980	0.106	0.911	0.034
26	0.985	0.975	0.962	0.954	0.945	0.940	0.927	0.908	0.914	0.894	0.884	0.872	0.878	0.892	0.879	0.881	0.879	0.886	0.877	0.883	0.881	0.872	0.985	0.113	0.909	0.036
27	0.993	0.977	0.966	0.960	0.953	0.931	0.937	0.906	0.900	0.888	0.882	0.867	0.878	0.888	0.897	0.881	0.879	0.873	0.880	0.878	0.881	0.867	0.993	0.126	0.909	0.040
28	0.990	0.983	0.966	0.960	0.951	0.929	0.931	0.908	0.914	0.904	0.886	0.874	0.888	0.892	0.886	0.884	0.897	0.878	0.878	0.872	0.888	0.872	0.990	0.118	0.912	0.037
29	0.992	0.981	0.974	0.957	0.941	0.925	0.920	0.913	0.915	0.901	0.898	0.880	0.918	0.892	0.887	0.892	0.890	0.879	0.877	0.877	0.883	0.877	0.992	0.115	0.914	0.036
30	0.987	0.977	0.962	0.949	0.929	0.916	0.911	0.903	0.903	0.874	0.888	0.882	0.866	0.897	0.894	0.895	0.886	0.880	0.885	0.873	0.878	0.873	0.997	0.114	0.907	0.034
31	0.988	0.973	0.949	0.935	0.920	0.912	0.906	0.886	0.890	0.873	0.882	0.871	0.877	0.890	0.885	0.894	0.888	0.887	0.893	0.890	0.925	0.871	0.988	0.117	0.905	0.032
32	0.983	0.969	0.950	0.924	0.915	0.907	0.906	0.896	0.873	0.871	0.865	0.866	0.875	0.893	0.904	0.890	0.882	0.889	0.887	0.888		0.865	0.999	0.134	0.903	0.037
Min	0.932	0.906	0.896	0.892	0.887	0.901	0.896	0.886	0.873	0.871	0.865	0.859	0.865	0.859	0.852	0.847	0.844	0.850	0.860	0.872	0.878					
Max	1.021	0.999	0.999	0.989	0.955	0.954	0.952	0.970	0.962	0.924	0.935	0.930	0.928	0.921	0.919	0.924	0.966	1.002	0.993	0.943	0.970					
Del	0.089	0.093	0.103	0.097	0.068	0.053	0.056	0.084	0.089	0.053	0.070	0.071	0.063	0.062	0.067	0.077	0.122	0.152	0.133	0.071	0.092					
Ave	0.968	0.956	0.945	0.938	0.931	0.926	0.918	0.909	0.908	0.898	0.897	0.882	0.888	0.882	0.878	0.880	0.885	0.890	0.893	0.897	0.913					
Dev	0.019	0.022	0.022	0.022	0.016	0.012	0.013	0.019	0.018	0.012	0.017	0.016	0.016	0.015	0.017	0.017	0.020	0.028	0.031	0.024	0.022					
ATTACHMEN SWT, # 6																										

SECTION SUMMARY

Minimum Thickness = 0.844 Minimum at 14,Q

ATTACHMENT - 1
 SWT, # 6 of 11

Maximum Thickness = 1.021 Maximum at 1,A
Delta = 0.177
Average Thickness = 0.909
Standard Deviation = 0.032

ATTACHMENT # 1
Sht. # 7 of 11


Company : Indiana Michigan Power/AEP Report Date: 21-MAR-97 Time : 10:40:47
Plant : D.C.Cook
Unit : 1
DB Name : COOK1

CHECKWORKS FAC Version 1.0D

*** UT Matrix ***

LINE NAME : 1-MS-001-1
COMPONENT NAME : 1-MS-001-1-M-9E
OUTAGE NAME : U1 R97
SECTION : U/S Main
Tnom = 1.000 (in), Tscreen = 0.907 (in)

[Grid data]

Color 
Max. 0.454 0.907 0.700 0.875 1.000 1.250

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	Min	Max	Del	Ave	Dev	
1	1.014	0.997	0.971	0.983	0.869	0.953	0.950	0.939	0.941	0.901	0.903	0.921	0.906	0.905	0.915	0.935	0.917	0.946	0.957	0.929	0.930	0.901	1.014	0.113	0.942	0.032	
2	0.954	0.952	0.948	0.938	0.935	0.898	0.900	0.885	0.910	0.889	0.888	0.897	0.888	0.887	0.885	0.889	0.893	0.911	0.920	0.922	0.920	0.885	0.954	0.069	0.910	0.024	
3	0.959	0.958	0.963	0.934	0.934	0.924	0.911	0.900	0.911	0.897	0.896	0.895	0.898	0.899	0.904	0.899	0.898	0.914	0.926	0.947	0.942	0.895	0.963	0.068	0.919	0.023	
4	0.949	0.952	0.946	0.968	0.926	0.923	0.914	0.905	0.908	0.898	0.903	0.898	0.891	0.892	0.885	0.887	0.885	0.899	0.907	0.922	0.960	0.939	0.884	0.978	0.094	0.922	0.028
5	0.978	0.967	0.959	0.944	0.937	0.936	0.927	0.915	0.914	0.905	0.909	0.900	0.888	0.884	0.887	0.885	0.899	0.907	0.922	0.960	0.939	0.884	0.978	0.094	0.922	0.028	
6	0.959	0.967	0.952	0.957	0.957	0.945	0.929	0.920	0.922	0.911	0.906	0.894	0.913	0.918	0.888	0.886	0.893	0.913	0.932	0.942	0.938	0.886	0.967	0.081	0.926	0.025	
7	0.962	0.957	0.957	0.950	0.954	0.938	0.925	0.926	0.933	0.908	0.902	0.929	0.892	0.887	0.880	0.878	0.893	0.918	0.921	0.936	0.936	0.878	0.962	0.084	0.923	0.026	
8	0.957	0.960	0.955	0.951	0.947	0.943	0.922	0.907	0.898	0.908	0.908	0.913	0.913	0.882	0.909	0.876	0.888	0.895	0.917	0.933	0.945	0.876	0.960	0.084	0.920	0.026	
9	0.963	0.969	0.962	0.947	0.942	0.942	0.922	0.909	0.901	0.907	0.894	0.907	0.881	0.877	0.876	0.867	0.888	0.892	0.907	0.937	0.955	0.867	0.969	0.102	0.916	0.032	
10	0.967	0.969	0.957	0.947	0.942	0.936	0.928	0.916	0.902	0.901	0.892	0.903	0.884	0.884	0.878	0.867	0.880	0.885	0.901	0.903	0.922	0.867	0.969	0.102	0.913	0.031	
11	0.975	0.971	0.969	0.951	0.935	0.933	0.914	0.902	0.926	0.898	0.887	0.900	0.896	0.874	0.872	0.889	0.878	0.879	0.886	0.902	0.929	0.872	0.975	0.103	0.913	0.033	
12	1.003	0.963	0.952	0.954	0.922	0.927	0.914	0.927	0.901	0.891	0.879	0.871	0.868	0.855	0.865	0.864	0.896	0.864	0.869	0.899	0.924	0.855	1.003	0.148	0.905	0.040	
13	0.969	0.959	0.943	0.936	0.925	0.917	0.904	0.893	0.903	0.892	0.875	0.872	0.864	0.857	0.857	0.860	0.851	0.851	0.856	0.908	0.908	0.851	0.969	0.118	0.895	0.037	
14	0.991	0.945	0.935	0.927	0.917	0.919	0.896	0.890	0.893	0.888	0.876	0.895	0.864	0.855	0.859	0.851	0.843	0.859	0.861	0.881	0.913	0.843	0.991	0.148	0.893	0.037	
15	0.972	0.949	0.939	0.928	0.909	0.909	0.905	0.894	0.908	0.889	0.888	0.859	0.868	0.864	0.856	0.857	0.864	0.860	0.869	0.878	0.913	0.856	0.972	0.116	0.894	0.033	
16	0.969	0.954	0.936	0.925	0.920	0.914	0.909	0.896	0.902	0.897	0.881	0.865	0.867	0.866	0.858	0.855	0.866	0.877	0.866	0.878	0.906	0.855	0.969	0.114	0.896	0.032	
17	0.951	0.934	0.917	0.920	0.914	0.919	0.907	0.893	0.904	0.896	0.907	0.891	0.871	0.859	0.857	0.858	0.868	0.869	0.878	0.895	0.905	0.857	0.951	0.094	0.896	0.026	
18	0.944	0.913	0.899	0.905	0.899	0.918	0.901	0.907	0.907	0.898	0.884	0.872	0.878	0.869	0.869	0.872	0.879	0.876	0.885	0.885	0.900	0.869	0.944	0.075	0.893	0.019	
19	0.936	0.908	0.901	0.895	0.903	0.917	0.914	0.905	0.903	0.911	0.899	0.888	0.896	0.886	0.875	0.872	0.882	0.879	0.879	0.879	0.897	0.872	0.936	0.064	0.896	0.016	
20	0.929	0.918	0.910	0.909	0.912	0.939	0.915	0.910	0.898	0.905	0.894	0.881	0.889	0.871	0.879	0.870	0.876	0.878	0.879	0.886	0.900	0.870	0.939	0.069	0.898	0.020	
21	0.940	0.927	0.918	0.912	0.911	0.926	0.920	0.907	0.903	0.901	0.911	0.869	0.869	0.864	0.859	0.871	0.886	0.887	0.880	0.890	0.901	0.859	0.940	0.081	0.898	0.023	
22	0.952	0.942	0.928	0.929	0.929	0.951	0.912	0.929	0.913	0.913	0.918	0.906	0.891	0.873	0.883	0.885	0.902	0.886	0.884	0.888	0.920	0.873	0.952	0.079	0.911	0.023	
23	0.963	0.957	0.937	0.947	0.937	0.939	0.925	0.919	0.918	0.913	0.899	0.883	0.887	0.883	0.882	0.886	0.888	0.882	0.880	0.884	0.900	0.880	0.963	0.083	0.910	0.028	
24	0.974	0.991	0.950	0.951	0.942	0.941	0.930	0.938	0.916	0.920	0.895	0.906	0.888	0.895	0.880	0.883	0.892	0.879	0.880	0.904	0.891	0.879	0.991	0.112	0.916	0.033	
25	0.981	0.972	0.959	0.953	0.946	0.945	0.937	0.928	0.909	0.906	0.892	0.871	0.885	0.881	0.879	0.888	0.887	0.877	0.872	0.901	0.911	0.871	0.989	0.118	0.914	0.039	
26	0.989	0.985	0.966	0.965	0.950	0.948	0.936	0.916	0.917	0.895	0.882	0.871	0.885	0.881	0.879	0.888	0.887	0.877	0.872	0.901	0.911	0.871	0.989	0.118	0.914	0.039	
27	0.997	0.980	0.964	0.961	0.947	0.942	0.921	0.926	0.900	0.891	0.883	0.873	0.878	0.883	0.877	0.881	0.879	0.889	0.901	0.870	0.884	0.870	0.997	0.127	0.911	0.039	
28	0.993	0.979	0.972	0.961	0.948	0.933	0.924	0.905	0.905	0.905	0.896	0.880	0.883	0.893	0.885	0.882	0.877	0.883	0.876	0.883	0.873	0.873	0.993	0.120	0.911	0.038	
29	0.998	0.984	0.973	0.955	0.953	0.937	0.916	0.924	0.915	0.898	0.878	0.882	0.896	0.899	0.888	0.885	0.878	0.883	0.911	0.887	0.879	0.878	0.998	0.120	0.915	0.037	
30	1.000	0.982	0.970	0.942	0.930	0.917	0.909	0.907	0.905	0.881	0.869	0.878	0.893	0.898	0.885	0.897	0.889	0.886	0.889	0.890	0.891	0.869	1.000	0.131	0.910	0.036	
31	0.991	0.982	0.967	0.942	0.915	0.913	0.920	0.893	0.892	0.865	0.870	0.874	0.890	0.899	0.910	0.899	0.885	0.915	0.891	0.898	0.922	0.865	0.991	0.126	0.911	0.034	
32	0.994	0.972	0.956	0.926	0.913	0.906	0.877	0.879	0.879	0.865	0.872	0.864	0.885	0.885	0.923	0.891	0.894	0.917	0.921	0.902	0.900	0.864	0.994	0.130	0.906	0.034	
Min	0.929	0.908	0.899	0.895	0.899	0.896	0.877	0.879	0.879	0.865	0.869	0.859	0.864	0.855	0.856	0.851	0.843	0.851	0.856	0.870	0.873						
Max	1.014	0.997	0.973	0.983	0.969	0.953	0.950	0.939	0.941	0.920	0.918	0.929	0.913	0.918	0.923	0.935	0.917	0.946	0.957	0.960	0.955						
Del	0.085	0.089	0.074	0.088	0.070	0.057	0.073	0.060	0.062	0.055	0.049	0.070	0.049	0.063	0.067	0.084	0.074	0.095	0.101	0.090	0.082						
Ave	0.971	0.960	0.948	0.941	0.932	0.930	0.917	0.910	0.908	0.898	0.892	0.888	0.886	0.882	0.881	0.880	0.884	0.889	0.894	0.904	0.914						
Dev	0.022	0.022	0.021	0.020	0.017	0.014	0.014	0.015	0.012	0.012	0.013	0.018	0.013	0.016	0.017	0.016	0.014	0.021	0.025	0.025	0.021						

ATTACHMENT =
SW # 8

ATTACHMENT # 1
SW # 8 of 11

SECTION SUMMARY

Minimum Thickness = 0.843 Minimum at 14,Q
Maximum Thickness = 1.014 Maximum at 1,A
Delta = 0.171
Average Thickness = 0.910
Standard Deviation = 0.032

ATTACHMENT # 1
SHT. # 9411

95 - 173
data

*** UT Matrix ***

LINE NAME : 1-MS-001-1
COMPONENT NAME : 1-MS-001-1-M-9E
OUTAGE NAMES : U1 R95, U1 R97
SECTION : U/S Main
Tnom = 1.000 (in), Tscreen = 0.907 (in)
[Wear data]
Color [REDACTED]
Max. -0.040 -0.021 -0.002 0.018 0.037

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	Min	Max	Del	Ave	Dev
1	0.007	-0.004	0.028	0.005	-0.018	-0.007	-0.014	0.031	0.021	0.023	0.000	-0.012	0.022	0.010	0.004	-0.011	0.049	0.056	0.036	-0.005	0.040	-0.018	0.056	0.074	0.013	0.022
2	0.000	-0.005	-0.008	-0.005	-0.009	0.005	0.002	0.005	0.003	-0.001	0.001	0.004	0.003	0.008	-0.006	-0.016	0.004	0.006	0.036	0.009	0.003	-0.016	0.036	0.052	0.002	0.011
3	0.031	-0.005	-0.010	0.017	0.005	0.000	0.000	0.006	-0.009	0.004	0.001	-0.009	0.002	0.005	0.010	0.009	-0.006	-0.005	0.001	-0.014	-0.017	-0.017	0.031	0.048	0.001	0.011
4	0.005	-0.002	0.003	0.016	0.012	0.003	0.007	-0.003	-0.002	0.006	0.001	-0.008	0.003	-0.004	0.000	0.003	0.006	0.004	0.001	-0.006	0.005	-0.008	0.016	0.024	0.003	0.006
5	-0.025	-0.011	-0.004	0.006	0.003	-0.003	0.005	0.023	-0.001	0.015	0.009	0.030	0.007	0.004	-0.003	0.004	-0.007	0.006	0.004	-0.019	0.001	-0.025	0.030	0.055	0.002	0.013
6	-0.002	-0.014	0.003	-0.008	-0.002	-0.013	0.000	0.010	0.016	0.002	0.029	0.005	-0.015	-0.035	0.001	0.006	0.005	0.004	0.010	-0.010	-0.010	-0.035	0.029	0.064	-0.001	0.013
7	-0.002	0.002	-0.002	-0.004	-0.010	0.016	0.004	-0.007	0.016	-0.003	0.007	0.000	0.005	-0.004	0.001	0.012	0.006	0.001	0.007	-0.003	0.001	-0.040	0.016	0.056	0.000	0.012
8	0.014	-0.005	0.001	-0.011	-0.004	0.001	-0.002	0.029	0.001	-0.009	-0.009	-0.025	-0.017	0.006	-0.024	0.009	0.005	0.011	0.001	-0.014	-0.008	-0.025	0.029	0.054	-0.003	0.013
9	-0.001	-0.008	-0.013	-0.007	-0.004	0.000	-0.003	0.006	0.002	-0.004	0.026	-0.022	0.003	0.001	-0.003	0.011	0.000	0.007	-0.006	-0.005	-0.031	-0.031	0.026	0.057	-0.002	0.012
10	0.001	-0.001	-0.001	-0.004	-0.001	-0.005	-0.006	-0.015	0.001	-0.002	-0.002	0.000	0.001	-0.012	-0.008	0.011	0.002	0.009	-0.007	-0.003	-0.002	-0.015	0.011	0.026	-0.002	0.006
11	-0.003	-0.007	-0.007	-0.004	0.001	-0.009	-0.008	0.001	-0.034	-0.007	0.001	0.004	-0.025	0.012	-0.009	-0.020	0.001	0.003	-0.001	-0.002	-0.015	-0.034	0.017	0.051	-0.006	0.011
12	-0.032	-0.006	-0.009	-0.011	-0.001	-0.010	-0.004	-0.028	0.017	0.003	0.000	-0.006	0.001	0.009	-0.012	-0.004	-0.013	0.007	0.005	-0.021	0.001	-0.032	0.017	0.049	-0.005	0.012
13	-0.002	-0.010	-0.007	-0.006	-0.004	0.000	0.004	-0.004	-0.009	-0.002	0.033	-0.010	0.001	0.004	-0.003	-0.011	0.006	0.008	0.005	-0.029	0.009	-0.029	0.033	0.062	-0.001	0.012
14	-0.029	0.000	-0.001	-0.004	-0.007	-0.011	0.000	-0.002	-0.003	0.001	0.011	-0.030	0.002	0.009	-0.006	-0.004	0.001	-0.009	0.001	-0.006	-0.001	-0.030	0.011	0.041	-0.004	0.010
15	-0.006	0.004	0.000	-0.010	0.003	0.007	-0.008	0.000	-0.005	0.010	-0.013	0.001	0.001	0.002	-0.006	0.011	-0.004	-0.003	-0.003	-0.005	-0.013	0.011	0.024	-0.001	0.006	
16	-0.006	-0.011	-0.007	-0.003	0.002	0.004	-0.002	0.001	0.022	-0.008	-0.003	-0.006	0.028	-0.005	-0.006	0.001	-0.009	-0.016	0.003	0.004	0.003	0.003	0.003	0.003	-0.001	0.010
17	0.006	0.002	-0.003	-0.007	-0.005	0.004	-0.007	-0.002	-0.016	-0.004	-0.022	0.001	-0.004	0.000	0.001	0.000	-0.003	-0.001	-0.009	-0.007	-0.002	-0.022	0.006	0.028	-0.004	0.006
18	-0.003	0.000	0.000	-0.011	-0.012	-0.008	0.017	-0.012	-0.015	-0.001	0.000	-0.007	0.006	0.000	0.001	-0.005	-0.003	-0.001	-0.010	-0.002	0.007	-0.015	0.017	0.032	-0.003	0.007
19	-0.002	-0.002	-0.005	-0.003	0.003	0.000	-0.001	-0.004	-0.008	-0.010	0.003	0.000	-0.016	-0.011	-0.005	0.004	-0.003	0.005	0.001	0.006	-0.010	-0.016	0.006	0.022	-0.003	0.006
20	0.003	-0.004	-0.003	-0.003	0.007	-0.017	-0.001	-0.008	0.001	-0.003	0.000	0.002	-0.013	-0.002	0.008	0.001	0.002	0.008	-0.007	0.001	-0.008	-0.017	0.008	0.025	-0.002	0.006
21	0.002	0.002	0.002	0.001	0.009	-0.008	0.002	-0.002	-0.004	-0.006	-0.023	0.000	0.005	0.007	0.008	0.009	0.002	0.003	-0.003	-0.004	0.004	-0.023	0.015	0.038	0.001	0.008
22	-0.003	-0.003	-0.001	0.001	0.003	-0.025	0.010	-0.024	-0.004	-0.010	0.005	-0.030	0.003	-0.006	0.001	0.002	-0.017	-0.007	-0.008	-0.003	0.008	-0.030	0.010	0.040	-0.005	0.011
23	-0.003	-0.009	0.001	-0.016	0.002	-0.005	0.027	0.016	0.000	0.000	0.021	0.001	0.030	0.024	0.003	-0.002	-0.002	0.000	0.002	0.003	-0.002	-0.016	0.030	0.046	0.004	0.012
24	-0.002	-0.034	0.001	-0.011	0.001	-0.003	-0.005	0.005	-0.004	-0.010	0.030	-0.022	0.008	-0.013	0.001	0.010	-0.009	0.001	0.002	-0.024	0.032	-0.034	0.032	0.066	-0.002	0.015
25	-0.001	-0.008	-0.001	-0.001	0.005	-0.006	-0.004	-0.017	0.006	0.000	0.006	0.010	-0.002	0.001	0.000	-0.004	0.002	0.015	0.003	0.005	-0.021	-0.021	0.015	0.036	-0.001	0.008
26	-0.004	-0.010	-0.004	-0.011	-0.005	-0.008	-0.009	-0.008	-0.003	-0.001	0.002	0.001	-0.007	0.011	0.000	-0.007	-0.008	0.009	0.005	-0.018	-0.030	-0.030	0.011	0.041	-0.005	0.009
27	-0.004	-0.003	0.002	-0.001	0.006	-0.011	0.016	-0.020	0.000	-0.003	0.001	-0.006	0.000	0.005	0.010	0.000	0.000	-0.016	-0.021	0.008	-0.003	-0.021	0.016	0.037	-0.002	0.009
28	-0.003	0.004	-0.006	-0.001	0.003	-0.004	0.007	0.003	0.009	-0.001	-0.010	-0.006	0.005	-0.001	0.001	0.002	0.020	-0.005	0.002	-0.011	0.015	-0.011	0.020	0.031	0.001	0.008
29	-0.006	-0.003	0.001	0.002	-0.012	-0.012	0.034	-0.011	0.000	0.003	0.020	-0.002	0.022	-0.007	-0.001	0.007	0.012	-0.004	-0.034	-0.010	0.034	-0.034	0.022	0.056	-0.001	0.012
30	-0.013	-0.005	-0.008	0.007	-0.001	-0.001	0.002	-0.004	-0.002	-0.007	0.019	0.004	-0.007	0.001	0.009	-0.002	-0.003	-0.006	-0.004	-0.017	-0.013	-0.017	0.019	0.036	-0.003	0.008
31	-0.003	-0.009	-0.018	-0.007	0.005	-0.001	-0.014	-0.007	-0.002	0.008	0.012	-0.003	-0.013	-0.009	-0.025	-0.005	0.003	-0.028	0.002	-0.008	0.003	-0.028	0.012	0.040	-0.006	0.010
32	-0.011	0.027	-0.006	-0.002	0.002	0.001	0.029	0.017	-0.006	0.006	-0.007	0.002	-0.010	-0.002	-0.019	-0.001	-0.012	-0.028	-0.034	-0.014	-0.034	0.029	0.063	-0.003	0.016	
Min	-0.032	-0.034	-0.018	-0.016	-0.018	-0.025	-0.014	-0.028	-0.034	-0.010	-0.023	-0.040	-0.025	-0.035	-0.025	-0.020	-0.017	-0.028	-0.034	-0.029	-0.031					
Max	0.031	0.027	0.028	0.017	0.012	0.016	0.029	0.031	0.022	0.023	0.033	0.030	0.030	0.024	0.010	0.014	0.049	0.056	0.036	0.009	0.040					
Del	0.063	0.061	0.046	0.033	0.030	0.041	0.043	0.059	0.056	0.033	0.056	0.070	0.055	0.059	0.035	0.034	0.066	0.064	0.070	0.038	0.071					
Ave	-0.003	-0.004	-0.003	-0.003	-0.001	-0.004	0.002	-0.001	0.000	0.000	0.005	-0.005	0.002	0.000	-0.002	0.000	0.002	0.001	-0.001	-0.007	-0.001					
Dev	0.011	0.009	0.007	0.007	0.007	0.008	0.010	0.014	0.011	0.007	0.014	0.014	0.013	0.011	0.009	0.008	0.012	0.014	0.014	0.009	0.015					

ATTACHMENT 2
Sheet # 10

ATTACHMENT # 1
Sht. # 10 of 11

SECTION SUMMARY
Minimum Wear = -0.040 Minimum at 7,L

Maximum Wear = 0.056 Maximum at 1,R
Delta = 0.096 Number of Rows = 32
Average Wear = -0.001 Number of Cols = 21
Standard Deviation = 0.011

ATTACHMENT # 1
Sheet # 11 of 11

QUALITY CONTROL RECORD

BEND	21"	56°
RAD	12' 6"	12' 6"
TAN	2:39 1/4	6:7 1/4
ARC	4' 7"	12' 2 1/8
TOL	19' 6 1/2"	

M-214
500908

1-195-1-1

J. Anglin
1-31-72

6084. LBS

NOTES

SHOP COPY

TESTON QUALITY CONTROL
 BY Richard Laiter

ATTACHMENT #2
CALL # DC-D-01: 115

WELD. END		DRG. 1-5281-1		DRG. 1-5281-2		REV. 1/72		10'-7 1/2" WAS 10'-5 1/2" AR		D-2		SYSTEM: MAIN STEAM	
PER		DRG. 1-5281-1		DRG. 1-5281-2		REV. 2/74		2' 8" WAS 3' 16" 13A				DWG. 005050 - 4265	
BY		ON		CHK D. BY		ON							
A-33		A-115		A-333		A-312		CHMS. 1/2" BLAST 1/2" BACK DRG. 1-5281-1					
GRC						0.908" MIN		STR. RELIEF YES HYDRO. -- R.T. 100%				TUBECO INC.	
10		20		30		40		50		60		123 VARICK AVENUE	
100		120		140		160		180		200		BROOKLYN, N. Y. 11231	
WELD. U.T. -- R.T. -- P.T. -- D-3													
SPEC. 1-16													
REF. DWG. 1-5281-3													

DIMENSION & VISUAL RESP.

FOREMAN'S INSPECTION

HC DATE 1-31-72

221 FRI. PHIP PLAZA BUILDING
5937 BROAD ST. MAIN
PITTSBURGH, PA. 15206

J# 0056
P/321

Date October 24

MESSRS. S I D E R I U S, I N C.
NEW YORK, N.Y. 10022 U.S.A.

Order N° 690139

TUBSCO

DALMINE S.p.A.

Mill Order N° 791038

This is to certify that we have inspected the following material
furnished on the order at the:

DALMINE - BERGAMO - ITALY
(Location of Plant)

DALMINE S.p.A.
(Name of Manufacturer)

Having found this material to comply with the requirements of the
above order and in accordance with applicable parts A. S. T. M.
specification - A 106 LATEST EDITION.

We accepted this material for shipment subject to shipping instructions.
Our acceptance mark "ME" was also stamped at one end of each length.

MATERIAL	GRADE	SIZE	WT/FT	RANGE
SEAMLESS CARBON STEEL	C	30.000"	321.34	20.1" / 21"
PIPE	PIECES	FOOTAGE	MEASURES	POUNDS
	25	544.6"	116.34	19,640
				89663

SHIPPING MARKS

TD-ASTM-A 106- GR. C - 30.000" O.D. X 1.038" W.T. - FT... TSS... R°..
TESTED 1660 - HEAT N°-

T. P. O - 6050

Yours very truly

MOODY ENGINEERING COMPANY

James T. L.

Ron Frederick

ME-TD-HEAT N°- GR. C - R°-

FEB. 5 1972

EXTERNAL COATING : HOT DIPPED GALVANIZED OIL.

SHEET 1 OF 3

M-214

ATTACHMENT # 3
CALC. # DC-D-01-MSC-66
Page 1 of 4

ORDINE CLIENTE
Customer's order
N° 690139

NOSTRA COMMESCA
Works reference
Cous. Inc. N° 721033

TIPO DEL TUBO
Type of pipe
SAFARISS CARBON STEEL PIPE

DIAMETRO DEL TUBO
Pipe diameter
N° 162.00 mm
0.530.000 inches

SPESSORE
Thickness
N° 26.36 mm
1.038 inches

ACCIAIO
Steel
N° GR. C (E.F.)
(C.H.)

PESO
Weight
N° 112.19 kg
321.34 lb

PRESSIONE IDRAULICA DI PROVA
Hydraulic test pressure
N° 1660 kg/cm²
1660 psi

PROVA EFFETTUATA SECONDO LE NORME
Test effected according Specifications
N° ASTM - A 106

NUMERO DEI TUBI
Number of pipes
N° 25

PESO TOTALE
Total weight
N° 89663 kg
197.610 lbs

LUNGHEZZA TOTALE
Total length
N° 11.6.01 m
514.6 ft

PESO DEI PROTETTO
Weight of protectors
N° //

POS. 1 25
OVERNIGHT 6.5% Account

CERTIFICATO DI ANALISI CHIMICA

Chemical analysis certificate
Ladys - Ind

COLATA Casting N°	C	Mn	Si	P	S	Y psi	T psi	E 2"
LADLE ANALYSIS								
500930	0.22	1.06	0.26	0.015	0.024	42900	78300	29.6
500931	0.21	0.96	0.28	0.023	0.028	43200	76800	30.5
500928	0.21	0.95	0.27	0.020	0.030	44700	78300	29.6
300930	0.22	0.55	0.20	0.023	0.030	42800	79200	29.6
500908	0.21	1.05	0.25	0.023	0.025	42600	77800	29.6
500918	0.21	1.03	0.25	0.030	0.030	41200	78600	30.5
500932	0.24	0.98	0.27	0.027	0.029	42600	77400	29.7

SHIPPING MARKS

TD-ASTM-A 106 GR. C -- 30.000 C.H. X 1.038 H.T. -- FT. ... LBS. ... N° ...
TESTED 1660 -- HEAT N° +

TPO - 6050

STAMPED

MC-TD-HEAT N° - GR. C - N°

SHIPPING NOTICE - 2551

SHEET 2 OF 2

112-214

ATTACHMENT # 3
CALC. # DC-D-01-MSC-65
Page 2 of 4

Stabilizing: A. Valerio - Bergamo

October 1962

ITALY

Customer: MESSRS. S I D B R I U S, INC. - NEW YORK, N.Y. 10022 - U.S.A.

Customer's Order: 690139 *Tubeco*

Mill Order: 791038.

SEAMLESS CARBON STEEL PIPE 30.000" O.D. X 1.038 W.T.

STEEL GRADE C ASTM-A 106

ATTACHMENT #3
Calc. # DC-D-01-MSC-65
Page 3 of 4

SHEET 3 OF 3 005050 P/0321

102-214

No	n	Ft/in	Kg	Lbs.	MSA
47	6.98	22' 11"	3554	7835	5009
48	7.03	23' 1"	3580	7892	5009
49	7.24	23' 9"	3687	8128	5009
50	6.97	22' 10"	3535	7793	5009
51	7.12	23' 4"	3620	7981	5009
52	7.32	24' 0"	3728	8219	5009
53	7.34	24' 1"	3738	8241	3009
54	7.54	24' 9"	3840	8466	5009
55	6.67	21' 11"	3375	7440	5009
56	6.96	22' 10"	3544	7813	5009
57	6.90	22' 8"	3513	7745	5009
58	7.47	24' 6"	3804	8386	5009
59	6.71	22' 0"	3380	7452	5009
60	7.21	23' 8"	3772	8316	5009
61	6.79	22' 3"	3457	7621	5009
62	6.90	22' 8" ✓	3513	7744	✓ 5009
63	6.99	22' 11"	3559	7846	5009
64	7.07	23' 2"	3600	7937	5009
65	7.10	23' 3"	3615	7970	5009
66	6.95	22' 10"	3539	7802	5009
67	7.29	23' 11"	3712	8183	5009
68	6.88	22' 7"	3503	7723	5009
69	7.31	24' 0"	3722	8205	5009
70	7.18	23' 6"	3656	8060	5009
71	6.12	20' 1"	3117	6872	5009

25

176.04

577' 6"

89663

197670

ESIBIZIONE DI ONLINE

$$M=214$$

SETTORE COLLAUDO

2011 Department
Budget - 2012

MESSRS. S I D E R I U S I N C . - NEW YORK , N.Y. 10022 - U.S.A. -

COMALUCA
2000 0000
VICI-AUTIS

791033

ORDINE DEL CLIENTE
order
BESCHLUSSE

690139

146200

ASTIS - A 1

[illegible]

NOTE: Standard round specimen

Pressure tension test

דאס איז
די גאנצע
זאך

~~COMPUTATION~~

12-22
Ch-4
11:22:22

TABLE 4.7-1
STEAM LINE SAFETY VALVES PER LOOP

<u>VALVE NUMBER</u>	<u>LIFT SETTING (+3%)*</u>	<u>ORIFICE SIZE</u>
a. SV-1A	1065 psig	16 in. ²
b. SV-1B	1065 psig	16 in. ²
c. SV-2A	1075 psig	16 in. ²
d. SV-2B	1075 psig	16 in. ²
e. SV-3	1085 psig	16 in. ²

* The lift setting pressure shall correspond to ambient conditions of the valve at nominal operating temperature and pressure.

ATTACHMENT # 4
CALC. # DC-D-01-MSC-65
Page 1 of 1

To: AMIYA K. DEY@NDG@AEPSC
Cc: Jim D. Benes@NESB@COOK, Michael E Russo@NSA@Cook
Mark R Michaelson@NESB@COOK
Richard A.F. Harris@NESB@COOK
Bcc:
From: David G Turner@NESB@COOK
Subject: Unit 1 Operational Data
Date: Tuesday, March 25, 1997 10:56:51 est
Attach:
Certify: N
Priority: Normal
Defer until:
Expires:
Forwarded by:

Amiya,

Data from the last two Unit 1 fuel cycles has been reviewed for the purpose of determining how much time the secondary side would be pressurized to greater than ~1000 psig. The logic used is that while the unit is generating power, the pressure will almost always be less than 980 psig. This 980 psig corresponds to 10% RTO.

Therefore, the period when the unit could have pressure greater than 1000 psig in the secondary cycle would be anytime when in modes 1, 2, or 3 and at less than 10% RTO in parallel. Mode 3 is a transitional mode when the primary loop temperatures are in the range of greater than 350°F up to full temperature and pressure. Including all this time would be conservative. Therefore, all the hours when the unit was in modes 1, 2, or 3 are used to bound the conservative time when the unit may have a secondary side pressure of >1000 psig.

The last two Cycle's statistics are:

Hours in M1-M3 = 22248.7
Hours Critical = 21335.8
Hours Parallel = 21003.2

Hours in M1-M3 not in Parallel = 1245.5
Percent of M1-M3 time possible at >1000 psig = 5.6% of the time

My thanks to Mike Russo for sharing some of his statistics on Unit 1 hours operation in the different modes.

Contact me if you have any questions. Extension/pager 1095.

Dave Turner

ATTACHMENT # 5
CALC. # DC-D-01-MSC-66
Page 1 of 1

DONALD C. COOK NUCLEAR PLANT

NEMD/NESD

Section

DESIGN VERIFICATION CHECKLIST - CALCULATIONS

Calculation Number DC-D-01-MSC-66

Rev. 0

Signature of Verifier

Date

4-2-97

1.0 Were the inputs correctly selected, incorporated and documented into the calculation?

Yes ☒ N/A ☐

Basis: THE DESIGN INPUTS, AS REFERENCED THROUGHOUT THE CALCULATION, ARE ACCURATE AND CORRECTLY IMPLEMENTED.

2.0 Are assumptions necessary to perform the calculation adequately described and reasonable?

Yes ☐ N/A ☒

Basis: NO DESIGN ASSUMPTIONS WERE USED.

3.0 Are the applicable codes, standards and regulatory requirements identified and requirements for design met?

Yes ☒ N/A ☐

Basis: THE PURPOSE OF THIS CALCULATION WAS TO JUSTIFY ADHERENCE TO CODE AND REGULATORY REQUIREMENTS.

4.0 Was an appropriate design method used?

Yes ☒ N/A ☐

Basis: THE DESIGN METHODOLOGY USED IN THIS CALCULATION ADHERES TO THE APPLICABLE CODES AS REQUIRED.

5.0 Is the output reasonable compared to input?

Yes ☒ N/A ☐

Basis: CONSIDERING THE CODE REQUIREMENTS AND ASSOCIATED REFERENCES AS REQUIRED, THE ACHIEVED RESULTS ARE REASONABLE

6.0 Are the results numerically correct?

Yes ☒ N/A ☐

Basis: THE RESULTS WERE VERIFIED BY THE USE OF A CALCULATOR.

