

# CHEM-NUCLEAR SYSTEMS

**INFORMATION  
ONLY**

CONTROLLED COPY NO. 3242

	PRINTED OR TYPED NAME	SIGNATURE	DATE
PREPARED BY:	MARK WHITTAKER	<i>ms Whittaker</i>	8/17/98
INDEPENDENT REVIEWER:	CHARLES WITT	<i>CRW</i>	8/17/98

DOCUMENT TITLE:

EVALUATION OF DOSE RATE FROM U-TUBE END OF D.C. COOK STEAM  
GENERATOR LOWER ASSEMBLY

DOCUMENT NO. ER-98-012	REV. 1	PAGE 1 of 4
---------------------------	-----------	----------------

## TABLE OF CONTENTS

	<u>Page No.</u>
1.0 INTRODUCTION .....	3
2.0 EVALUATION METHODOLOGY .....	3
3.0 RESULTS .....	3
4.0 CONCLUSION .....	4
5.0 ATTACHMENTS .....	4

## 1.0 INTRODUCTION

American Electric Power (AEP) replaced the D.C. Cook Unit 2 steam generators in 1988. As part of the replacement project, the steam domes were removed and a 3" steel end plate was welded to the transition cone to seal the steam generator lower assembly (SGLA) prior to placing them in storage. CNS intends to ship these SGLAs from D.C. Cook unpackaged with the approval of DOT. To support the DOT request for exemption from several of the shipping requirements allowing the SGLAs to be shipped unpackaged, the dose rate was estimated at the end of the SGLA for the hypothetical case that the 3" steel end plate was removed during transportation. This dose rate estimate was compared to the limiting dose rate for a Type A packaged shipment of SCO.

## 2.0 EVALUATION METHODOLOGY

The radioactivity in the heat exchanger tubes produces a radiation field which can be detected and quantified external to the SGLA. The amount of radioactivity can be estimated from a model of the SGLA by adjusting the input activity until the calculated dose rate matches the measured dose rate. Using this estimated activity and adjusting the model by removing the end plate, the dose rate at the now open end of the SGLA can be calculated.

AEP provided survey results of external measurements made on the four SGLAs. Included in the survey was a measurement on contact at the center of the steel plate welded to the transition cone. The maximum dose rate measured was 42 mrem/hr.

The Microshield point kernel computer code was used to model the SGLA and calculate dose rates at the center of the end plate. The contaminated heat exchanger tubes were assumed to be the only source of radiation. The isotope was assumed to be Co-60. At the transition cone end of the steam generator, the tubes bend in a u-shape forming a semi-spherical array of tubes; the remaining straight section of tubes forms a cylindrical array. Microshield allows a limited number of source geometries, none of which exactly match the shape of the tube bundle. To approximate the tube bundle, two source geometries were used, a sphere and a cylinder. The sphere was expected to underestimate the actual source and the cylinder to overestimate it. For each geometry, a source was determined that produced a dose rate on the outside of the 3" plate equal to that measured by AEP, i.e., 42 mrem/hr. Without changing the activity, the 3" steel plate was replaced by air and the resulting dose rate calculated.

## 3.0 RESULTS

The activity which results in 42 mrem/hr on the end plate is 6.3 Ci and 27.5 Ci for the spherical and cylindrical model, respectively. The dose rate without the end plate, calculated with the spherical model, is 580 mrem/hr. The dose rate without the end plate, calculated with the cylindrical model, is 870 mrem/hr.

#### 4.0 CONCLUSION

The estimated dose rate at the transition cone end of the SGLA if the steel plate were removed would be between 580 and 870 mrem/hr. This result is less than the limit of 1000 mrem/hr at a distance of 3 meters.

#### 5.0 ATTACHEMENTS

Microshield Results  
Sketch SK:46628-001  
AEP Surveys

## ATTACHMENTS

Microshield Results  
4 pages

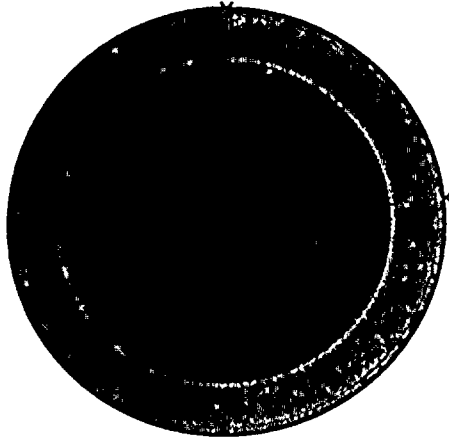
Sketch, SGLA Parameters, SK:46628-001  
1 page

AEP Surveys  
4 pages

Page : 1  
JOS File : DCCOKEND.MS5  
Run Date: August 14, 1998  
Run Time: 1:36:57 PM  
Duration : 00:00:01

File Ref: \_\_\_\_\_  
Date: \_\_\_\_\_  
By: \_\_\_\_\_  
Checked: \_\_\_\_\_

Case Title: DCCOOK END  
Description: DCCOOK dose with end plate  
Geometry: 6 - Sphere



Radius 151.994 cm 4 ft 11.8 in

#### Dose Points

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	203.6 cm 6 ft 8.2 in	0 cm 0.0 in	0 cm 0.0 in

#### Shields

Shield Name	Dimension	Material	Density
Source	1.47e+07 cm <sup>3</sup>	Alloy 600	0.658
Shield 1	42.951 cm	Air	0.00122
Shield 2	7.62 cm	Iron	7.86
Transition		Air	0.00122
Air Gap		Air	0.00122

#### Source Input

Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	$\mu\text{Ci/cm}^3$	Bq/cm <sup>3</sup>
Co-60	6.3000e+000	2.3310e+011	4.2833e-001	1.5848e+004

#### Buildup

The material reference is : Shield 2

#### Integration Parameters

Rho (Radial)	10
Angle	10

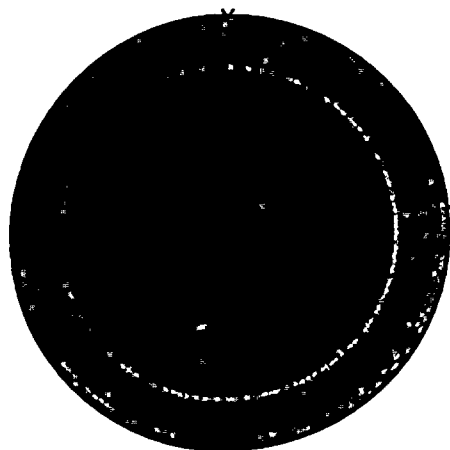
#### Results

Energy MeV	Activity photons/sec	Fluence Rate		Exposure Rate	
		<u>No Buildup</u> MeV/cm <sup>2</sup> /sec	<u>With Buildup</u> MeV/cm <sup>2</sup> /sec	<u>No Buildup</u> mR/hr	<u>With Buildup</u> mR/hr
0.6938	3.802e+07	3.985e-02	3.651e-01	7.694e-05	7.050e-04
1.1732	2.331e+11	1.626e+03	1.001e+04	2.906e+00	1.789e+01
1.3325	2.331e+11	2.496e+03	1.392e+04	4.330e+00	2.414e+01
TOTALS:	4.662e+11	4.122e+03	2.393e+04	7.237e+00	4.204e+01

age : 1  
OS File : DCCOKEND.MS5  
un Date: August 11, 1998  
ur Time: 7:57:59 AM  
ui on : 00:00:01

File Ref: \_\_\_\_\_  
Date: \_\_\_\_\_  
By: \_\_\_\_\_  
Checked: \_\_\_\_\_

Case Title: DCCOOK END  
Description: DCCOOK dose without end plate  
Geometry: 6 - Sphere



Source Dimensions  
Radius 151.994 cm 4 ft 11.8 in

Dose Points  
# 1 X 203.6 cm 6 ft 8.2 in Y 0 cm 0.0 in Z 0 cm 0.0 in

Shield Name	Dimension	Material	Density
Source	1.47e+07 cm <sup>3</sup>	Alloy 600	0.658
Shield 1	42.951 cm	Air	0.00122
Shield 2	7.62 cm	Air	0.00122
Transition		Air	0.00122
Air Gap		Air	0.00122

Source Input  
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	μCi/cm <sup>3</sup>	Bq/cm <sup>3</sup>
Co-60	6.3000e+000	2.3310e+011	4.2833e-001	1.5848e+004

Buildup  
The material reference is : Source

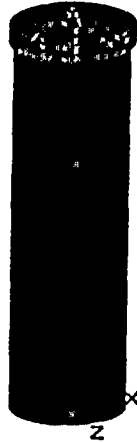
Integration Parameters  
Rho (Radial) 10  
Angle 10

Energy MeV	Activity photons/sec	Fluence Rate		Exposure Rate	
		No Buildup	With Buildup	No Buildup	With Buildup
0.6938	3.802e+07	6.200e+00	1.219e+01	1.197e-02	2.353e-02
1.1732	2.331e+11	8.267e+04	1.510e+05	1.477e+02	2.698e+02
1.3325	2.331e+11	9.988e+04	1.786e+05	1.733e+02	3.099e+02
TOTALS:	4.662e+11	1.826e+05	3.296e+05	3.210e+02	5.797e+02

age : 1  
OS File : DCCCKENDC.MS5  
Run Date : August 11, 1998  
Run Time : 8:12:16 AM  
Duration : 00:00:01

File Ref: \_\_\_\_\_  
Date: \_\_\_\_\_  
By: \_\_\_\_\_  
Checked: \_\_\_\_\_

Case Title: DCCOOK END CYL  
Description: DCCOOK END DOSE CYLINDER MODEL  
Geometry: 8 - Cylinder Volume - End Shields



	Height	1.1e+3 cm	34 ft 8.6 in
	Radius	151.994 cm	4 ft 11.8 in

Dose Points

	<u>X</u>	<u>Y</u>	<u>Z</u>
# 1	0 cm 0.0 in	1109.8 cm 36 ft 4.9 in	0 cm 0.0 in

Shields

<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>
Source	7.68e+07 cm <sup>3</sup>	Alloy 600	0.659
Shield 1	42.951 cm	Air	0.00122
Shield 2	7.62 cm	Iron	7.86
Air Gap		Air	0.00122

Source Input

Grouping Method : Actual Photon Energies

<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>μCi/cm<sup>3</sup></u>	<u>Bq/cm<sup>3</sup></u>
Co-60	2.7500e+001	1.0175e+012	3.5809e-001	1.3249e+004

Buildup

The material reference is : Shield 2

Integration Parameters

Radial	20
Circumferential	10
Y Direction (axial)	10

Results

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm<sup>2</sup>/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm<sup>2</sup>/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
0.6938	1.660e+08	3.687e-02	3.471e-01	7.119e-05	6.702e-04
1.1732	1.018e+12	1.559e+03	9.948e+03	2.786e+00	1.778e+01
1.3325	1.018e+12	2.417e+03	1.399e+04	4.194e+00	2.427e+01
TOTALS:	2.035e+12	3.976e+03	2.394e+04	6.980e+00	4.205e+01



age : 1  
OS File : DCCCKENDC.MS5  
un Date: August 11, 1998  
u me: 8:13:20 AM  
u on : 00:00:01

File Ref: \_\_\_\_\_  
Date: \_\_\_\_\_  
By: \_\_\_\_\_  
Checked: \_\_\_\_\_

Case Title: DCCOOK END CYL  
Description: DCCOOK END DOSE CYLINDER MODEL  
Geometry: 8 -Cylinder Volume - End Shields



	Source Dimensions	
Height	1.1e+3 cm	34 ft 8.6 in
Radius	151.994 cm	4 ft 11.8 in

	Dose Points		
	X	Y	Z
# 1	0 cm	1109.8 cm	0 cm
	0.0 in	36 ft 4.9 in	0.0 in

	Shields			
<u>Shield Name</u>	<u>Dimension</u>	<u>Material</u>	<u>Density</u>	
Source	7.68e+07 cm <sup>3</sup>	Alloy 600	0.659	
Shield 1	42.951 cm	Air	0.00122	
Shield 2	7.62 cm	Air	0.00122	
Air Gap		Air	0.00122	

Source Input  
Grouping Method : Actual Photon Energies

<u>Nuclide</u>	<u>curies</u>	<u>becquerels</u>	<u>μCi/cm<sup>3</sup></u>	<u>Bq/cm<sup>3</sup></u>
Co-60	2.7500e+001	1.0175e+012	3.5809e-001	1.3249e+004

Buildup  
The material reference is : Source

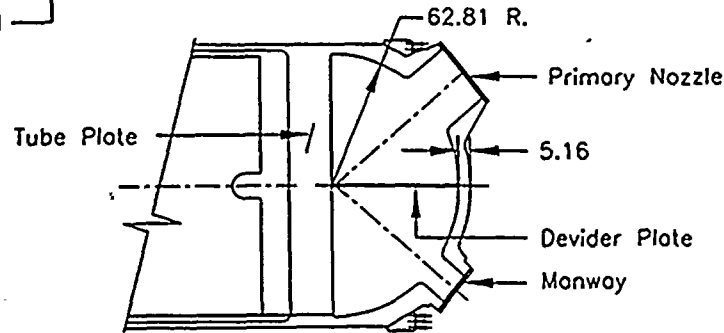
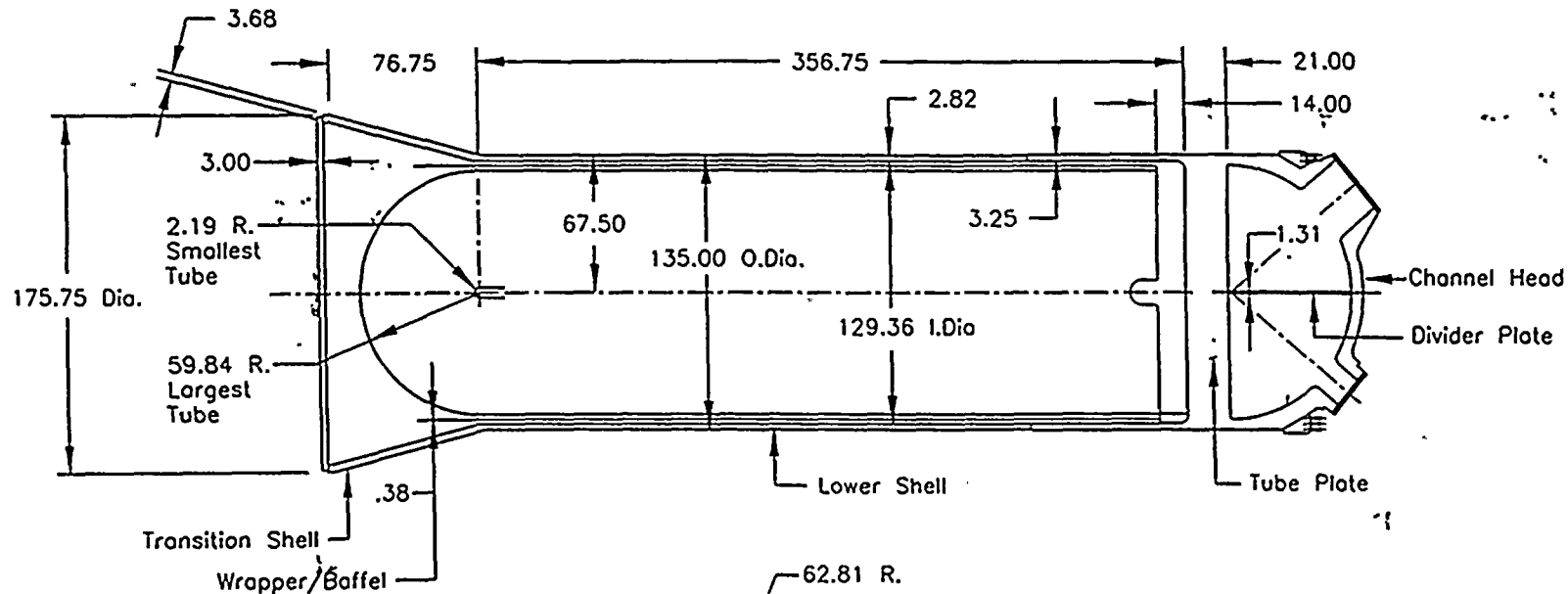
Integration Parameters

Radial	20
Circumferential	10
Y Direction (axial)	10

Results

<u>Energy</u> <u>MeV</u>	<u>Activity</u> <u>photons/sec</u>	<u>Fluence Rate</u> <u>MeV/cm<sup>2</sup>/sec</u> <u>No Buildup</u>	<u>Fluence Rate</u> <u>MeV/cm<sup>2</sup>/sec</u> <u>With Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>No Buildup</u>	<u>Exposure Rate</u> <u>mR/hr</u> <u>With Buildup</u>
0.6938	1.660e+08	9.872e+00	1.876e+01	1.906e-02	3.621e-02
1.1732	1.018e+12	1.294e+05	2.271e+05	2.313e+02	4.059e+02
1.3325	1.018e+12	1.556e+05	2.671e+05	2.700e+02	4.635e+02
TOTALS:	2.035e+12	2.851e+05	4.943e+05	5.013e+02	8.694e+02

DC COOK UNIT 2 SGLA  
REFERENCE DATA FOR WASTE CHARACTERIZATION



Channel Head Region Components

SGLA PARAMETERS	
Numbers of tubes	3,388
Tube outside diameter, in.	0.875
Nominal tube wall thickness, in.	0.050
Tube material	Alloy 600
SK:46628-001	Rev. 0

# RADIOLOGICAL AREA STATUS SHEET

AREA DESCRIPTION S/G MAUSOLEUM - Generator Detail

MAP NO.     

## AREA CLASSIFICATION

- ☒ RADIATION
- ☐ HIGH RADIATION
- ☐ EXTREME HIGH RADIATION
- ☐ CONTAMINATION
- ☐ AIRBORNE RADIOACTIVITY

## REMARKS

Dose Rate Survey Only  
J. Gratzel/S. Olsowski

## METER TYPE/NO.

RSO #350

## REASON FOR SURVEY

S/G Dose Rates

RWP USED: 0510-01

UNLESS NOTED: \* DENOTES CONTACT / 30 CM

DOSE RATES IN MR / HR, AT, WAIST LEVEL & CONTAMINATION IN DPM / 100CM<sup>2</sup>

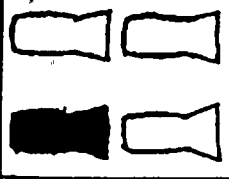
SURVEYED BY J. Gratzel

TIME / 030

DATE 7-6-98

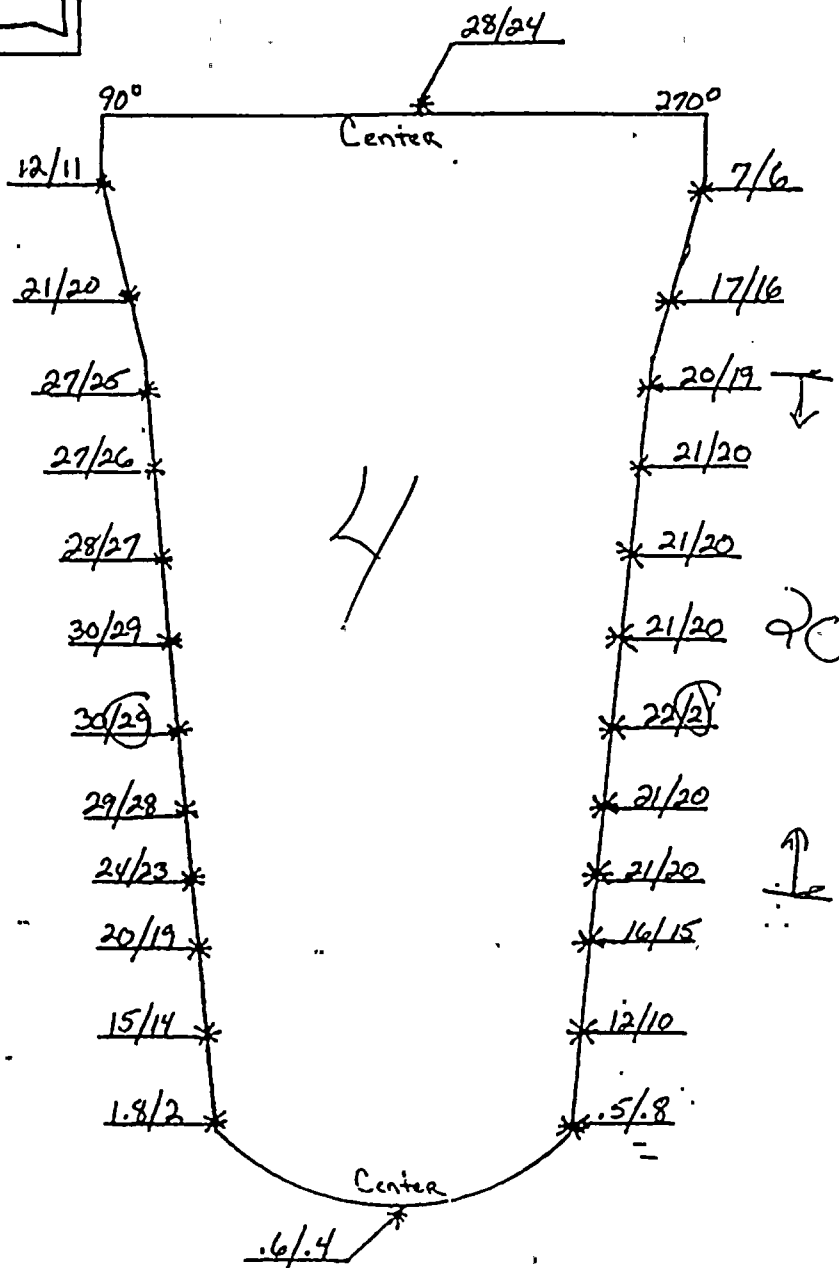
REVIEWED BY J. Gratzel

DATE 7-7-98



## CONTAMINATION/REMARKS

1	/
2	/
3	/
4	/
5	/
6	/
7	/
8	/
9	/
10	/
11	/
12	/
13	/
14	/
15	/
16	/
17	/
18	/
19	/
20	/
21	/
22	/
23	/
24	/
25	/
26	/
27	/
28	/
29	/
30	/



# RADIOLOGICAL AREA STATUS SHEET

AREA DESCRIPTION S/G MAUSOLEUM - Generator Detail

MAP NO.       

## AREA CLASSIFICATION

- ☒ RADIATION
- ☐ HIGH RADIATION
- ☐ EXTREME HIGH RADIATION
- ☐ CONTAMINATION
- ☐ AIRBORNE RADIOACTIVITY

## REMARKS

Dose Rate Survey Only  
J. Gentile / S. Oburshi

## METER TYPE/NO.

RSO #350

## REASON FOR SURVEY

S/G Dose Rates

RWP USED: 05/0-01

UNLESS NOTED: \* DENOTES CONTACT / 30 CM.

DOSE RATES IN MR / HR AT WAIST LEVEL & CONTAMINATION IN DPM / 100 CM<sup>2</sup>

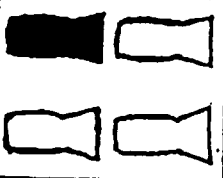
SURVEYED BY J. Gentile

TIME 1030

DATE 7-6-98

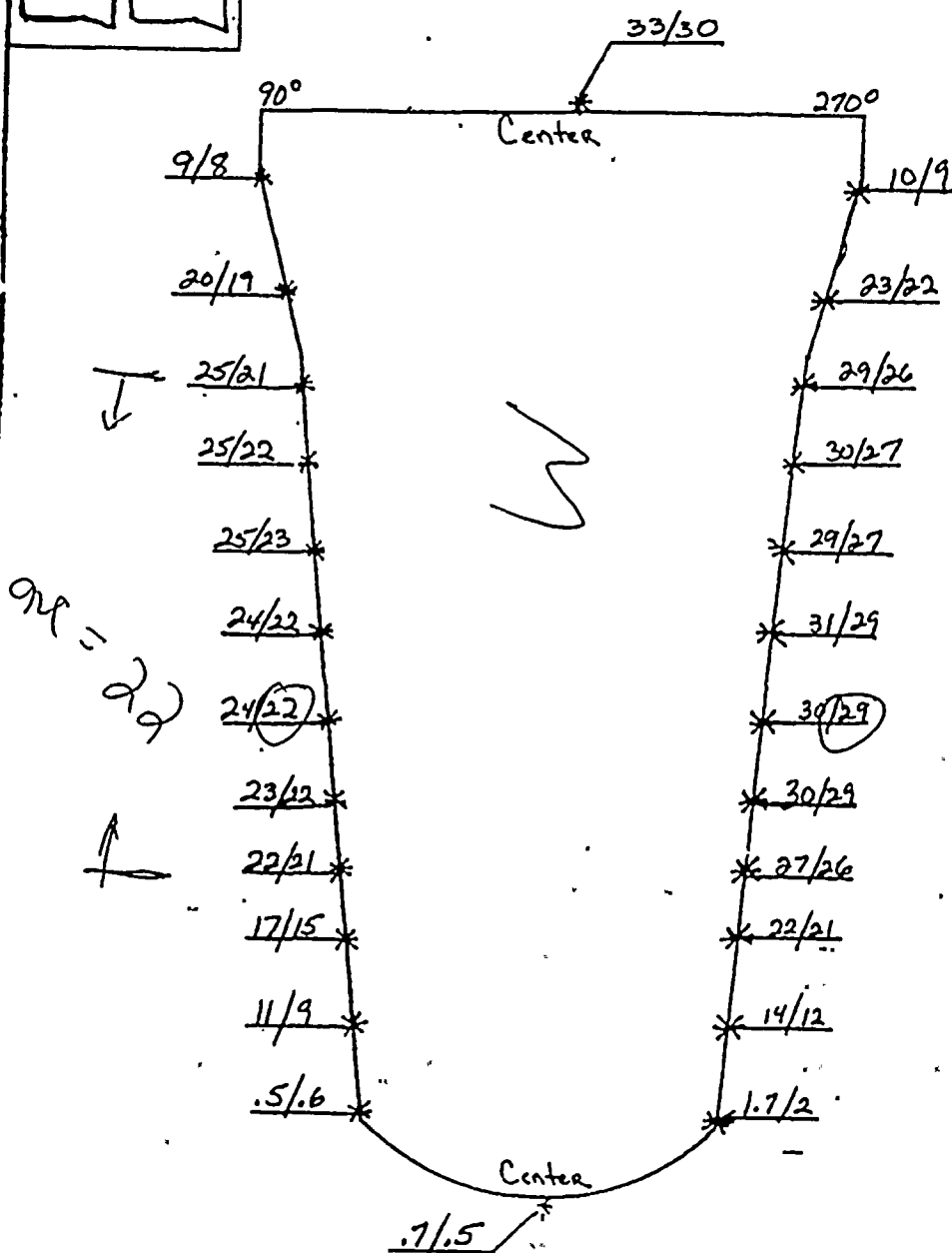
REVIEWED BY J. Gentile

DATE 7-7-98



## CONTAMINATION / REMARKS

1	/
2	/
3	/
4	/
5	/
6	/
7	/
8	/
9	/
10	/
11	/
12	/
13	/
14	/
15	/
16	/
17	/
18	/
19	/
20	/
21	/
22	/
23	/
24	/
25	/
26	/
27	/
28	/
29	/
30	/



# RADIOLOGICAL AREA STATUS SHEET

AREA DESCRIPTION S/G MAUSOLEUM - GENERATOR Detail

MAP NO. —

## AREA CLASSIFICATION

- ☒ RADIATION
- ☐ HIGH RADIATION
- ☐ EXTREME HIGH RADIATION
- ☐ CONTAMINATION
- ☐ AIRBORNE RADIOACTIVITY

## REMARKS

Dose Rate Survey Only  
J. Gentile / S. D'Amico

## METER TYPE/NO.

RSO #350

## REASON FOR SURVEY

S/G Dose Rates

RWP USED: OS/0-01

UNLESS NOTED: \* DENOTES CONTACT / 30 CM

DOSE RATES IN MR / HR AT WAIST LEVEL & CONTAMINATION IN DPM / 100CM<sup>2</sup>

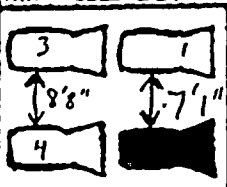
SURVEYED BY J. Gentile

TIME 1030

DATE 7-6-98

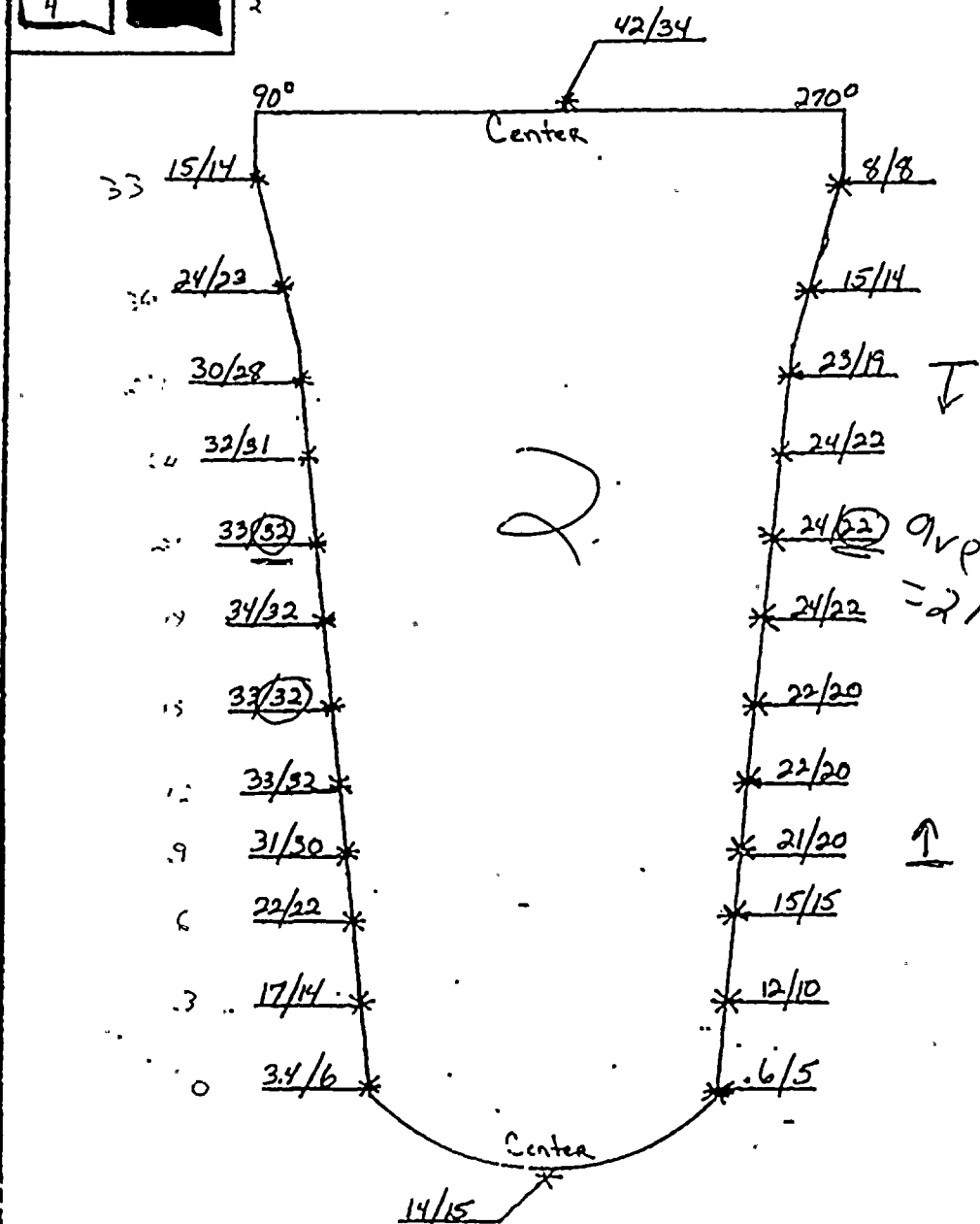
REVIEWED BY S. D'Amico

DATE 7-7-98



## CONTAMINATION/REMARKS

1	/
2	/
3	/
4	/
5	/
6	/
7	/
8	/
9	/
10	/
11	/
12	/
13	/
14	/
15	/
16	/
17	/
18	/
19	/
20	/
21	/
22	/
23	/
24	/
25	/
26	/
27	/
28	/
29	/
30	/



# RADIOLOGICAL AREA STATUS SHEET

AREA DESCRIPTION S/G MAUSOLEUM - Generator Detail

MAP NO.     

## AREA CLASSIFICATION

- ☒ RADIATION
- ☐ HIGH RADIATION
- ☐ EXTREME HIGH RADIATION
- ☐ CONTAMINATION
- ☐ AIRBORNE RADIOACTIVITY

## REMARKS

Dose Rate Survey Only

J. Gontale / S. Ouzanski

## METER TYPE/NO.

RSO #350

## REASON FOR SURVEY

S/G Dose Rates

RWP USED: 05/0-01

UNLESS NOTED: \* DENOTES CONTACT / 30 CM

DOSE RATES IN MR / HR AT WAIST LEVEL & CONTAMINATION IN DPM / 100CM<sup>2</sup>

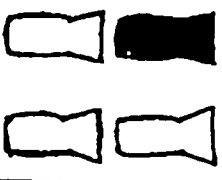
SURVEYED BY J. Gontale / S. Ouzanski

TIME 1050

DATE 7-6-98

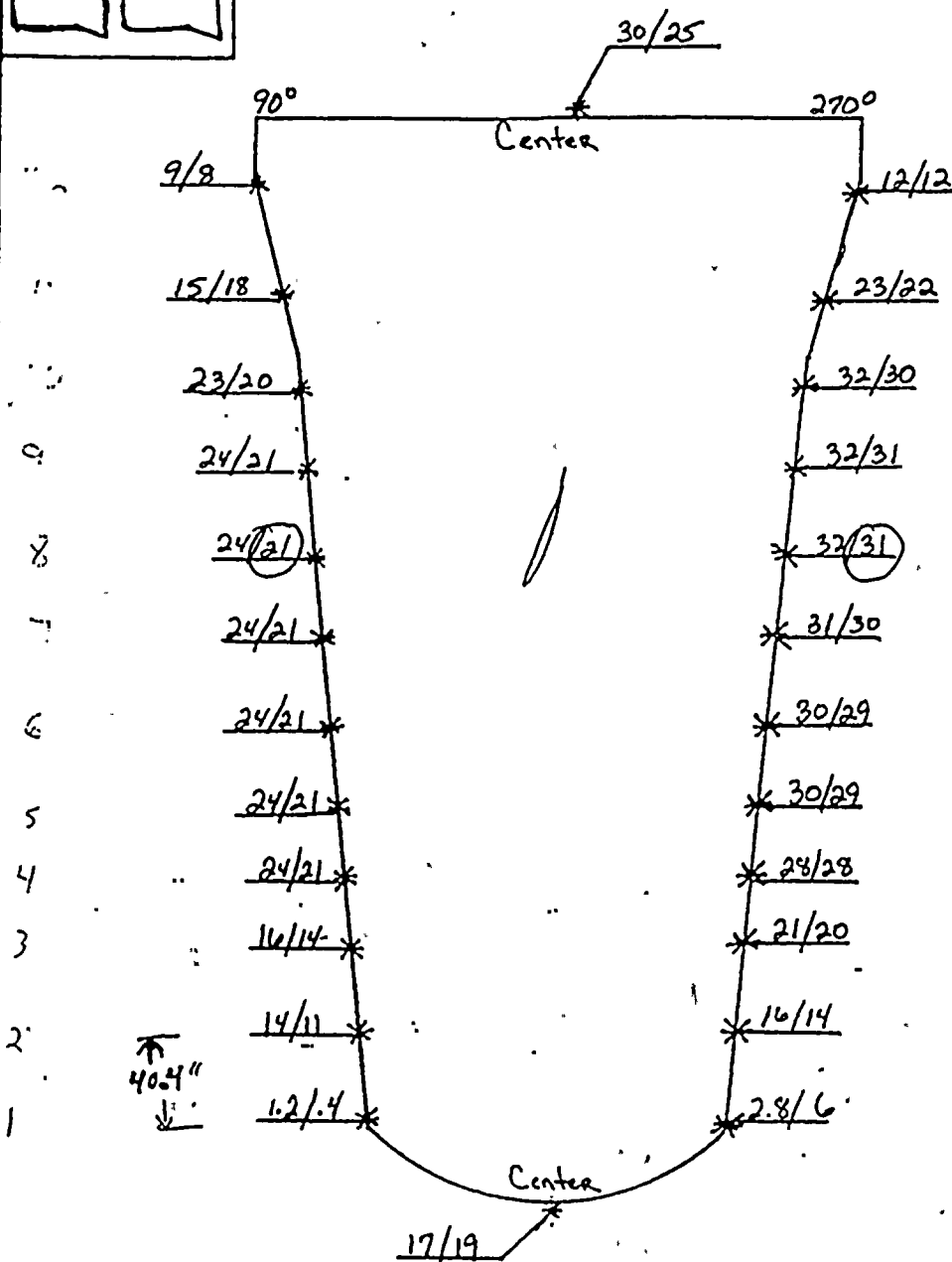
REVIEWED BY J. Gontale / S. Ouzanski

DATE 7-7-98



## CONTAMINATION/REMARKS

1	/
2	/
3	/
4	/
5	/
6	/
7	/
8	/
9	/
10	/
11	/
12	/
13	/
14	/
15	/
16	/
17	/
18	/
19	/
20	/
21	/
22	/
23	/
24	/
25	/
26	/
27	/
28	/
29	/
30	/

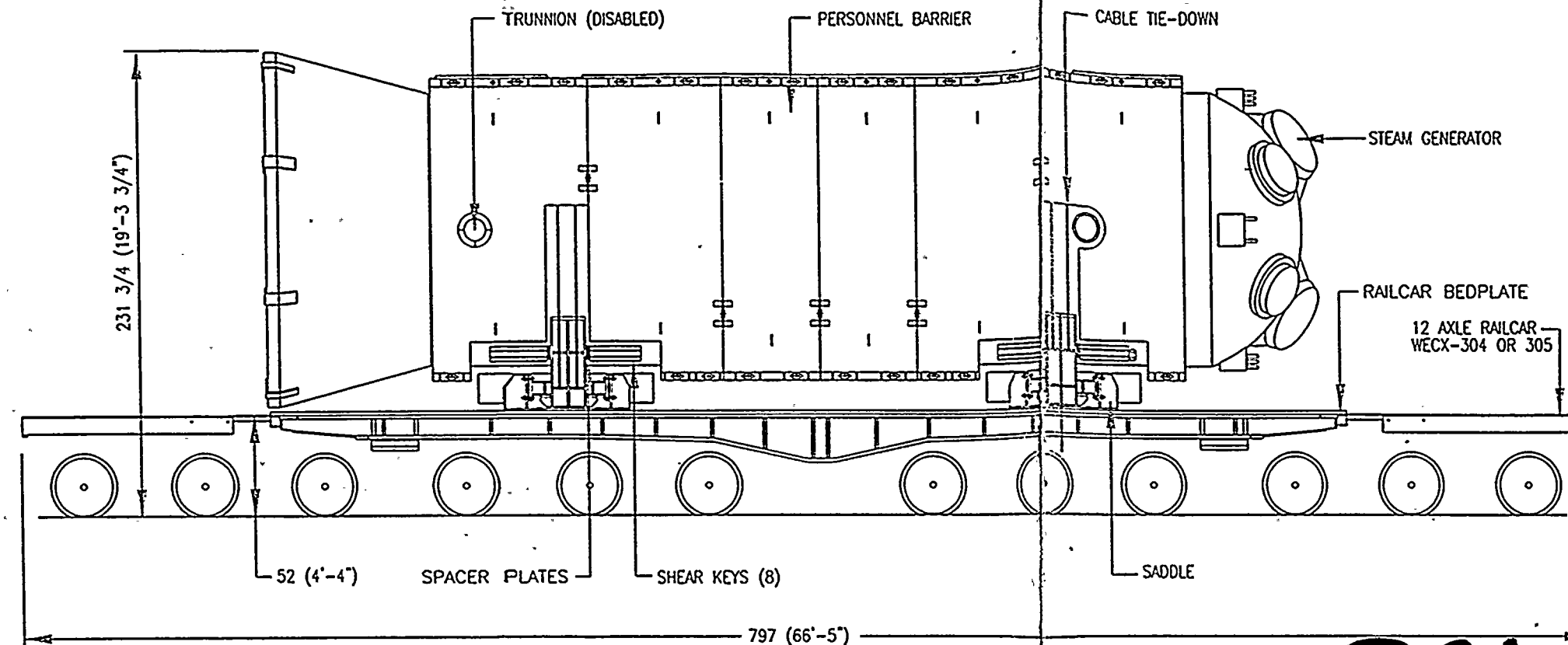


AMERICAN ELECTRIC POWER  
DONALD C. COOK NUCLEAR PLANT

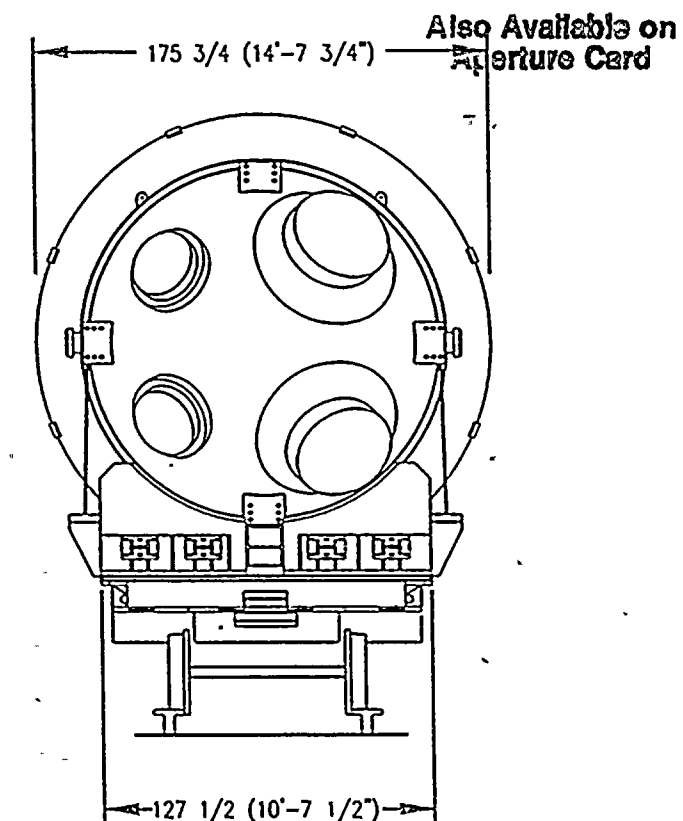
STEAM GENERATOR DISPOSAL EXEMPTION REQUEST

ATTACHMENT 4

CLOSURE AND SHEAR KEY DRAWINGS



ELEVATION VIEW



APERTURE CARD

Also Available on Aperture Card

9810140058-01

INFORMATION ONLY

3242

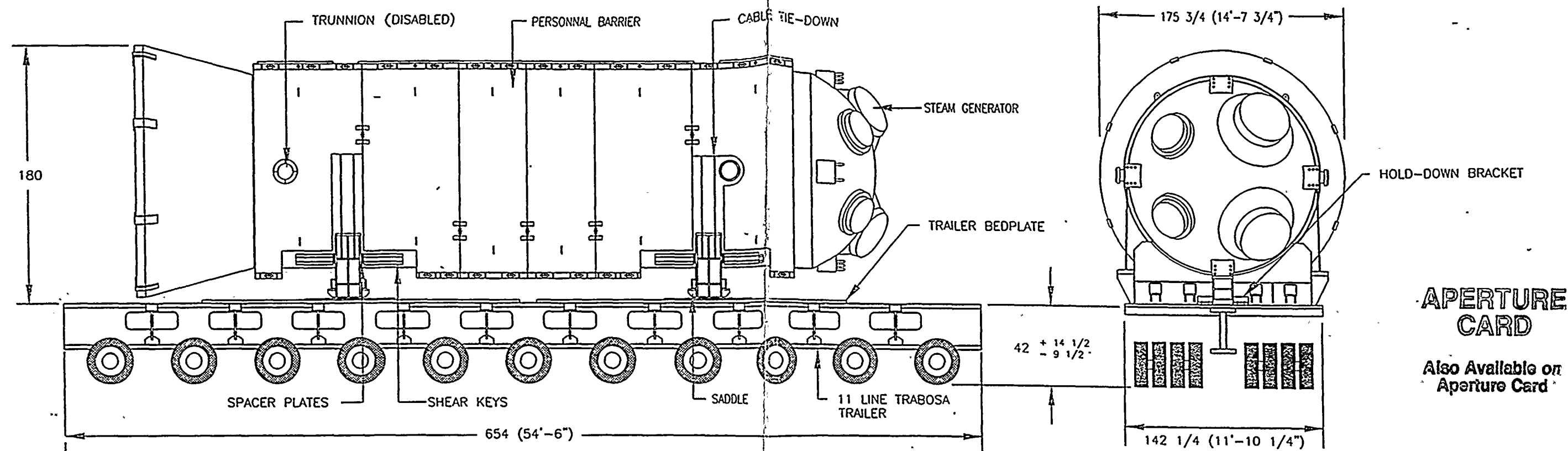
NOTES:

- 1: FOR CLOSURE DETAILS OF THE CONTAINMENT SEE CNS DRAWING No. C-110-B-46628-004
- 2: FOR SHEAR-KEY DETAILS SEE CNS DRAWING No. C-110-B-46628-003
- 3: STEAM GENERATOR LOWER ASSEMBLY SHRINK-WRAP NOT SHOWN IN THIS DRAWING FOR CLARITY
- 4: ALL DIMENSIONS ARE FOR REFERENCE ONLY

<input type="checkbox"/> PROPRIETARY <input checked="" type="checkbox"/> NON-PROPRIETARY		DO NOT SCALE PRINT		CHEM-NUCLEAR SYSTEMS	
SCM No. 54643		PROJECT No. 46628   FILE ID. 10620100 REVIEWERS OF ORIGINAL (REV. 0) DRAWN BY R. BREHEN 9/1/98 CHECKED BY <i>[Signature]</i> 9/1/98 ENGINEER <i>[Signature]</i> 9/1/98		DC COOK STEAM GENERATOR TRANSPORTATION CONFIGURATION	
THIS DRAWING IS THE PROPERTY OF CHEM-NUCLEAR SYSTEMS IS LOANED UPON THE CONDITION THAT IT IS NOT TO BE REPRODUCED, COPIED OR LOANED TO OTHERS WITHOUT WRITTEN PERMISSION OF CHEM-NUCLEAR SYSTEMS AND IS TO BE RETURNED UPON REQUEST.		SIZE B DRAWING NUMBER C-110-B-46628-006 SCALE 1/75   WT. N / A   SHEET 1 OF 2		REV. 0	



10-800410182

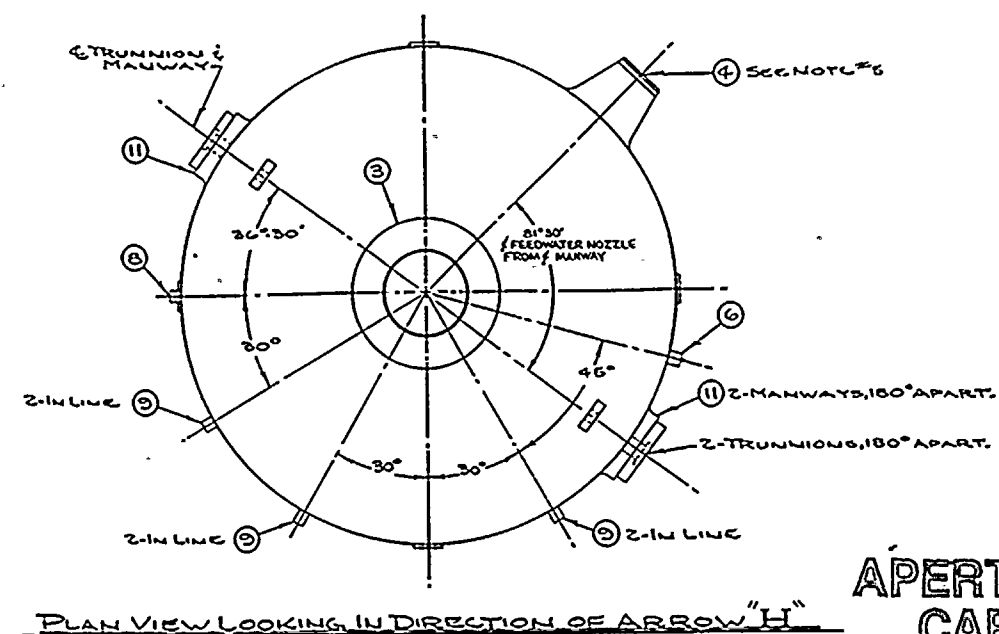
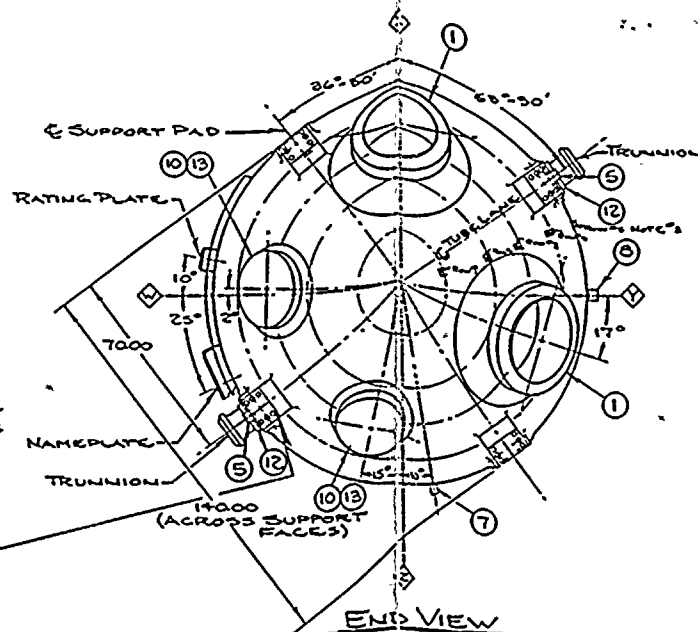
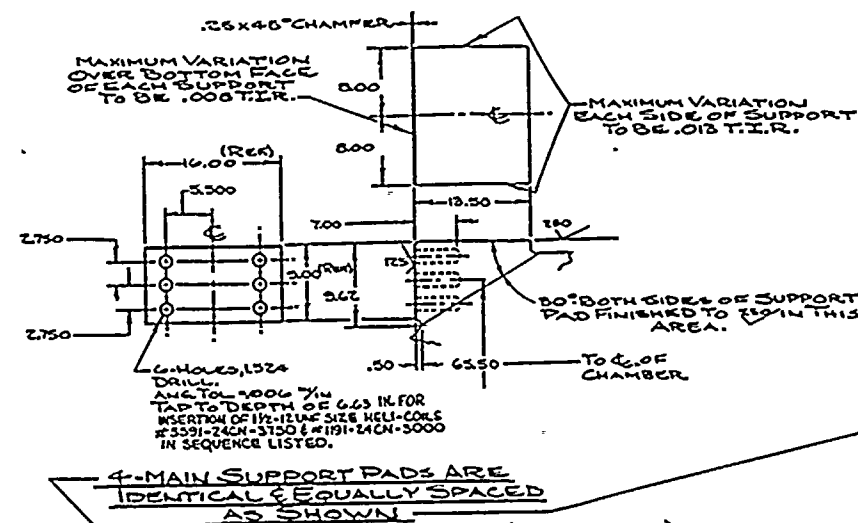


ELEVATION VIEW

9810140058-02

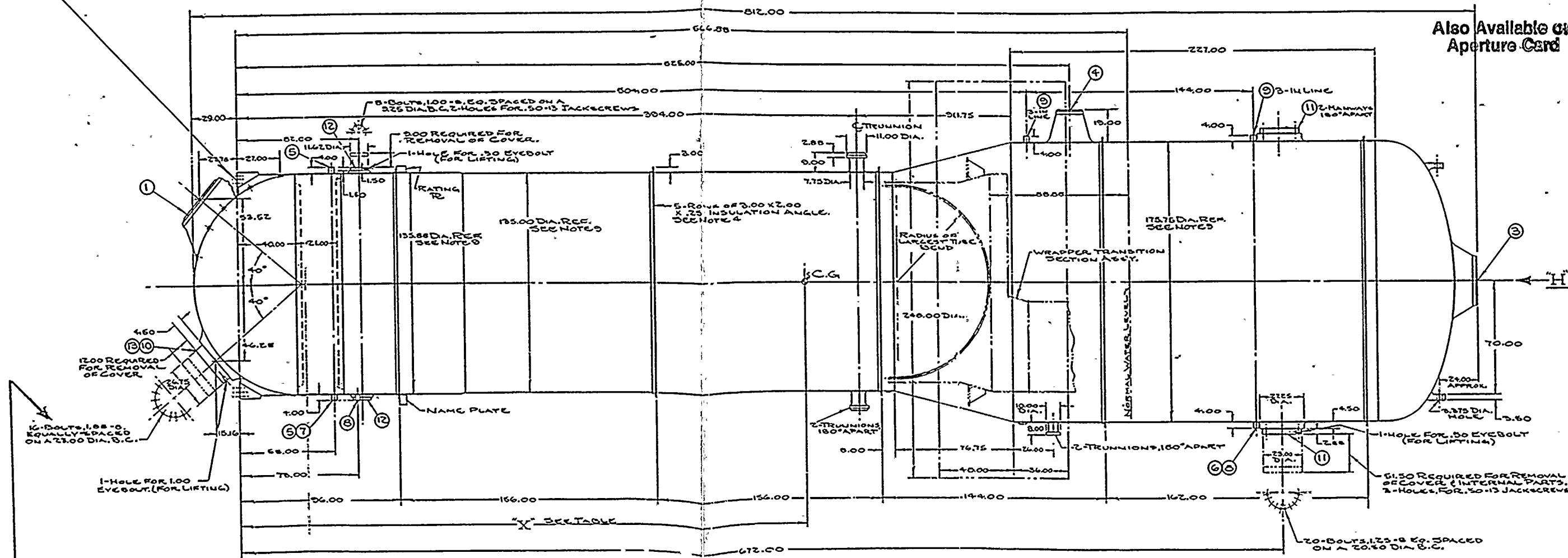
<input type="checkbox"/> PROPRIETARY		DO NOT SCALE PRINT		CHEM-NUCLEAR SYSTEMS	
<input checked="" type="checkbox"/> NON-PROPRIETARY		DIMENSIONS ARE IN INCHES UNLESS NOTED			
FSCM No. 54643		PROJECT No. 46628	FILE ID. 10620200	DC COOK STEAM GENERATOR	
THIS DRAWING IS THE PROPERTY OF CHEM-NUCLEAR SYSTEMS IT IS LOANED UPON THE CONDITION THAT IT IS NOT TO BE REPRODUCED, COPIED OR LOANED TO OTHERS WITHOUT WRITTEN PERMISSION OF CHEM-NUCLEAR SYSTEMS AND IS TO BE RETURNED UPON REQUEST.		REVIEWERS OF ORIGINAL (REV. 0)		TRANSPORTATION CONFIGURATION	
		DRAWN BY R. BREHEN 9/1/98			
		CHECKED BY <i>Paul H. M. Jones</i> 9/1/98			
		ENGINEER <i>Paul H. M. Jones</i> 9/1/98		SIZE B	DRAWING NUMBER C-110-B-46628-006
				SCALE 1/75	WT. N / A
				REV. 0 SHEET 2 OF 2	

70-82007-0189



APERTURE  
CARD

**Also Available on  
Aperture Card**



16 Bolts  
RFC '12-2960 added primary bolt washers  
RFC 12-2963 insert Heli-Coils at various  
bolt hole locations.

NOT A TRUE ORIENTATION  
FOR TRUE ORIENTATION SEE END VIEW

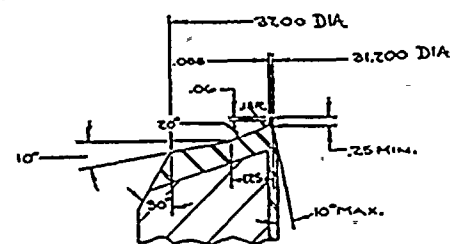
STATION  
END VIEW

9810140058-03

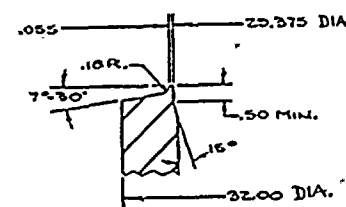
FIGURE 1-1 - *Continued*

FIGURE 1-1 - *Continued*

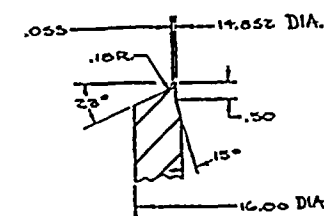
08-20401018



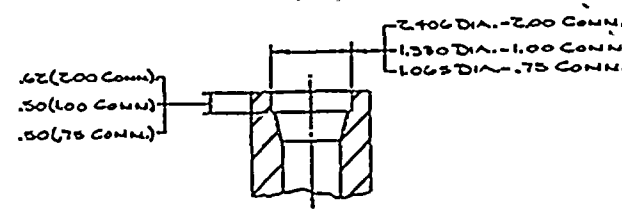
DETAIL A



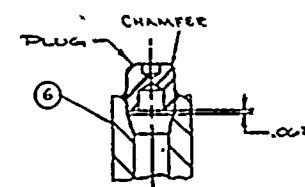
DETAIL B



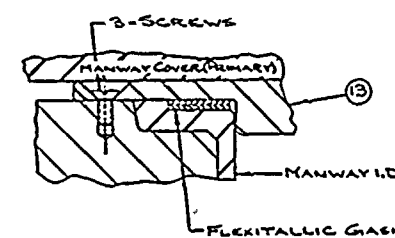
DETAIL C



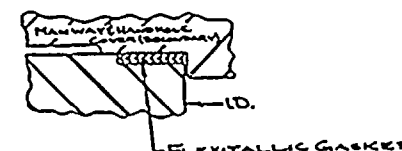
DETAIL D



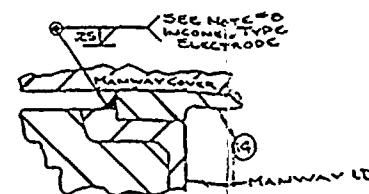
DETAIL H



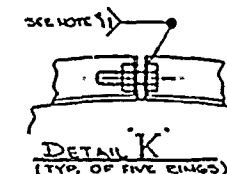
DETAIL E  
NORMAL CLOSURE ASSEMBLY



DETAIL F  
NORMAL CLOSURE ASSEMBLY



DETAIL I  
ALTERNATE CLOSURE ASSEMBLY  
WELD DIAPHRAGM IN FIELD



DETAIL K  
(TYP. OF FIVE RINGS)

Pc. No.	Title	Quan.	Material Spec.	See Detail	Size	Remarks
1	Primary Nozzle (Main)	2	SA-216 WCC With Ty. 308L S.S. Ends	A	31.00 I.D.	
2						
3	Steam Outlet	1	SA-508, Cl. 2	B	32.00	
4	Feedwater Inlet	1	SA-508, Cl. 2	C	16.00	Schedule 60
5	Bottom Blowdown	2	SA-508, Cl. 1	D	2.00	
6	Steam Drum Pressure Tap	1	SA-508, Cl. 1	D&H	1.00	Plugged
7	Shell Drain	1	SA-508, Cl. 1	D	1.00	
8	Wide Range Water Level Tap	2	SA-508, Cl. 1	D	.75	
9	Narrow Range Water Level Tap	6	SA-508, Cl. 1	D	.75	
10	Manway (Primary)	2	SA-533, Gr. A, Cl. 1	E	16.00 I.D.	Cover Weight
11	Manway (Secondary)	2	SA-516, Gr. 70	F	16.00 I.D.	Cover Weight
12	Handhole (Secondary)	2	SA-516, Gr. 70	F	6.00 I.D.	Cover Weight
13	Insert (Primary)	2	SA-240, Type 304	E	20.50 O.D.	Weight = 51 L
14	Diaphragm (Primary)	2	S8-168	J	18.09 O.D.	See Note 7

SA-533 GR. A, Cl. 2  
APPROVED ALTERNATE MATERIAL  
PER RF 12-2965  
WEIGHTS AND C. G.

Condition	Weight (Lbs.)	"X" (C. G.)
Lower Shell Dry Weight	439,000	
Upper Shell Dry Weight	223,000	
Total Dry Weight	662,000	350.5
Normal Operating (100% Load)	801,000	344.5
Flooded (Water at 70°F)	1,094,000	383.1

## APERTURE CARD

Also Available on  
Aperture Card

DESIGN DATA  
Size - 51,500 Square Feet

	Pressure (Initial Hydrotest)	Pressure (Design)	Temperature (Design)
PRIMARY	3106 PSIG	2485 PSIG	650°F
SECONDARY	1356 PSIG	1085 PSIG	600°F

PRIMARY - SECONDARY BOUNDARY COMPONENTS  
(A) Primary to Secondary  
Pressure Differential . . . . 1600 PSIG | 650°F  
(B) Secondary to Primary  
Pressure Differential . . . . 670 PSIG | 650°F

See Section 4 for details on hydrostatic testing, including water chemistry, and temperatures of the vessel and w primary and secondary hydrostatic tests.

The primary chamber (including tube sheet) and secondary chamber are built to ASME Boiler and Pressure Vess titled "Nuclear Vessels, Section III, Class 'A' Vessels" and applicable code interpretations or rulings. A code star be provided as required by Article 8 of the Section III Code.

### NOTES:

- Steam generator to be painted with high temperature aluminum paint. If touch up is necessary see Section - paint specifications.
- Finished face of support pads to be parallel with each other and perpendicular to the vessel C within 0.12.
- Five rows of .50 tex nuts spaced on channel as shown.  
1st Row - 4 nuts on approximate 36.00 diameter.  
2nd Row - 3 nuts on approximate 72.00 diameter.  
3rd Row - 12 nuts on approximate 96.00 diameter.  
4th Row - 21 nuts on approximate 120.00 diameter.  
5th Row - 21 nuts on periphery.
- Insulation rings (single) may be shipped separately.
- For orientation of upper shell assembly see Figure 1-2.
- Do not burn, weld, chip, grind or allow any arc strikes on this vessel.
- For removal spars see drawing 3453C53.
- Refer to technical manual for alternate closure assembly method.
- The allowable variation on the as built outside diameter is a function of the inside rolling diameter tolerance thickness variations and the fabrication tolerances allowed by the ASME Boiler and Pressure Vessel Code, S- Article 5.
- All external surfaces of the chamber, all pressure boundary welds and any repair welds must be magnetic pa inspected to Paragraph N-626 - ASME, Section III after hydrotest.
- Lock bolts by tack welding each bolt in two places.

9810140058-04

20107001

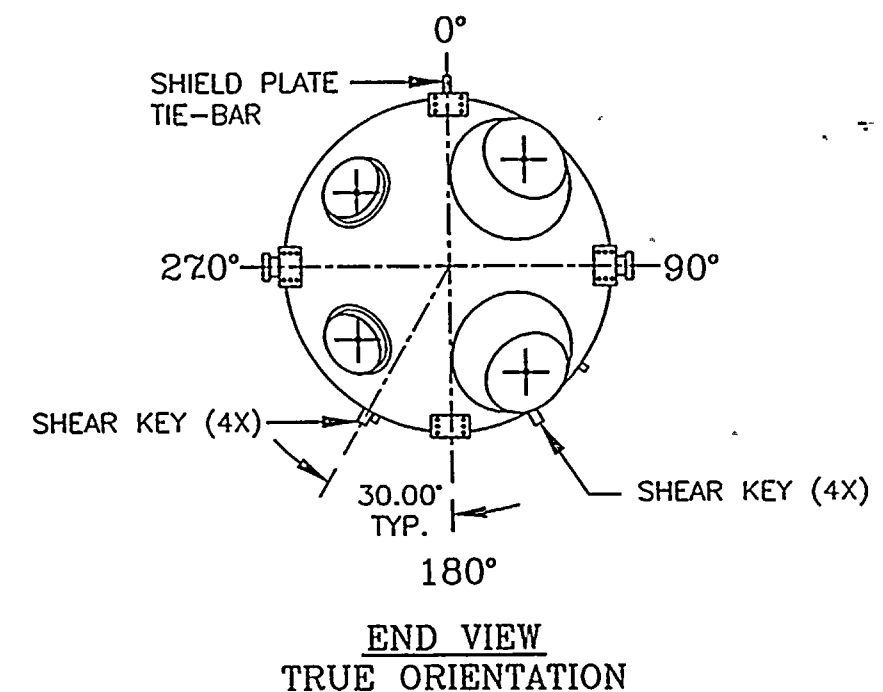
AMERICAN ELECTRIC POWER  
DONALD C. COOK NUCLEAR PLANT

STEAM GENERATOR DISPOSAL EXEMPTION REQUEST

ATTACHMENT 5

GENERAL ARRANGEMENT DRAWINGS



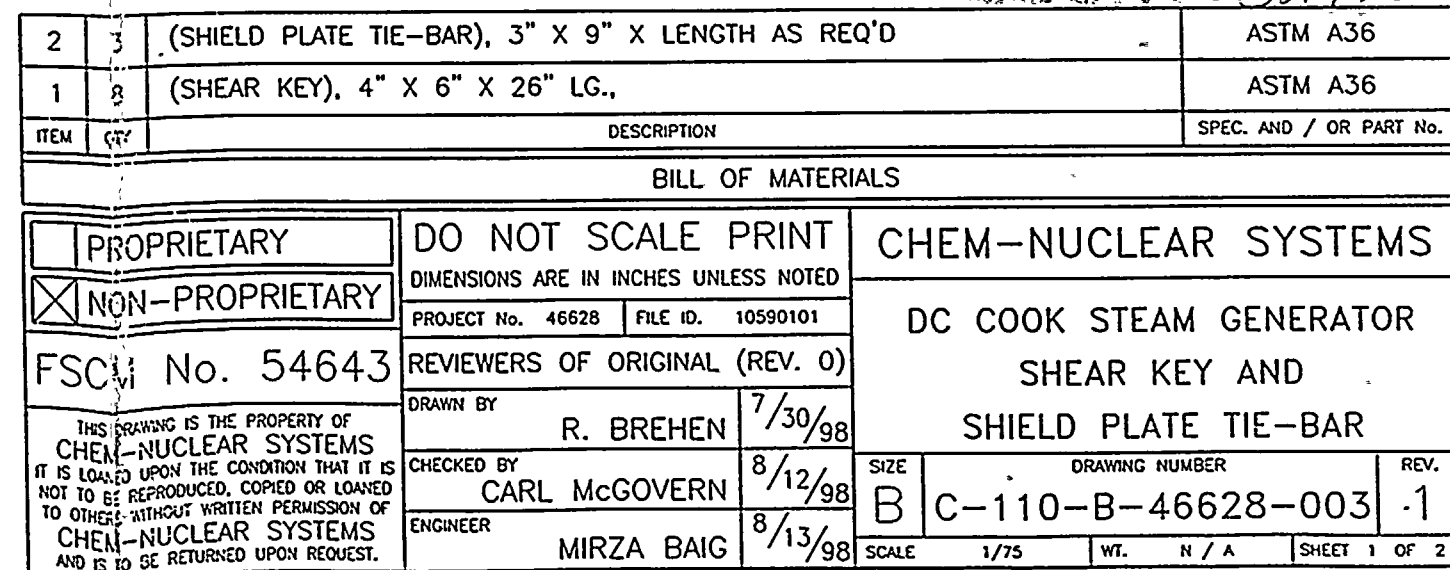


APERTURE  
-CARD

**Also Available on  
Aperture Card**

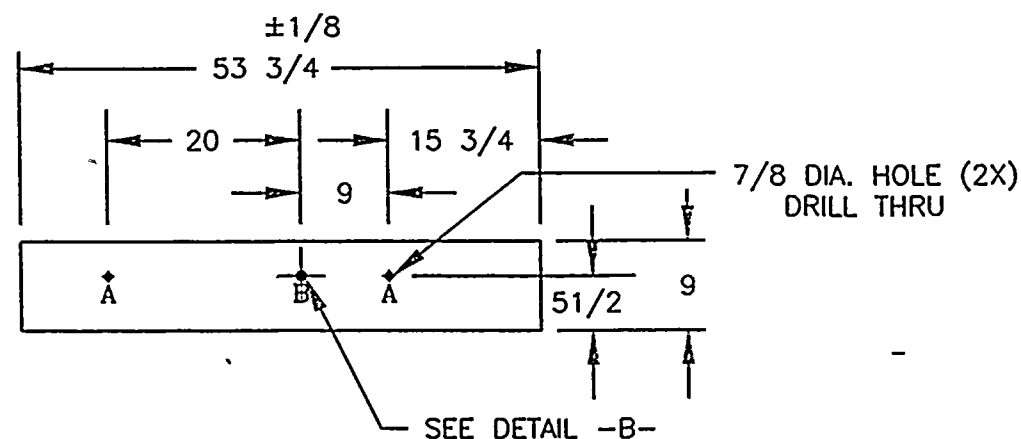
**INFORMATION  
ONLY**

32412

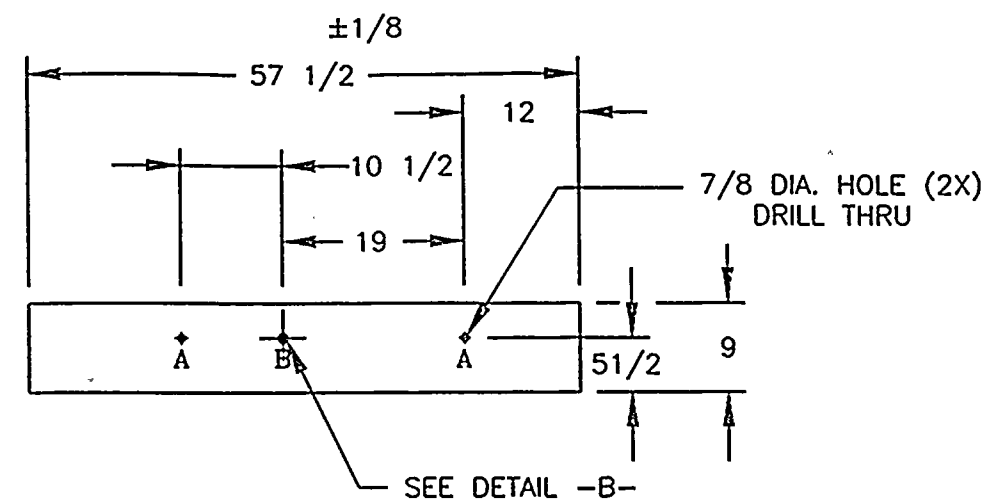


9810140058-05

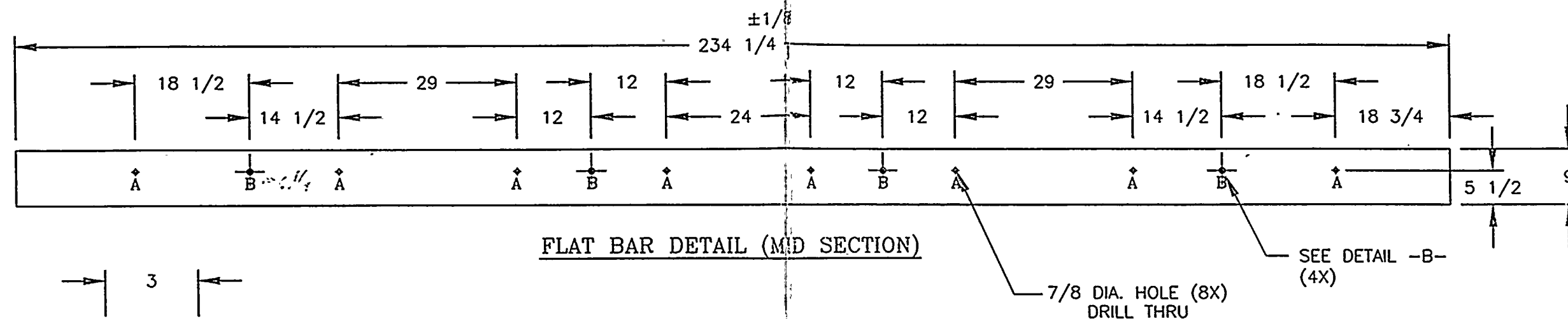
2020710180



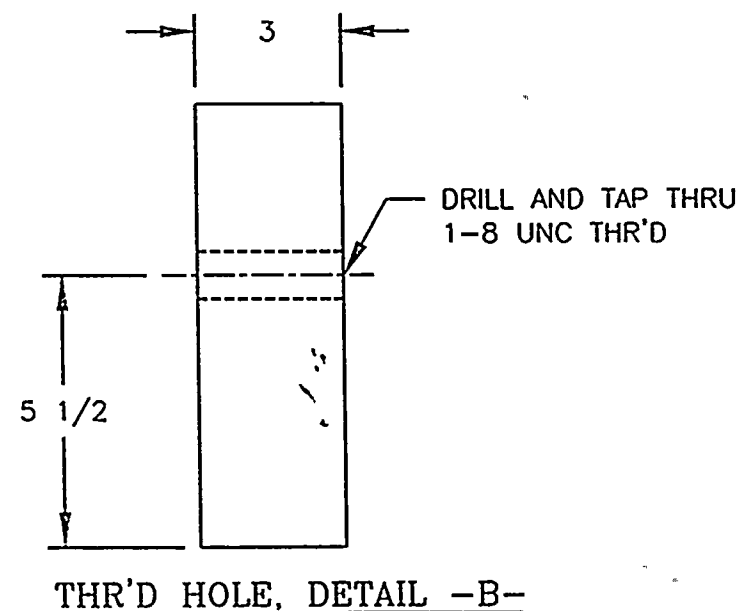
FLAT BAR DETAIL (SECONDARY SIDE)



FLAT BAR DETAIL (PRIMARY SIDE)



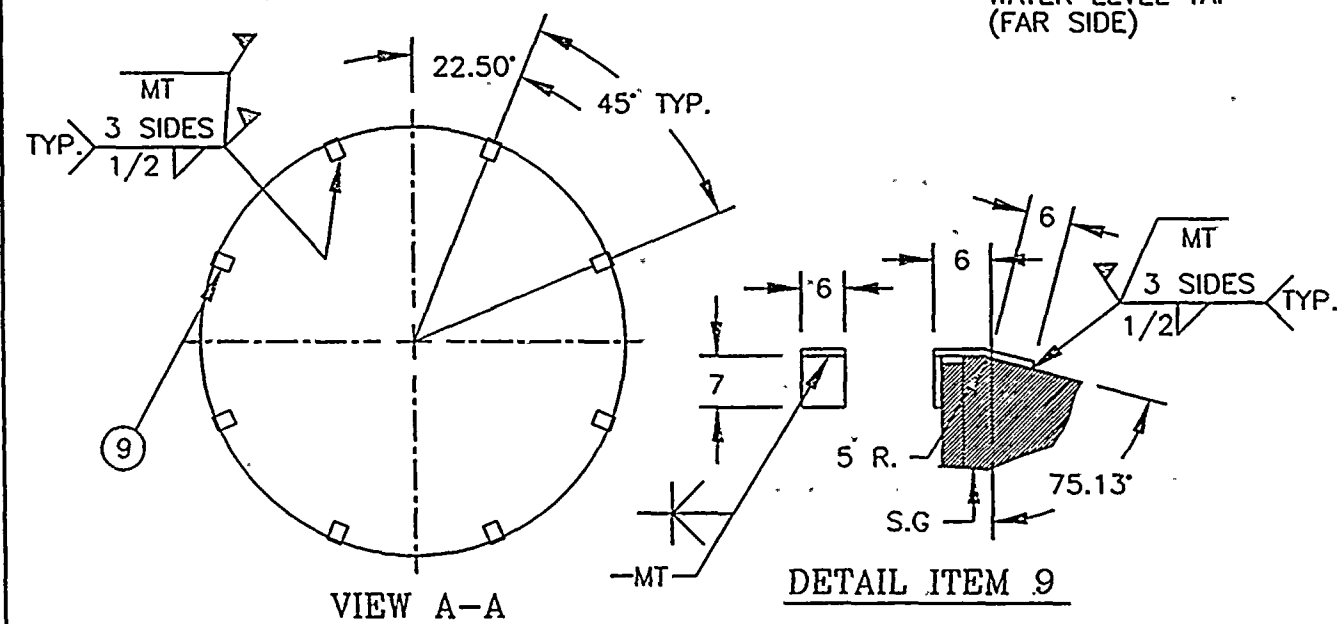
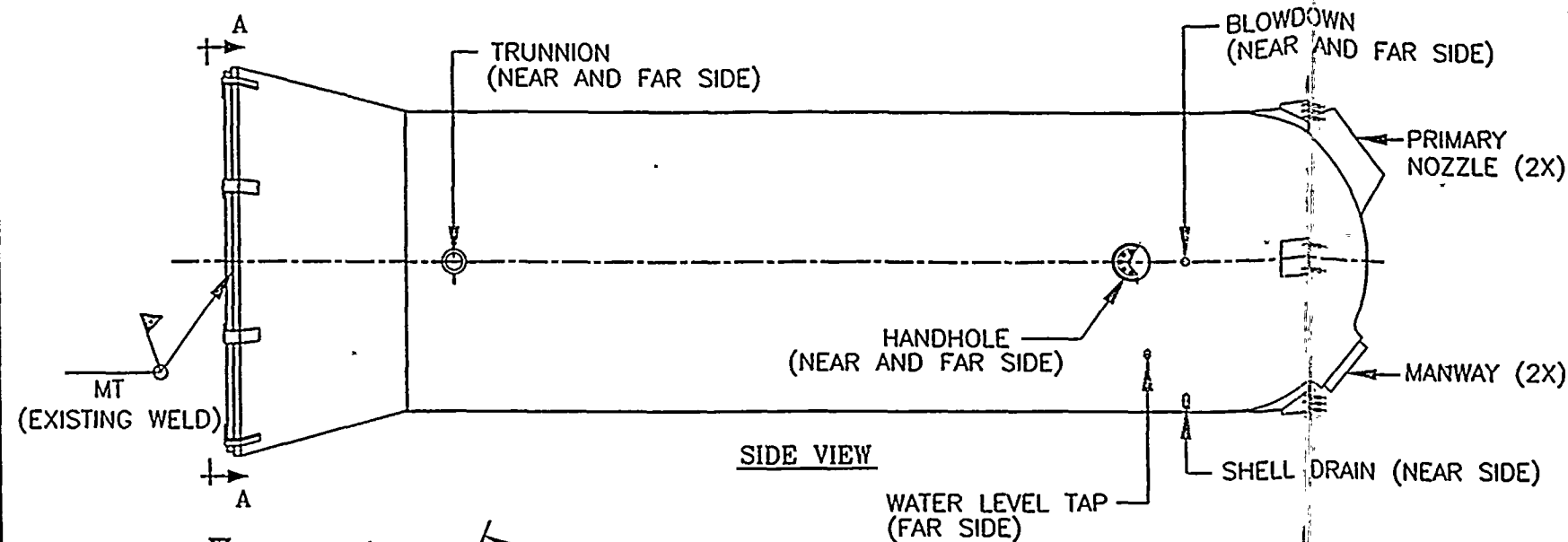
FLAT BAR DETAIL (MID SECTION)



<input type="checkbox"/> PROPRIETARY		DO NOT SCALE PRINT		CHEM-NUCLEAR SYSTEMS	
<input checked="" type="checkbox"/> NON-PROPRIETARY		DIMENSIONS ARE IN INCHES UNLESS NOTED		DC COOK STEAM GENERATOR SHEAR KEY AND SHIELD PLATE TIE-BAR	
PROJECT No. 46628		FILE ID. 10590201			
FSCM No. 54643		REVIEWERS OF ORIGINAL (REV. 0)			
THIS DRAWING IS THE PROPERTY OF CHEM-NUCLEAR SYSTEMS IT IS LOANED UPON THE CONDITION THAT IT IS NOT TO BE REPRODUCED, COPIED OR LOANED TO OTHERS WITHOUT WRITTEN PERMISSION OF CHEM-NUCLEAR SYSTEMS AND IS TO BE RETURNED UPON REQUEST.		DRAWN BY R. BREHEN		7/30/98	
		CHECKED BY CARL McGOVERN		8/12/98	
		ENGINEER MIRZA BAIG		8/13/98	
		SIZE B	DRAWING NUMBER C-110-B-46628-003		REV. .1
		SCALE 1/75	WT. N / A		SHEET 2 OF 2

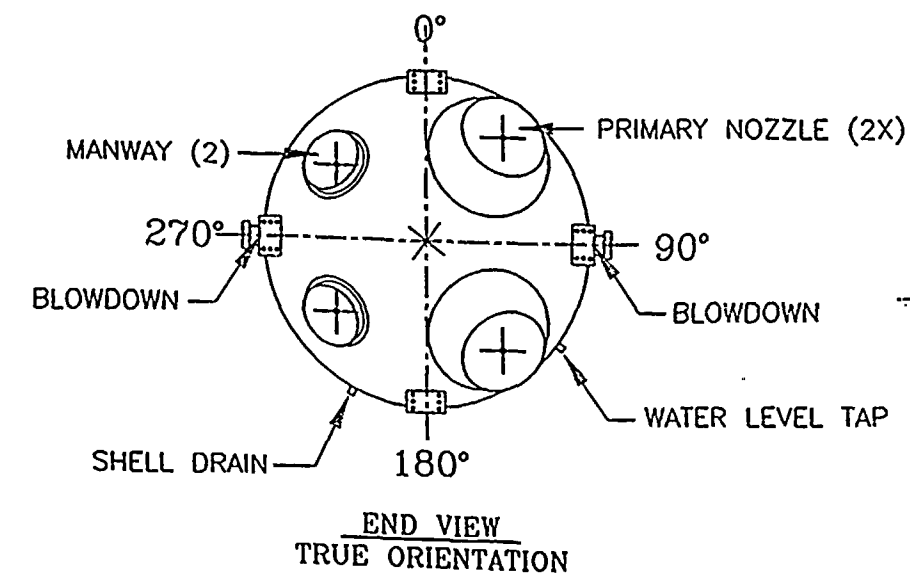
9810140058-06

902041018



PROTRUSION NOZZLE CLOSURE DETAILS

	DESCRIPTION	QTY.	SEE DETAIL	SIZE
1	PRIMARY NOZZLE	2	-A- SHT. 2	31" I.D.
2	MANWAY	2	-B- SHT. 2	16" I.D.
3	BLOWDOWN	2	-C- SHT. 3	2"
4	SHELL DRAIN	1	-C- SHT. 3	3/4"
5	WATER LEVEL TAP	1	-C- SHT. 3	3/4"
6	TRUNNION	2	-D- SHT. 1	7 3/4"



NOTE:  
1: ADD LIFT LUGS PER DETAIL 8 WHERE REQUIRED  
LUGS MUST BE REMOVED AFTER COVER IS INSTALLED

ITEM	QTY	DESCRIPTION	SPEC. AND / OR PART No.
9	8	PLATE, 1" THK.	ASTM A36
8	5	PLATE, 1/4" X 1 1/2" X 3"	ASTM A36
7	4	TAPERED PLUG, DIA. X LENGTH AS REQ'D	ASTM A36
6	4	PLATE, 1/4" THK. X DIA. AS REQ'D	ASTM A36
5	1	TUBING, 1/4" THK. WALL X 3/4" LG X I.D AS REQ'D. (SEE CAP DETAIL)	ASTM A512/513
4	2	PLATE, 1/4" THK. (SEE HANDHOLE CAP DETAIL)	ASTM A36
3	2	PLATE, 1/4" THK. (SEE PRIMARY NOZZLE CAP DETAIL)	ASTM A36
2	2	PLATE, 1/4" THK. (SEE MANWAY CAP DETAIL)	ASTM A36
1	8	PLATE, 1/4" THK. (SEE GUSSET DETAIL)	ASTM A36

BILL OF MATERIALS

PROPRIETARY  
☒ NON-PROPRIETARY

FSCM No. 54643

THIS DRAWING IS THE PROPERTY OF  
CHEM-NUCLEAR SYSTEMS  
IT IS LOANED UPON THE CONDITION THAT IT IS  
NOT TO BE REPRODUCED, COPIED OR LOANED  
TO OTHERS WITHOUT WRITTEN PERMISSION OF  
CHEM-NUCLEAR SYSTEMS  
AND IS TO BE RETURNED UPON REQUEST.

DO NOT SCALE PRINT

DIMENSIONS ARE IN INCHES UNLESS NOTED

PROJECT No. 46628 FILE ID. 10600101

REVIEWERS OF ORIGINAL (REV. 0)

DRAWN BY R. BREHEN 7/30/98

CHECKED BY CARL McGOVERN 8/12/98

ENGINEER MIRZA BAIG 8/12/98

CHEM-NUCLEAR SYSTEMS

DC COOK STEAM GENERATOR  
CONTAINMENT DETAILS

SIZE B DRAWING NUMBER C-110-B-46628-004 REV. 1

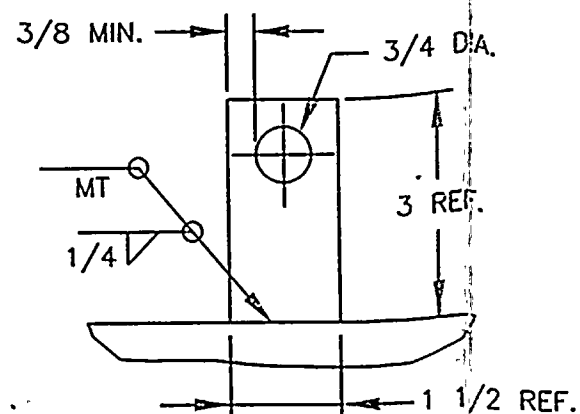
SCALE 1/75 WT. N/A SHEET 1 OF 3

APERTURE CARD

Also Available on Aperture Card

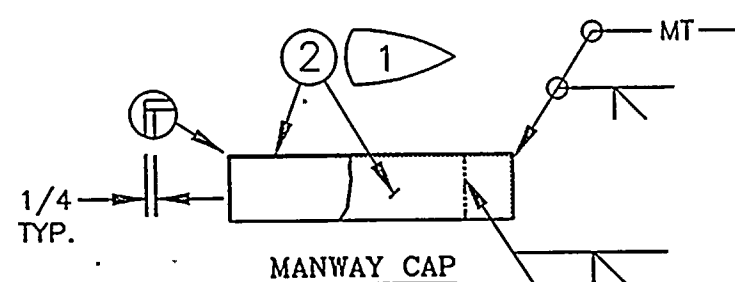
9810140058-07

10820710189

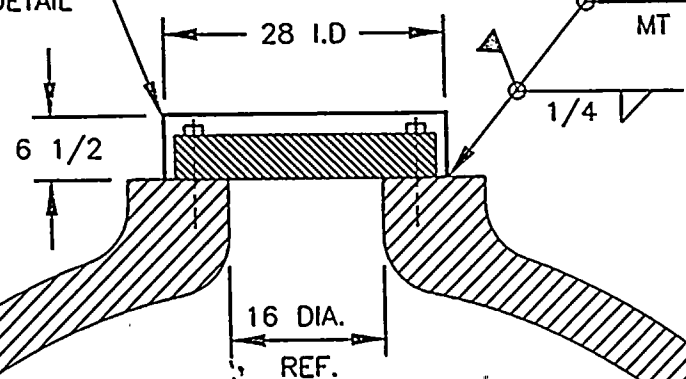
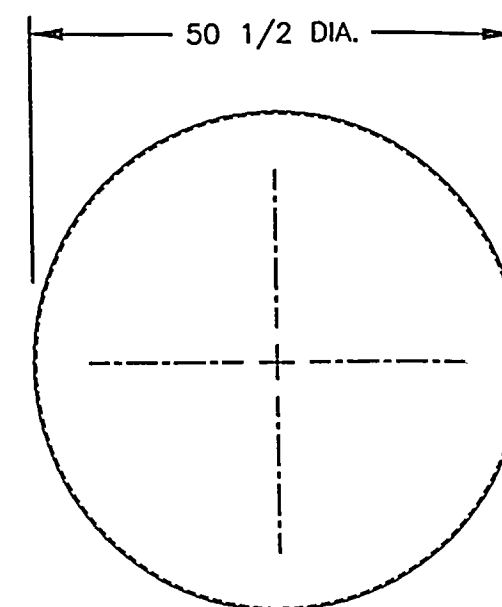
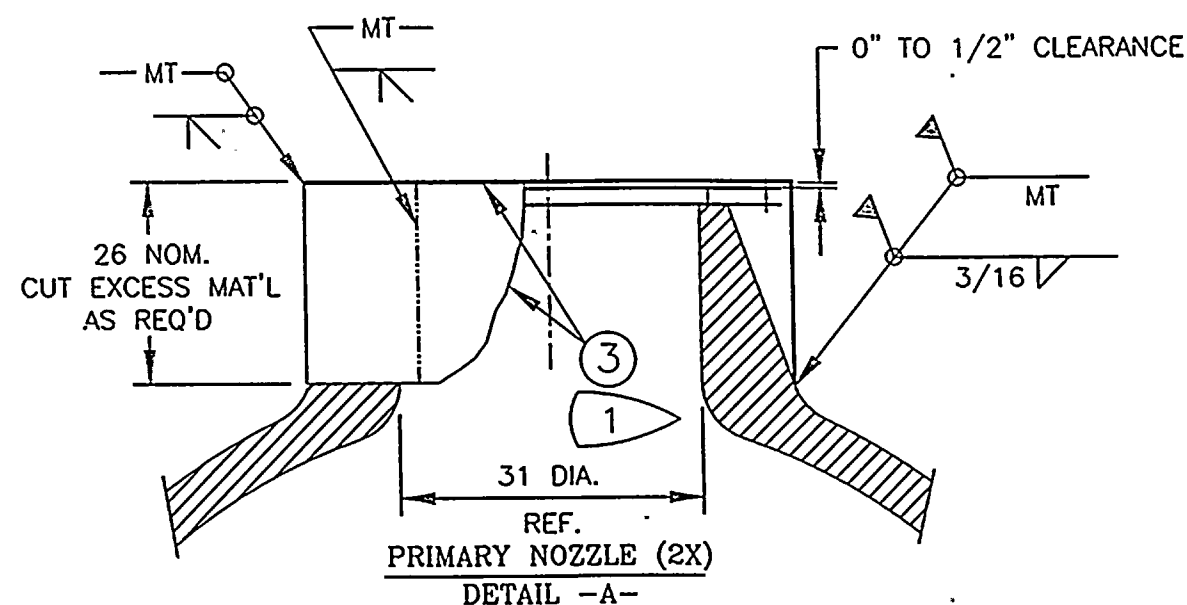


DETAIL ITEM 8

1



MANWAY CAP

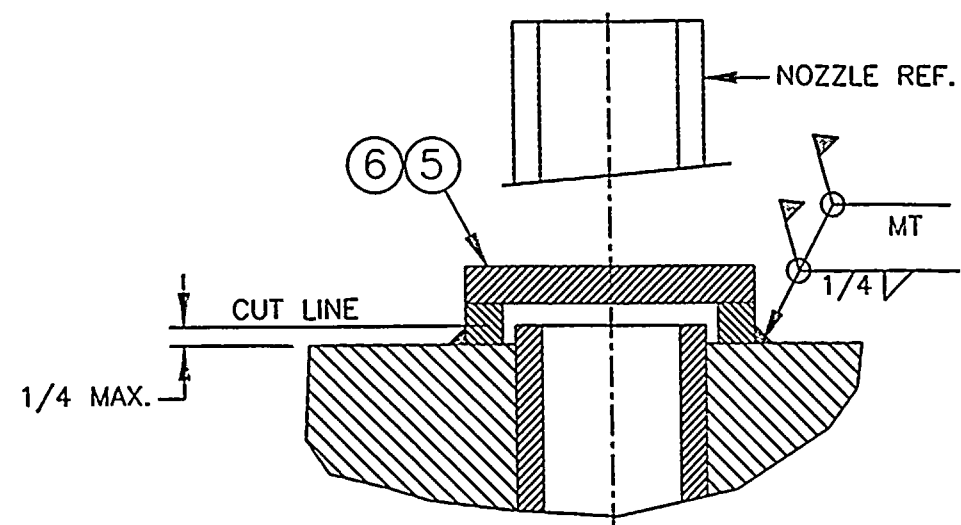
SEE MANWAY  
CAP DETAILMANWAY (2X)  
DETAIL -B-APERTURE  
CARDAlso Available on  
Aperture CardPRIMARY NOZZLE (2X)  
DETAIL -A-

<input type="checkbox"/> PROPRIETARY		DO NOT SCALE PRINT		CHEM-NUCLEAR SYSTEMS	
<input checked="" type="checkbox"/> NON-PROPRIETARY		DIMENSIONS ARE IN INCHES UNLESS NOTED			
FSCM No. 54643		PROJECT No. 46628	FILE ID. 10600201		
THIS DRAWING IS THE PROPERTY OF CHEM-NUCLEAR SYSTEMS IT IS LOANED UPON THE CONDITION THAT IT IS NOT TO BE REPRODUCED, COPIED OR LOANED TO OTHERS WITHOUT WRITTEN PERMISSION OF CHEM-NUCLEAR SYSTEMS AND IS TO BE RETURNED UPON REQUEST.		REVIEWERS OF ORIGINAL (REV. 0)		DC COOK STEAM GENERATOR CONTAINMENT DETAILS	
		DRAWN BY	R. BREHEN	7/30/98	
		CHECKED BY	CARL McGOVERN	8/12/98	
		ENGINEER	MIRZA BAIG	8/12/98	
		SIZE	B	DRAWING NUMBER	C-110-B-46628-004
		SCALE	1/75	WT.	N / A
		SHEET 2 OF 3		REV.	.1

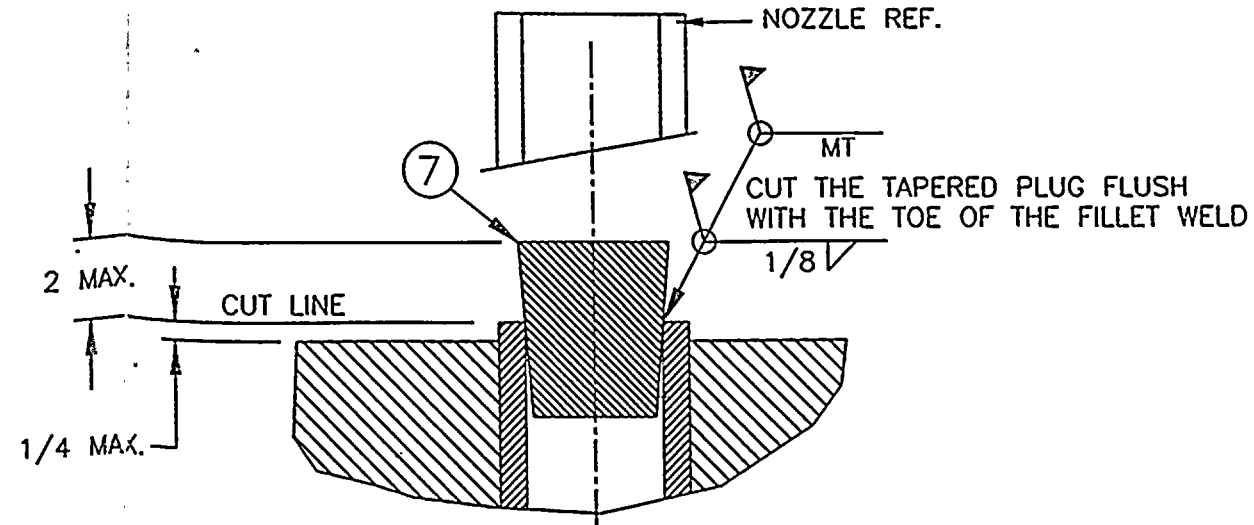
9810140058-08

8020710189



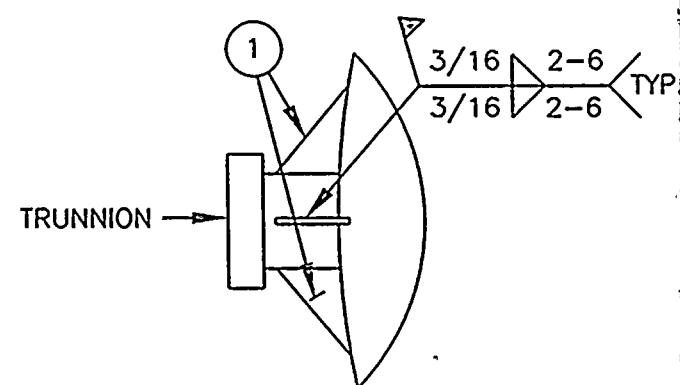


3/4" OR 2" NOZZLE DETAIL W/CAP  
FOR BLOWDOWN, SHELL DRAIN OR WATER LEVEL NOZZLES

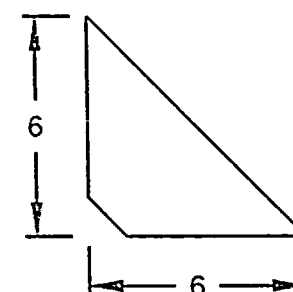


3/4" OR 2" NOZZLE DETAIL W/FITTED PLUG  
FOR BLOWDOWN, SHELL DRAIN OR WATER LEVEL NOZZLES

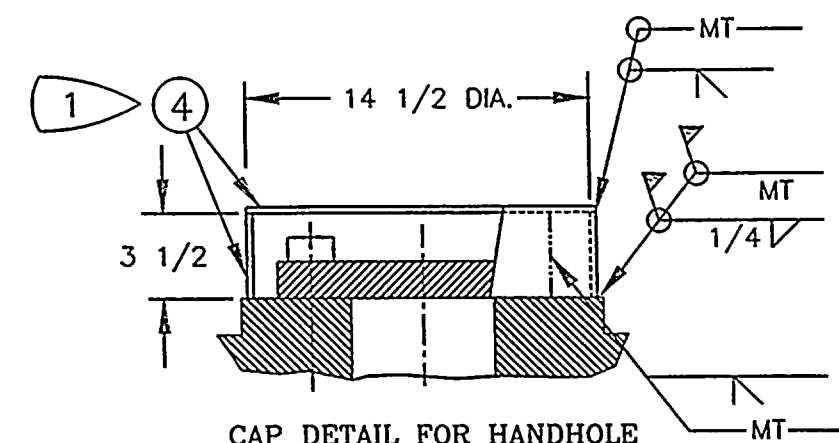
OR  
DETAIL -C-



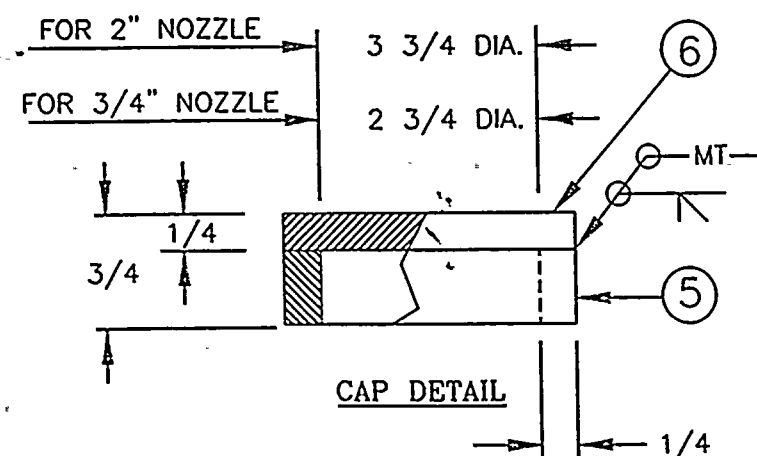
DETAIL -D-  
TRUNNIONS MAY BE CUTOFF



DETAIL ITEM 1



CAP DETAIL FOR HANDHOLE



CAP DETAIL

PROPRIETARY  
NON-PROPRIETARY

FSCM No. 54643

THIS DRAWING IS THE PROPERTY OF  
CHEM-NUCLEAR SYSTEMS  
IT IS LOANED UPON THE CONDITION THAT IT IS  
NOT TO BE REPRODUCED, COPIED OR LOANED  
TO OTHERS WITHOUT WRITTEN PERMISSION OF  
CHEM-NUCLEAR SYSTEMS  
AND IS TO BE RETURNED UPON REQUEST.

DO NOT SCALE PRINT

DIMENSIONS ARE IN INCHES UNLESS NOTED

PROJECT No. 46628 FILE ID. 10600301

REVIEWERS OF ORIGINAL (REV. 0)

DRAWN BY R. BREHEN 7/30/98

CHECKED BY CARL MCGOVERN 8/12/98

ENGINEER MIRZA BAIG 8/12/98

CHEM-NUCLEAR SYSTEMS

DC COOK STEAM GENERATOR  
CONTAINMENT DETAILS

SIZE	DRAWING NUMBER	REV.
B	C-110-B-46628-004	-1
SCALE	WT.	SHEET
1/75	N / A	3 OF 3

981014-0058-09

20207018