PROCEDURES, LICENSE AND SAFETY ANALYSIS REPORT

FOR

CHEM-NUCLEAR SYSTEMS, INC.

CNS 6-101

TYPE A RADWASTE SHIPPING CASK

Chem-Nuclear systems, Inc.

Corporate/Western Operations
P.O. Box 1866
Bellevue, WA 98009

March 1, 1983

TABLE OF CONTENTS

1.0 GENERAL INFORMATION

1.1 Introduction

This Safety Analysis Report describes a reusable shipping package designed to protect radioactive material during normal conditions of transport. The package is designated as the Model CNS 6-101 package.

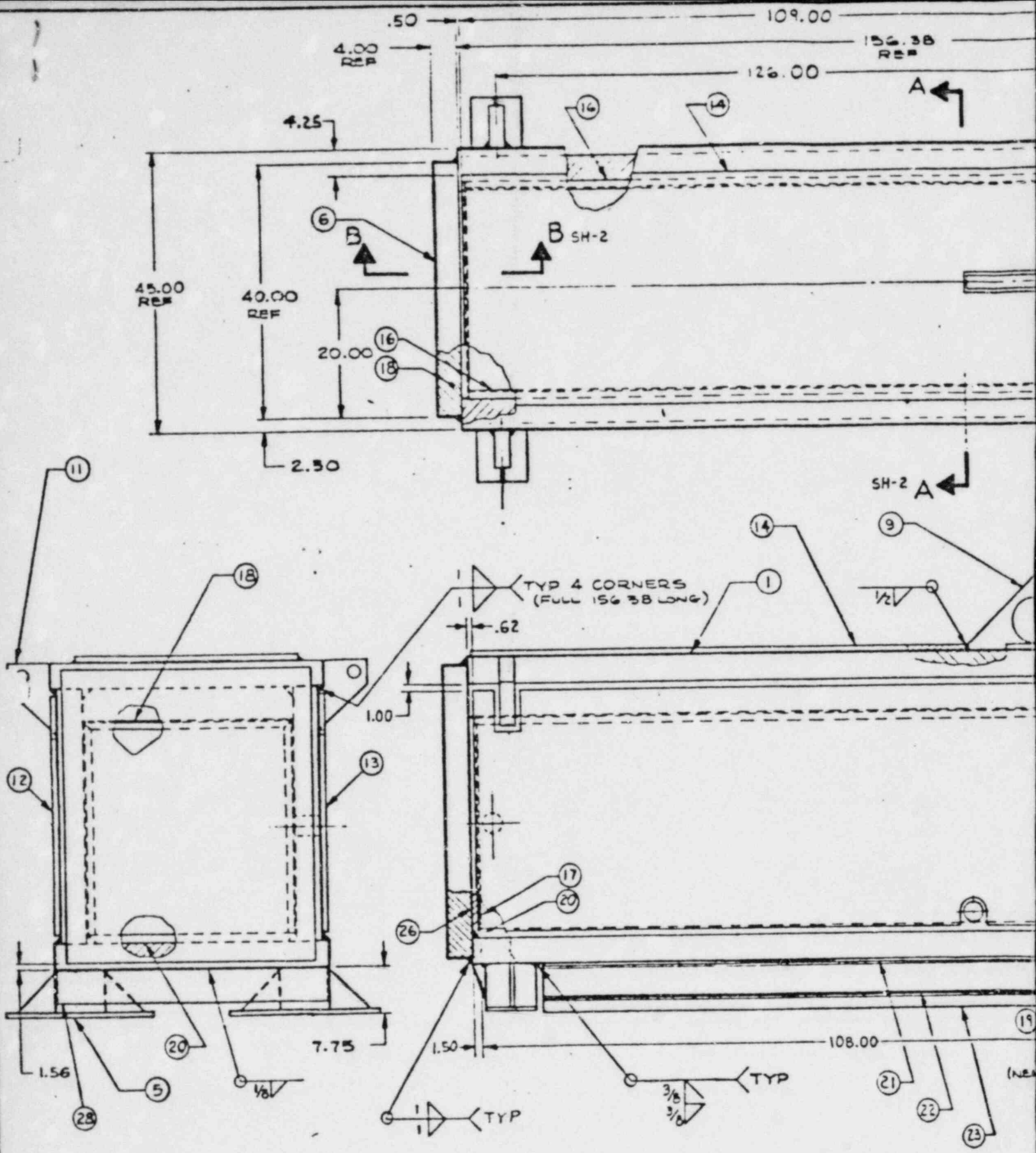
1.2 Package Description

1.2.1 Packaging

The container is an end loaded lead shielded steel rectangular box for low specific activity radioactive material held in secondary containers. The container is constructed of 4-inch thick steel walls welded to form a 34-inch wide by 40-inch high by 13-foot long cavity. One inch thick lead sheets are bonded to 1/4-inch steel plates mounted on the interior of the 4-inch thick steel plates along part of the sides and back. Positive closure of the 4-inch thick by 38-inch by 48-inch hydraulically actuated door is accomplished with twelve (12), 1.5-inch bolts. Four (4) mounting feet are welded to the cask bottom, and four (4) lifting lugs are welded to sides along the top. The package gross weight is 58,400 pounds.

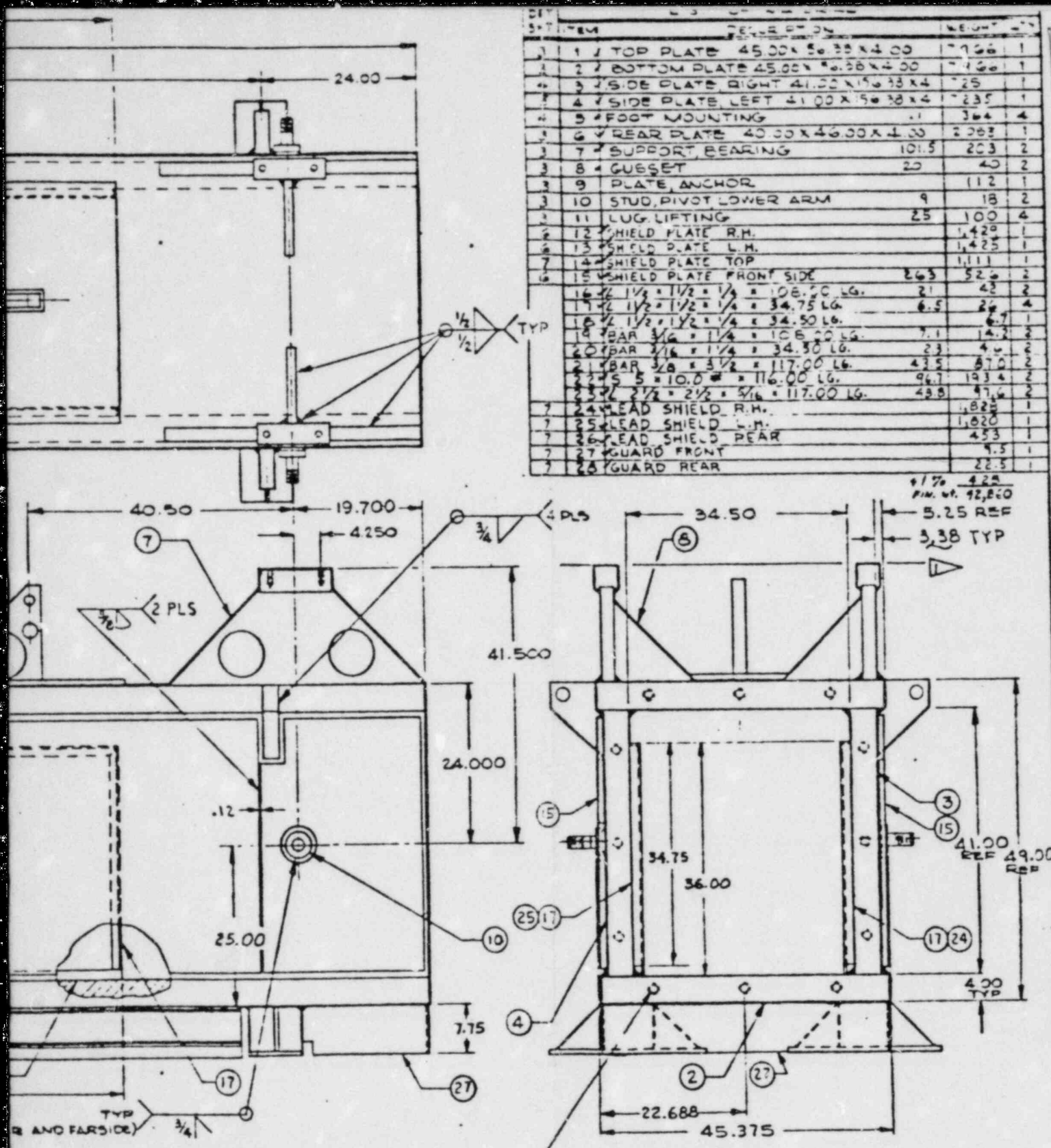
1.2.2 Contents of Packaging

The packaging is for the shipment of solid and solidified waste, meeting the requirements for low specific activity radioactive materials, in secondary containers which meet the requirements for Type A (49 CFR 173.389(j)) packaging. The secondary container is secured within the container cavity by means of shoring material as required. The maximum weight of the contents, secondary containers and shoring will not exceed 6,000 pounds.



NOTES:

1. ITEMS 10 AND 7 TO BE IN ITEM NO.
2. WELDING PROCEDURES & WELDE PER ASME SECTION 9.
3. ITEMS 24, 25 & 26 TO HAVE TO 1/4" STEEL PLATES.



SHT	ITEM	DESCRIPTION	WEIGHT	QTY
1	1	TOP PLATE 45.00 x 50.38 x 4.00	1766	1
1	2	BOTTOM PLATE 45.00 x 50.38 x 4.00	1766	1
1	3	SIDE PLATE, RIGHT 41.00 x 50.38 x 4	1625	1
1	4	SIDE PLATE, LEFT 41.00 x 50.38 x 4	1625	1
1	5	FOOT MOUNTING	364	4
1	6	REAR PLATE 40.00 x 46.00 x 4.00	2083	1
3	7	SUPPORT, BEARING 101.5	203	2
3	8	GUSSET 20	40	2
3	9	PLATE, ANCHOR	112	1
3	10	STUD, PIVOT LOWER ARM 9	18	2
1	11	LUG, LIFTING 25	100	4
6	12	SHIELD PLATE R.H.	1,429	1
6	13	SHIELD PLATE L.H.	1,425	1
7	14	SHIELD PLATE TOP	1,111	1
6	15	SHIELD PLATE FRONT SIDE 263	526	2
	16	1/4 1 1/2 x 1 1/2 x 1/4 x 108.50 LG. 21	42	2
	17	1/4 1 1/2 x 1 1/2 x 1/4 x 34.75 LG. 6.5	26	4
	18	1/4 1 1/2 x 1 1/2 x 1/4 x 34.50 LG.	6.9	1
	19	BAR 3/16 x 1 1/4 x 108.50 LG. 7.1	14.2	2
	20	BAR 3/16 x 1 1/4 x 34.50 LG. 2.3	4.6	2
	21	BAR 3/8 x 3 1/2 x 117.00 LG. 43.5	87.0	2
	22	S 5 x 10.0 # x 116.00 LG. 96.7	193.4	2
	23	1/2 2 1/2 x 2 1/2 x 5/16 x 117.00 LG. 48.8	97.6	2
7	24	LEAD SHIELD R.H.	1,825	1
7	25	LEAD SHIELD L.H.	1,820	1
7	26	LEAD SHIELD REAR	453	1
7	27	GUARD FRONT	9.5	1
7	28	GUARD REAR	22.5	1

+1% 429
PIN WT. 92,860

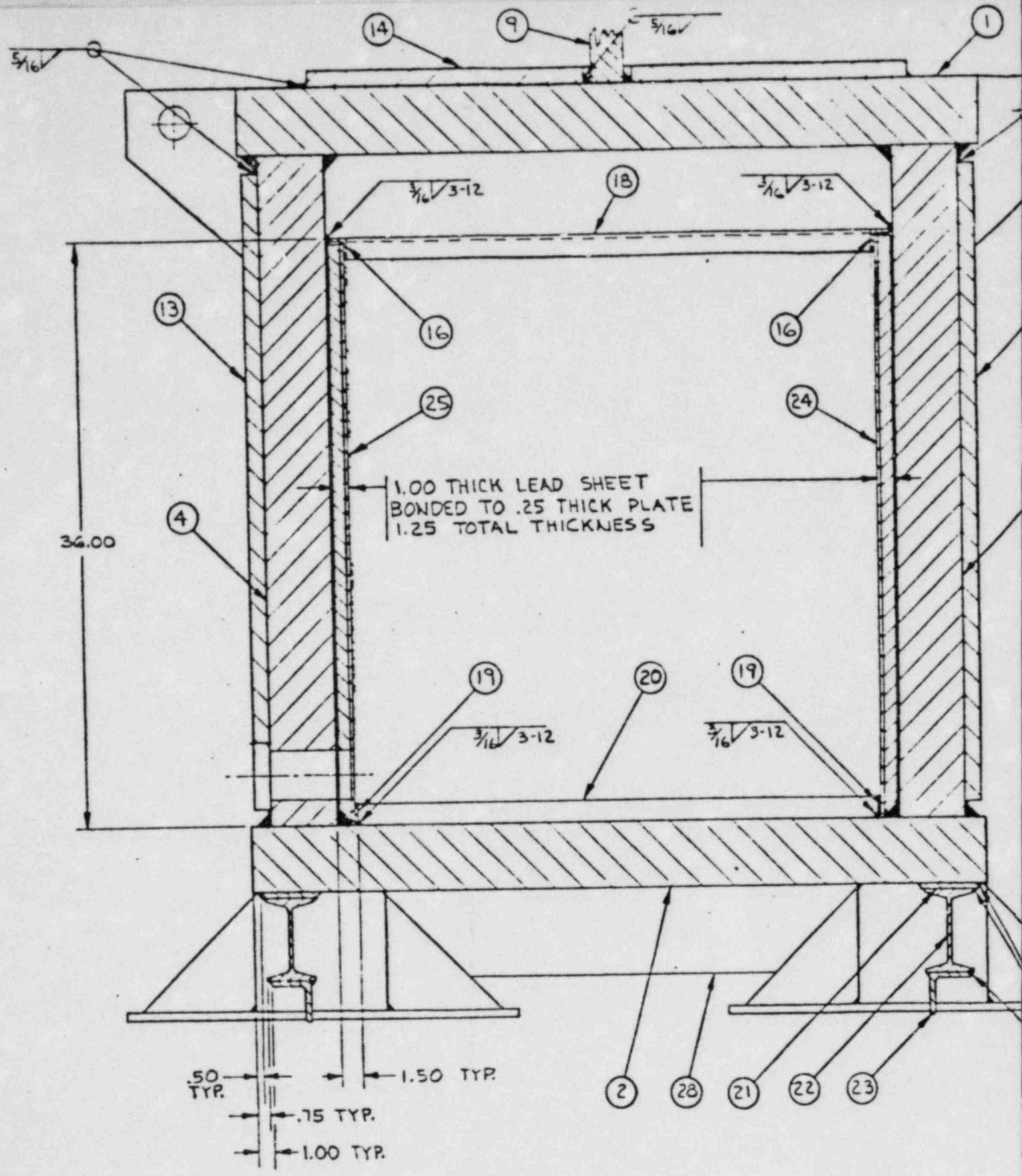
LINE WITH MATCHING

QUALIFICATIONS

LEAD SHEETS BONDED

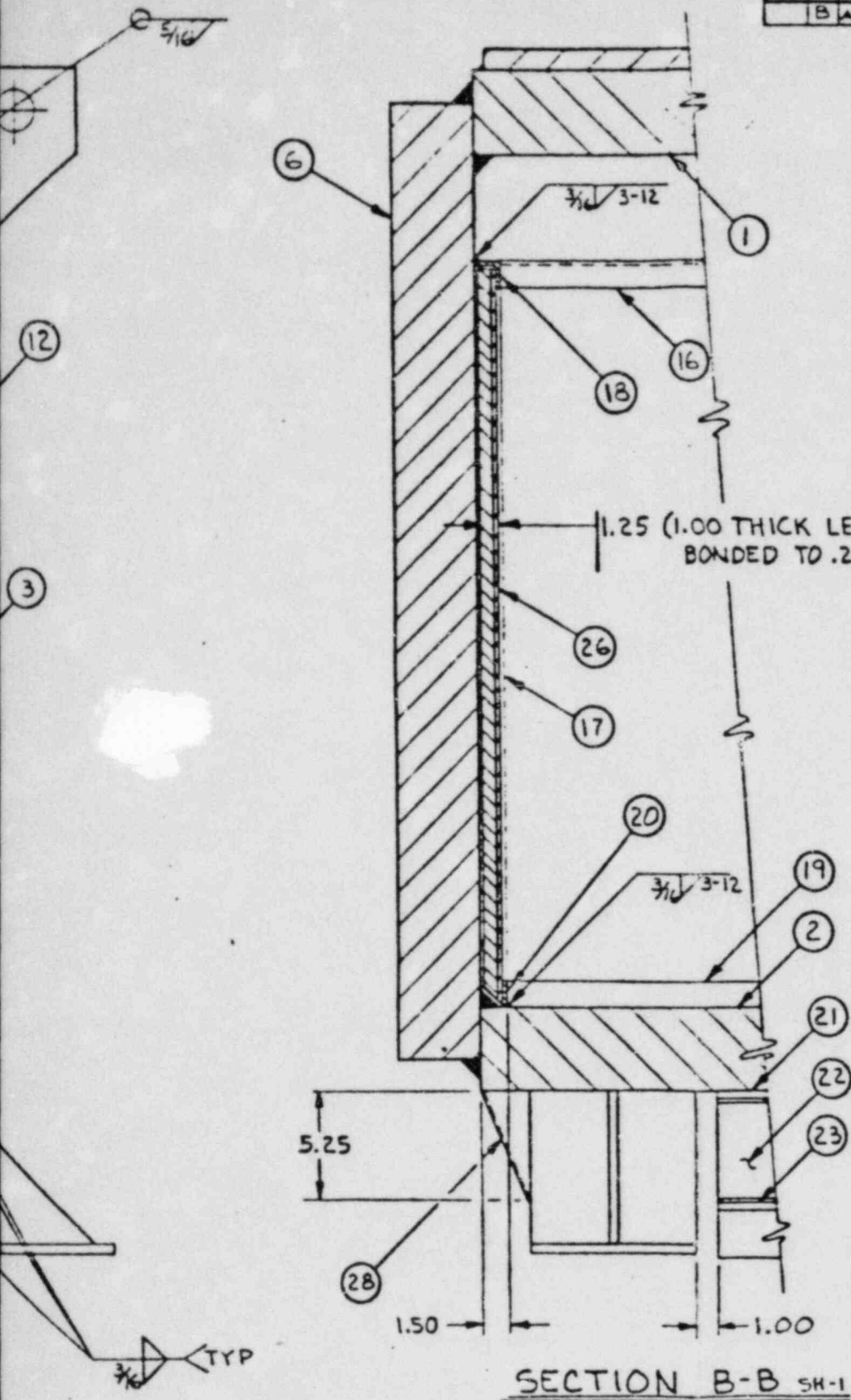
DG 080	K. HETTMAN 7/15	CHEM-NUCLEAR SYSTEMS, INC.
		SHIELD, CONTAINER RADWASTE CARRIER I
STL. ASTM-A36		D 2000-D-201 B
		1/10 WT 42,860

PIN WT 42,860



SECTION A-A SH-1

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	B	ADDED NEW SH 2 TO AS BU LT REV.	3-7-78	



SECTION B-B SH-1

ITEM	QTY	CODE IDENT	NOMENCLATURE OR DESCRIPTION	PART NO.
			PARTS LIST	

CONTRACT NO.

CHEM-NUCLEAR SYSTEMS, INC.

TANIS 11-3-78

K HETTMAN 11-9-78

MATERIAL

NEXT ASSEMBLY | USED ON

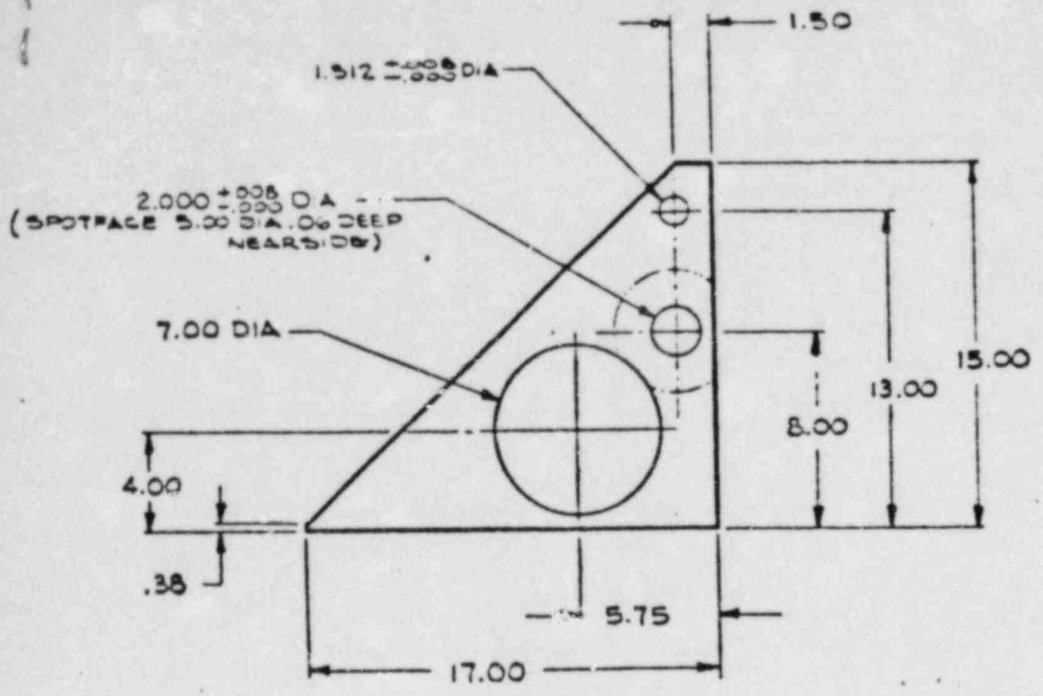
APPLICATION

FINISH

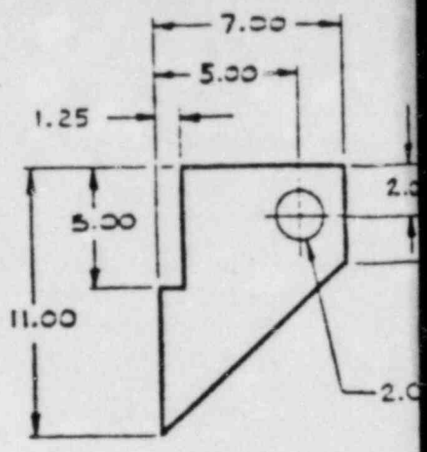
TITLE: SHIELD, CONTAINER RADWASTE CARRIER I

SIZE D | 2000-D-201 | REV B

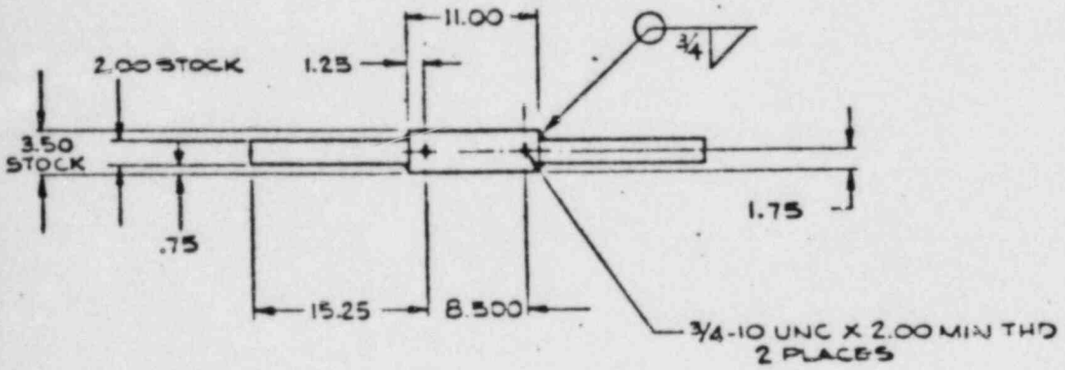
SCALE 1/4 | WT | SHEET

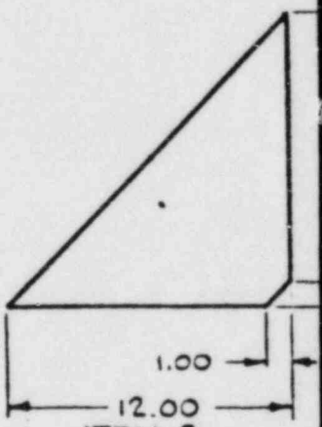


ITEM 9
MATL; HRS 2.00 THICK
1 REQD
(SCALE 1/4)

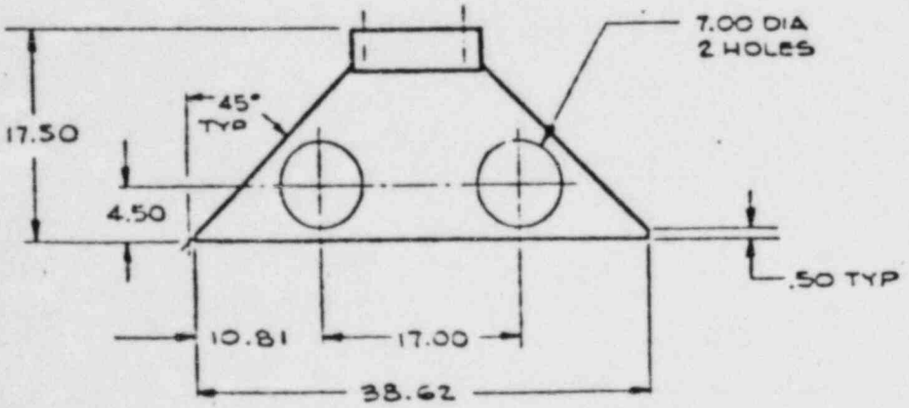


ITEM 11
MATL; HRS 2.00 THICK
4 REQD
(SCALE 1/4)

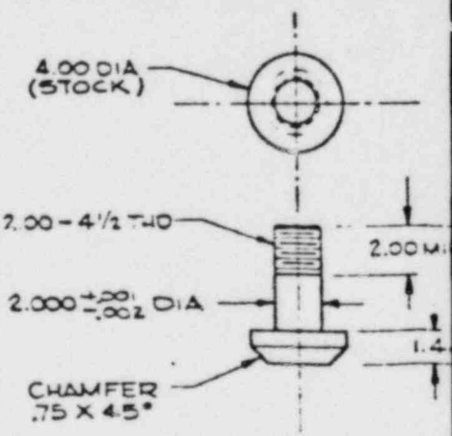




ITEM 8
MATL: HRS 1.00 THIC
2 REQD (SCALE 1/



ITEM 7
MATL; HRS 2.00 THK PLATE & 3.50 x 3.50 BAR
2 REQD
(SCALE 1/8)



ITEM 10
MATL; HRS 4" DIA RO
2 REQD
(SCALE 1/4)

ZONE	DESCRIPTION	DATE APPD
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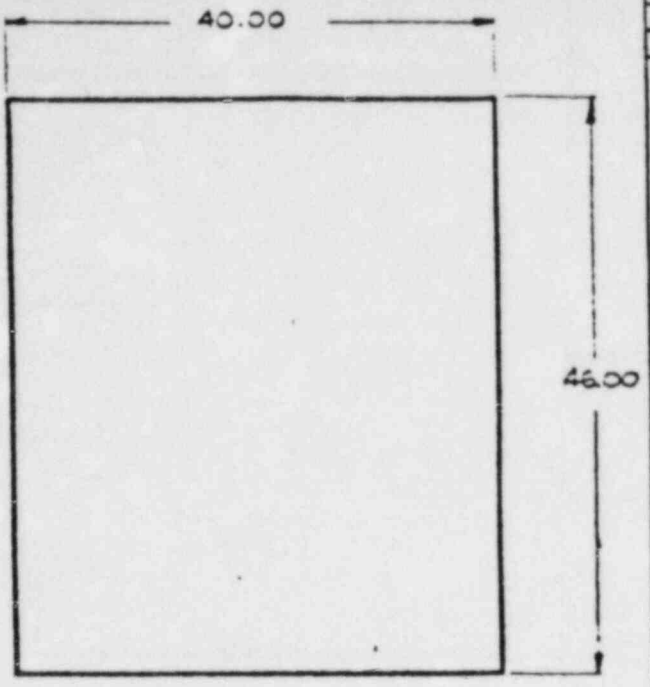

ITEM 6
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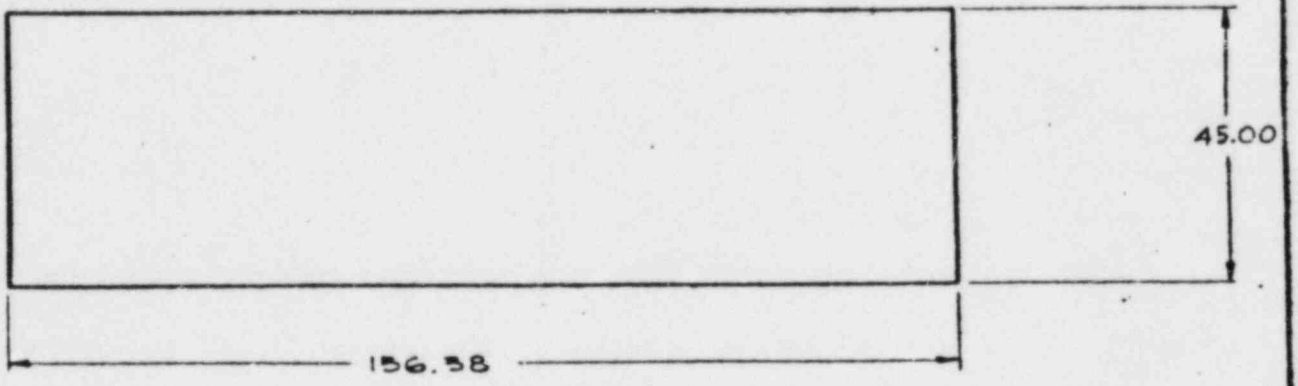
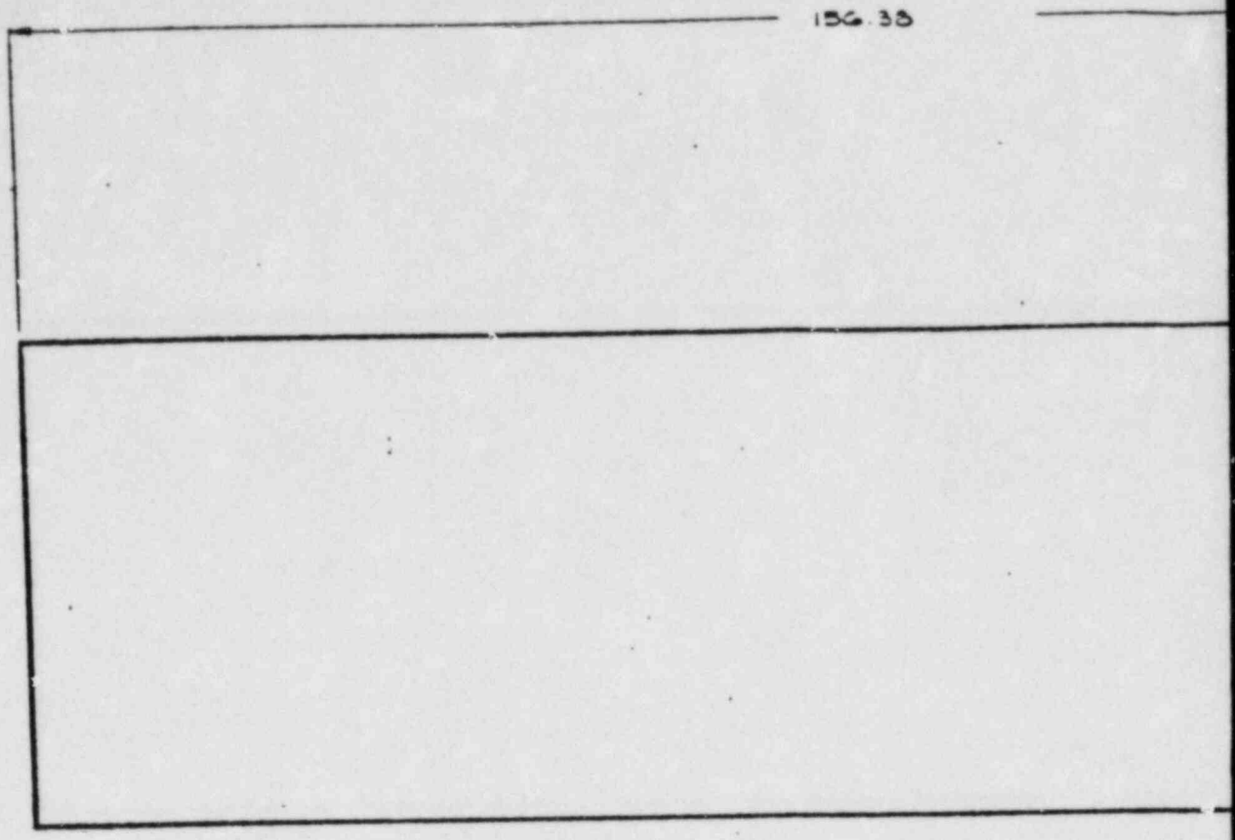
1 REQD
(SCALE 1/8)

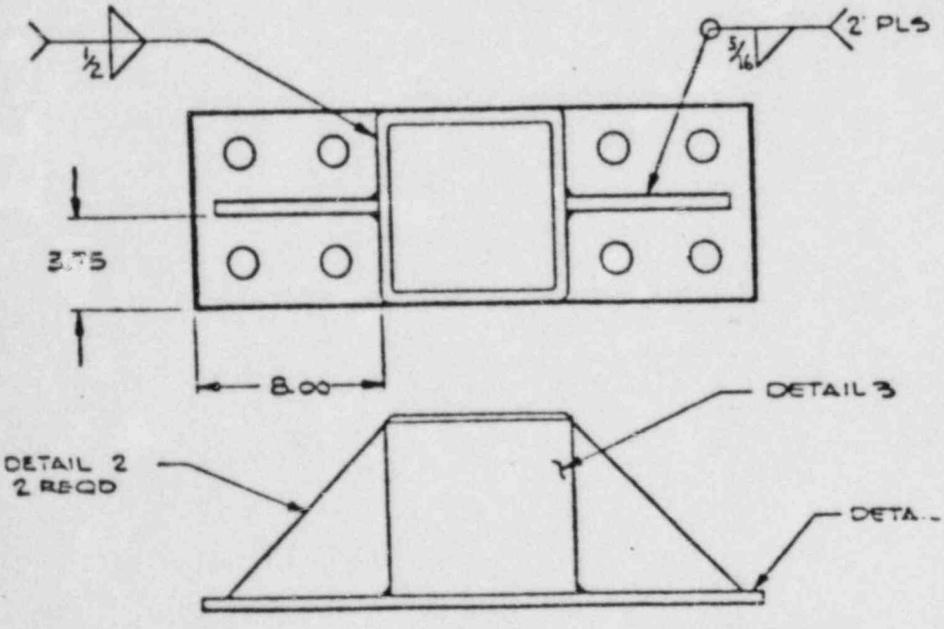


ITEM 1 AND ITEM 2
MATL; HRS 4.00 THICK
1 EACH REQD
(SCALE 1/16)

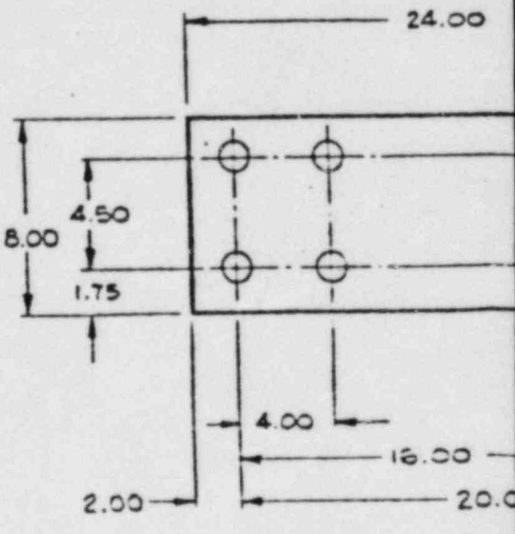
.09 - .030	K HEITMAN 7/13/78	CHEM-NUCLEAR SYSTEMS, INC.
		DETAILS, SHIELD CONTAINER RADWASTE CARRIER I
HRS ASTM A36	D	2000-D-201 B
	NOTED	



ITEM 3
MATL: HRS 4.00 THK
1 REQD (SCALE 1/8)

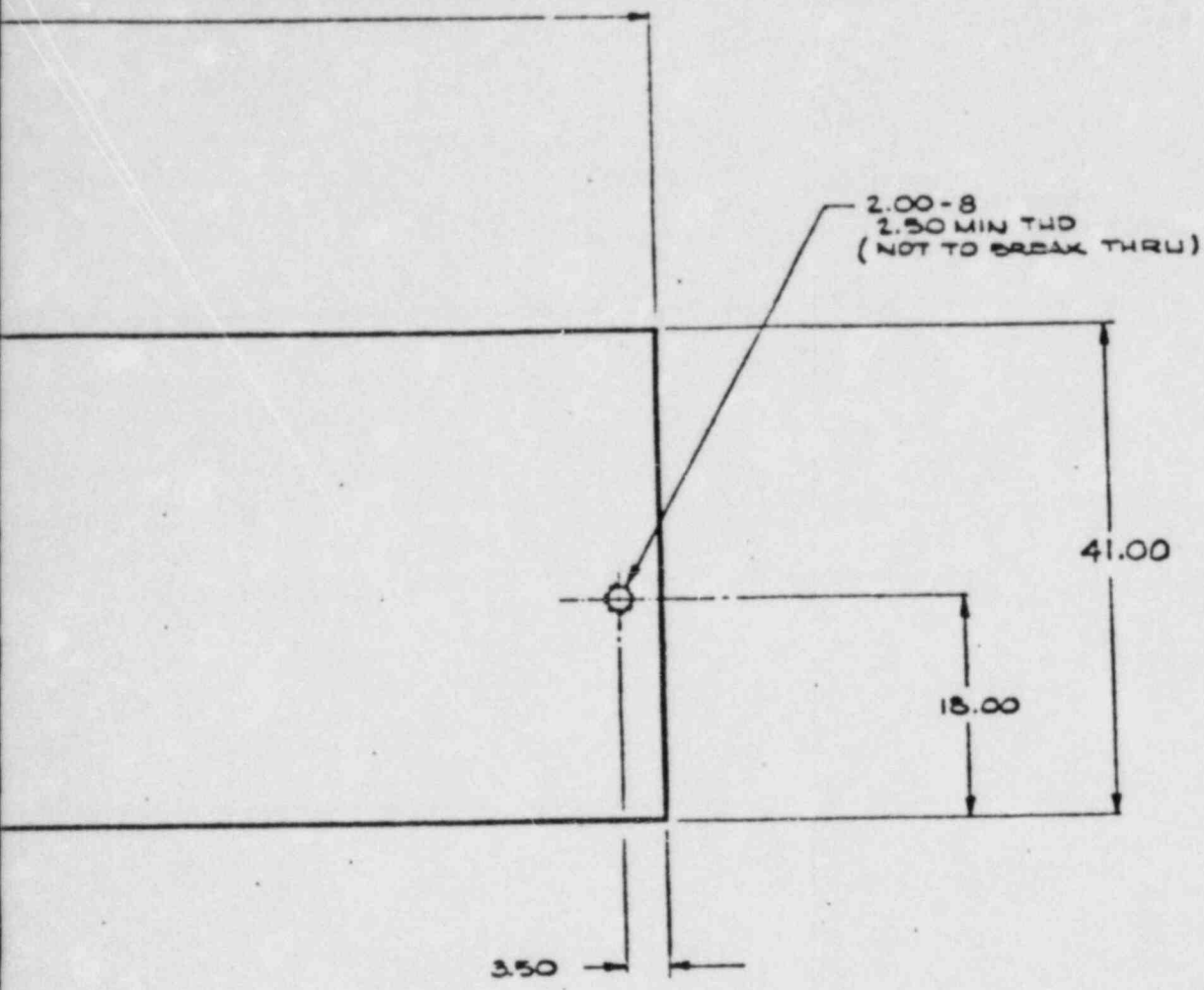


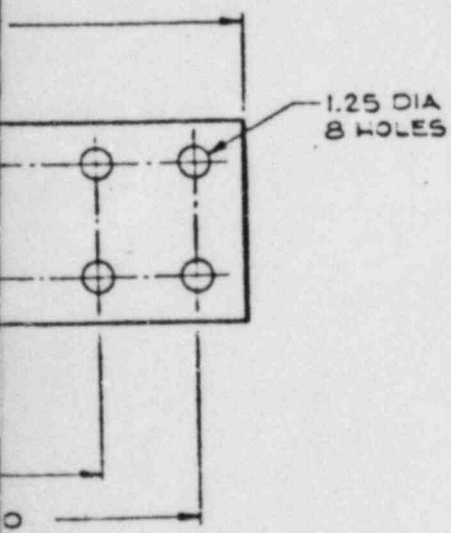
ITEM 5
MATL: NOTED
4 REQD
(SCALE 1/4)

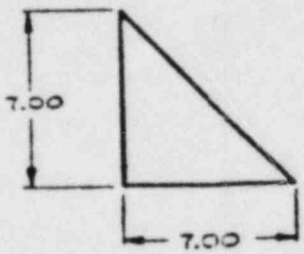


DETAIL 1
MATL: HRS .50
1 REQD
(SCALE 1/4)

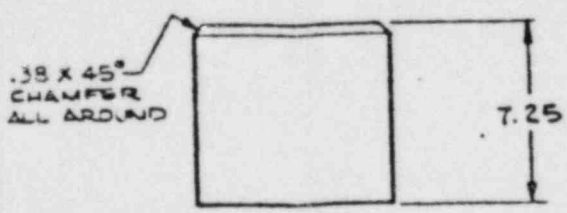
	B	REVISED AS BUILT







DETAIL 2
MATL; HRS .50 THK
2 REQD
(SCALE 1/4)



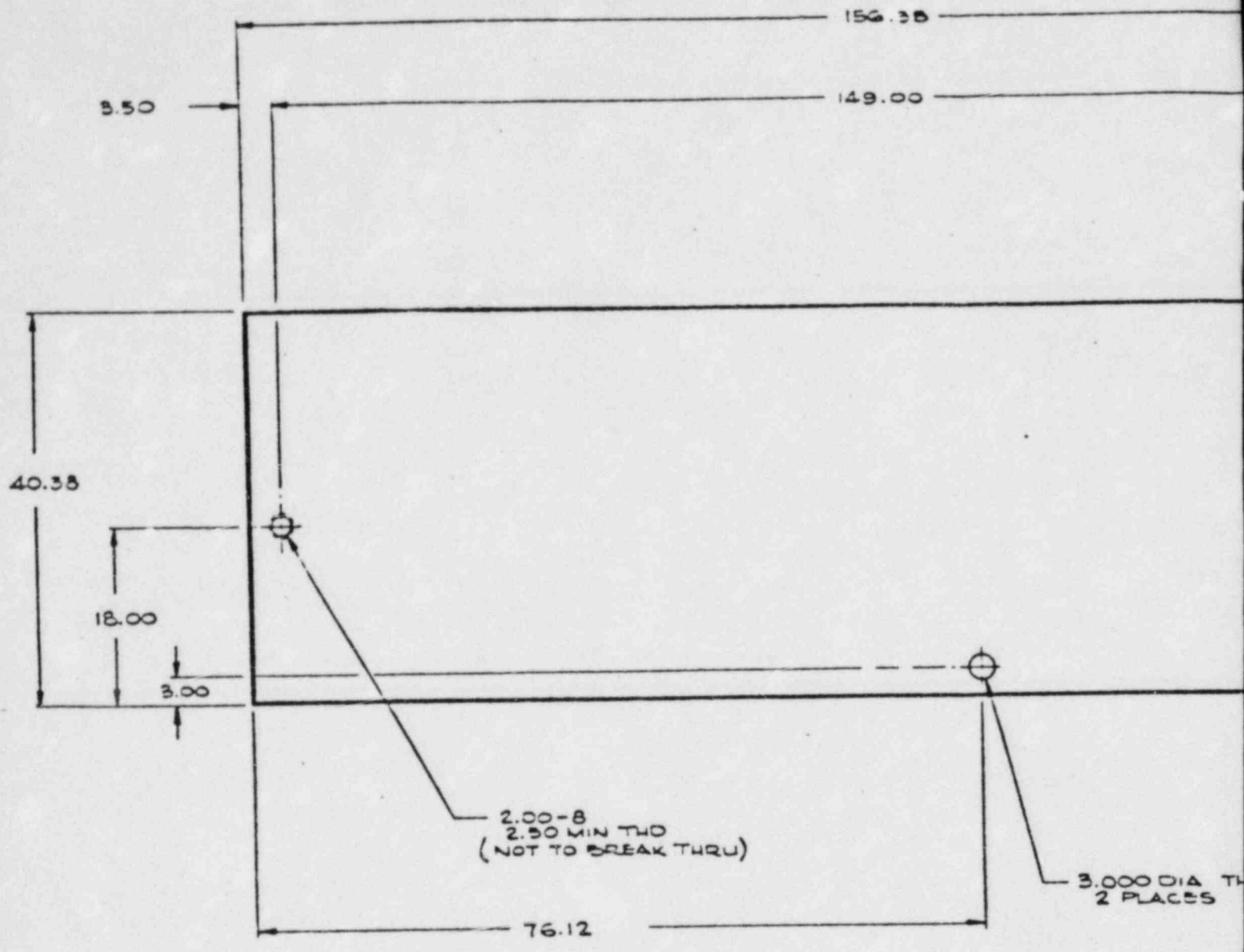
DETAIL 3
MATL; HRS SQ. TUBING 8.00 X 8.00
X .500 WALL
1 REQD
(SCALE 1/4)

DRAWN K HETTMAN	DATE 1-27-78
ENGR	
APPROVED	
MFGR	

CHEM-NUCLEAR SYSTEMS, INC.

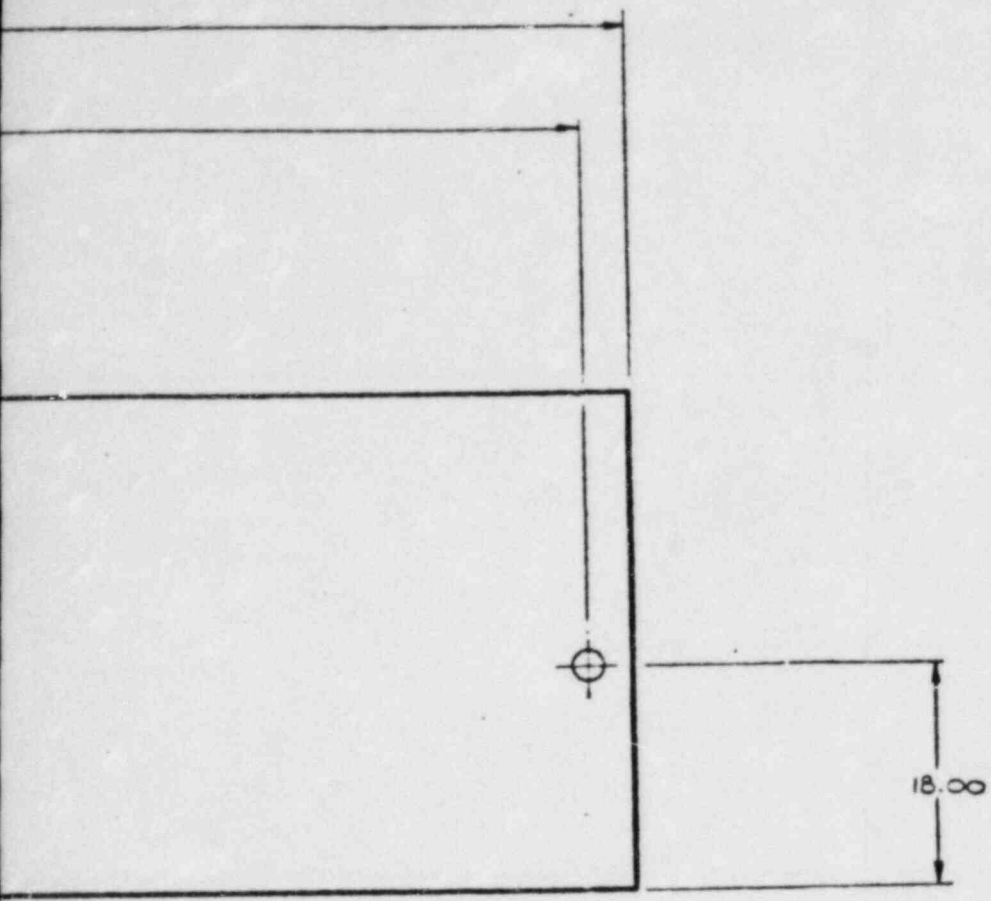
SIDE PLATE, RIGHT
RADWASTE CARRIER I
SEE 4

D 2000-C-20 E



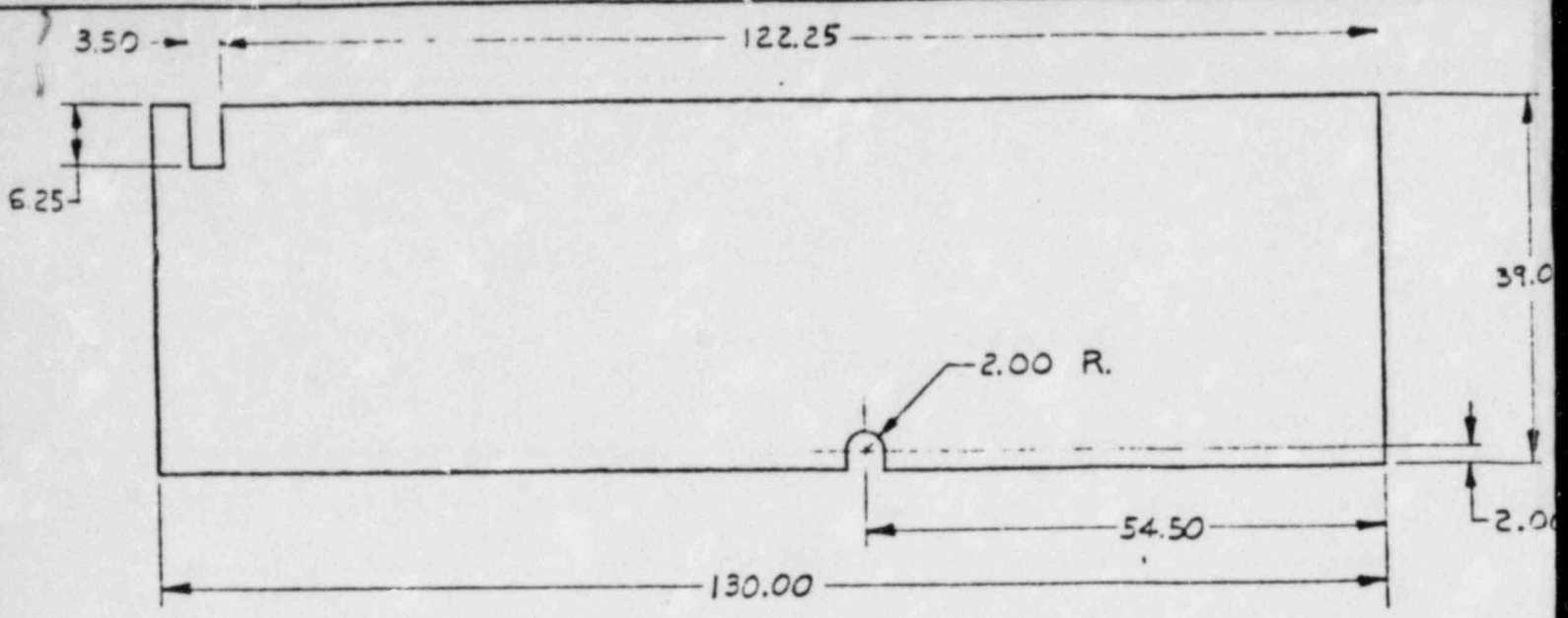
ITEM 4
MATL; HRS 4.00 THK
1 REQD

	DESCRIPTION	DATE APPROVED
B	REVISED AS BUILT	



RU

		SIZE A1/8 SCALE FULL Nov 30, 70
DRAWN TANIS	DATE Nov 70	CHEM-NUCLEAR SYSTEMS, INC.
CHECKED K. HETTMAN	11-27-70	
ENGINEER		SIDE PLATE, LEFT RADWASTE CARRIER I
APPROVED		NWS SHEET 5 OF DRAWING NO. REV. D 2000-D-20 B
APPROVED		



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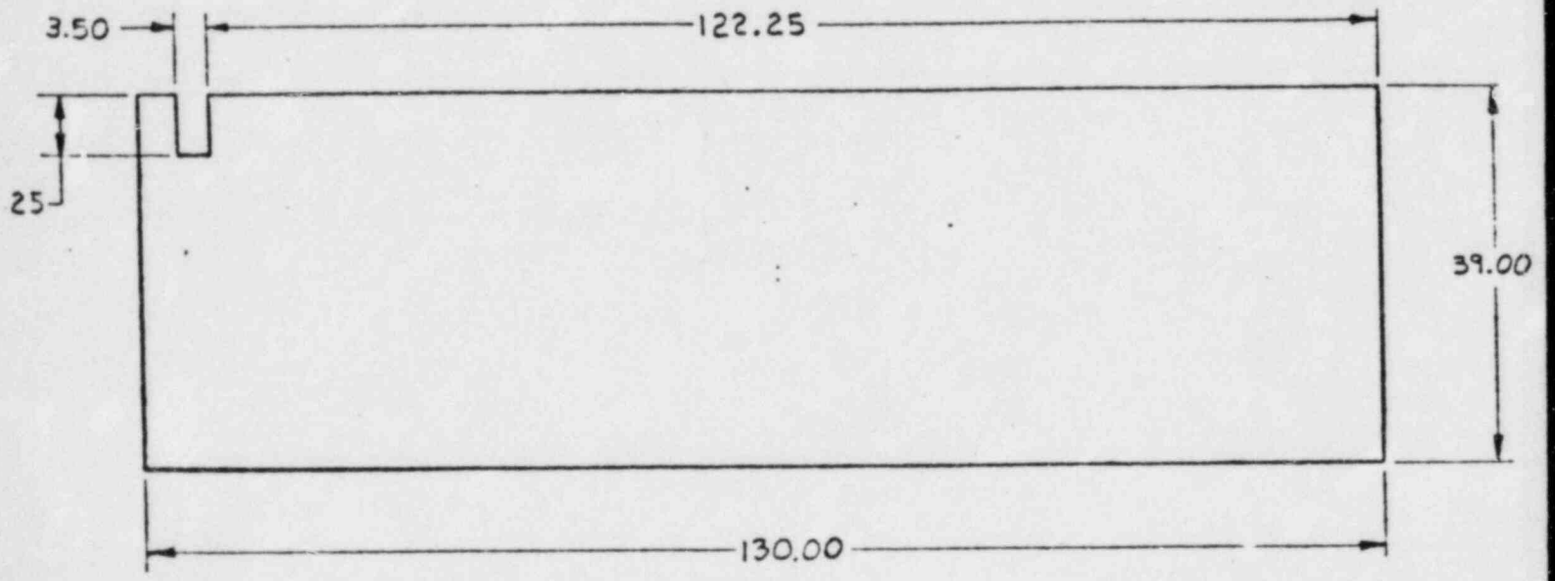
1 REQD
(SCALE 1/10)



ITEM 12
MATL: HRS 1.00 THICK
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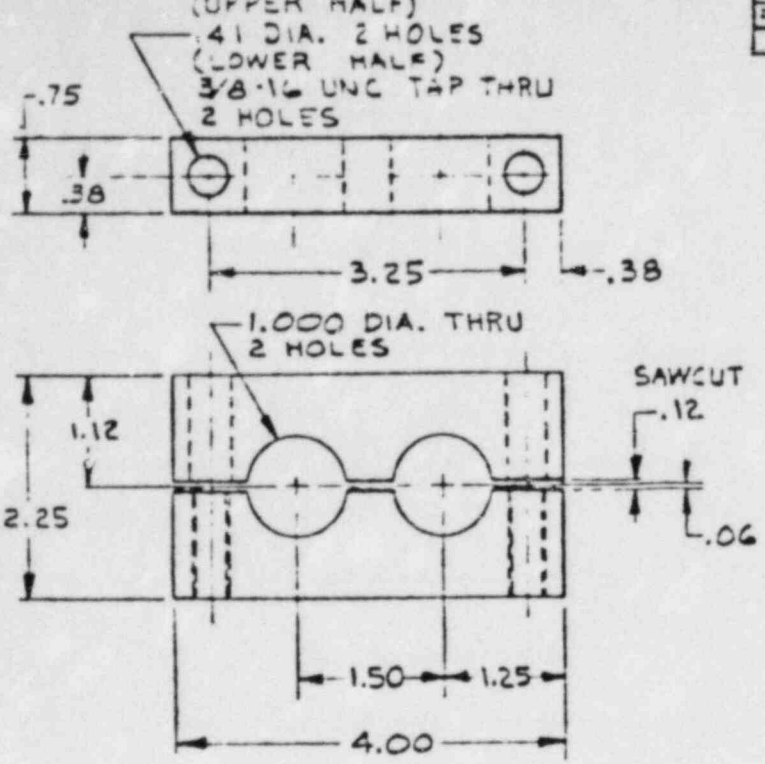
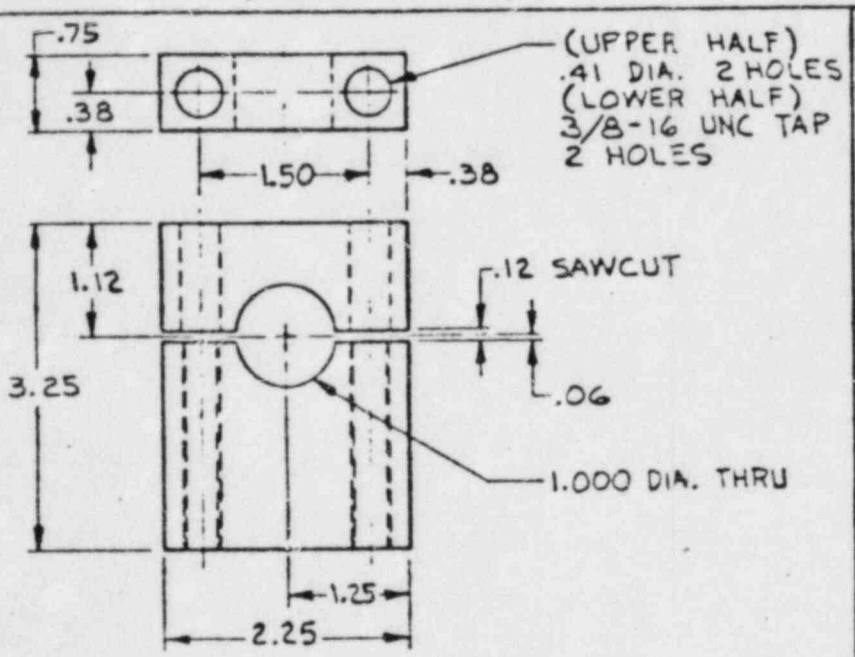
(SCALE 1/10)

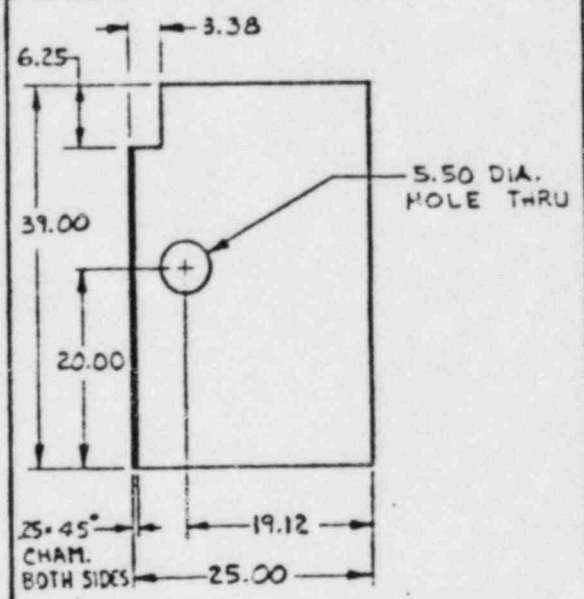
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	B	ADDED SH 6 TO AS BUILT REV.	1-6	



ITEM
MATL : HRS .75 THK
5 REQD
(SCALE FULL)



ITEM
MATL: HRS .75 THK
2 REQD
(SCALE FULL)



ITEM 15
MATL: HRS 1.00 THK
2 REQD
(SCALE 1/10)

ITEM	QTY	CODE IDENT	NOMENCLATURE OR DESCRIPTION	PART NO

PARTS LIST

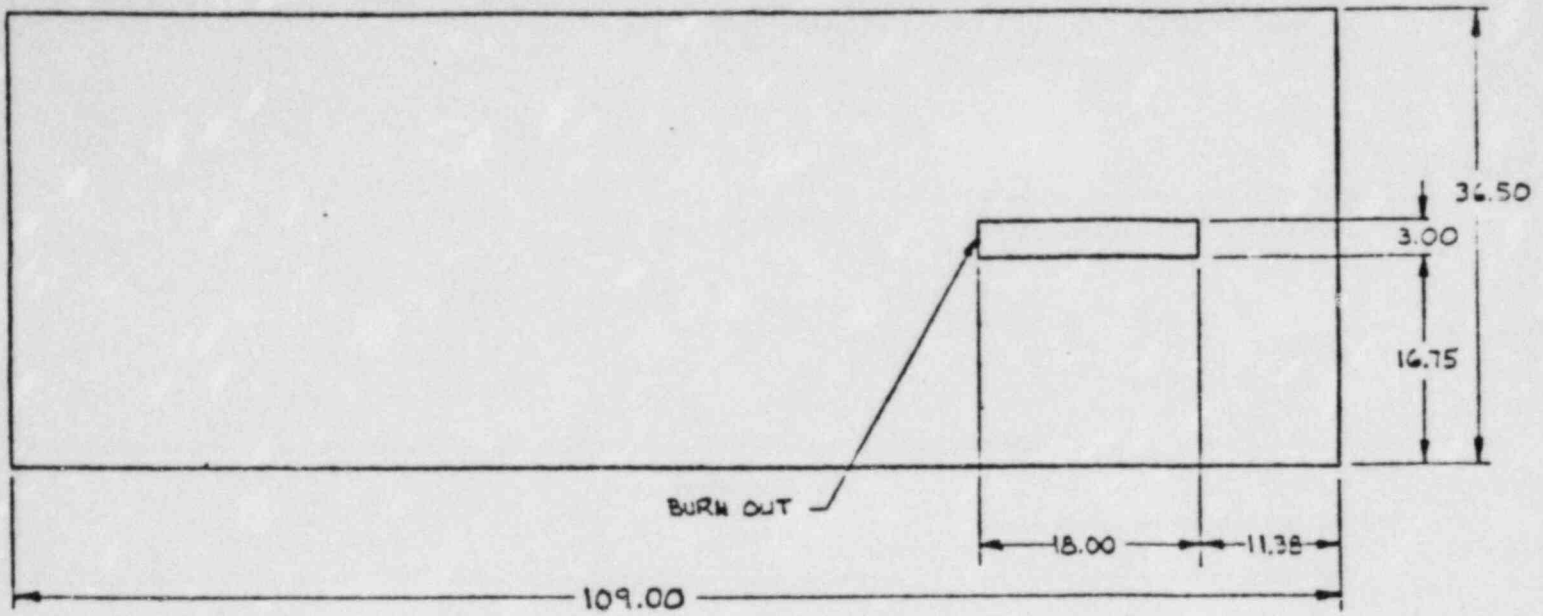
LINEAR TOLERANCES	.XX ± .56 .XXX ± .030
ANGULAR TOLERANCES	±
MATERIAL	SEE L/M
NEXT ASSEMBLY / USED ON	
APPLICATION	
FINISH	
CONTRACT NO.	
DRAWN TANIS	DATE 1-27-71
CHECKED K. METTMAN	DATE 1/27/71
ENGINEER	
QUALITY	
APPROVED	

CHEM-NUCLEAR SYSTEMS, INC.

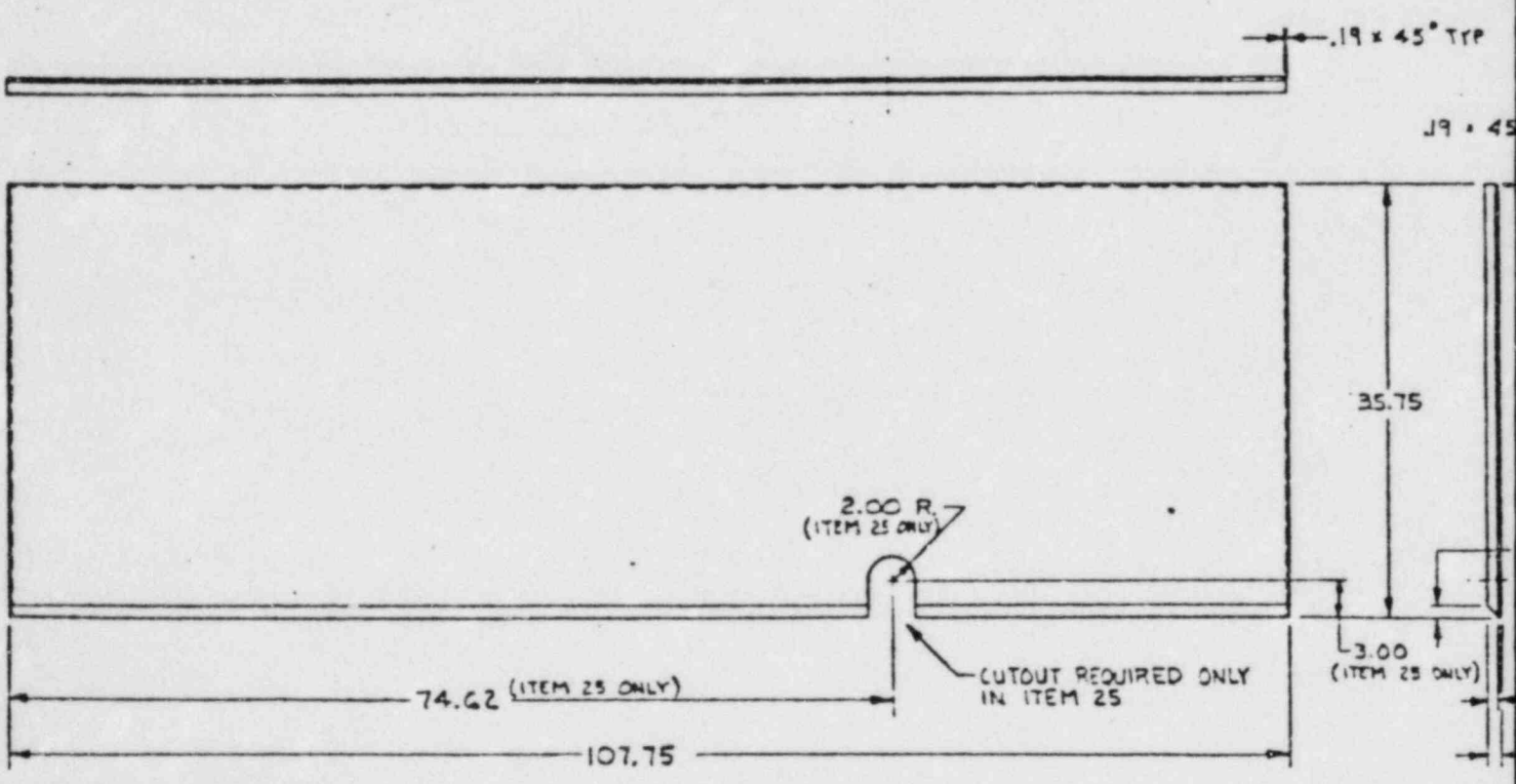
SHIELD, CONTAINER
RADWASTE CARRIER I

SIZE D | 2000-D-201 | REV E

SCALE AS NOTED | SHEET —

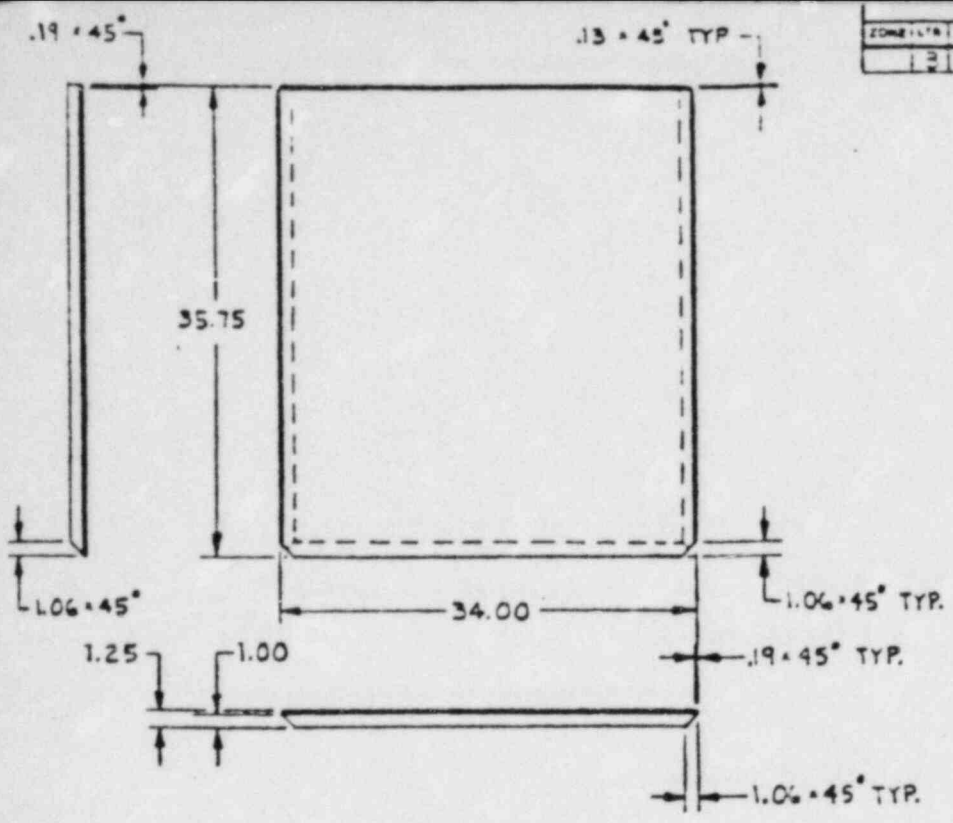


ITEM 14
MATL; HRS 1.00 THK
1 REQD

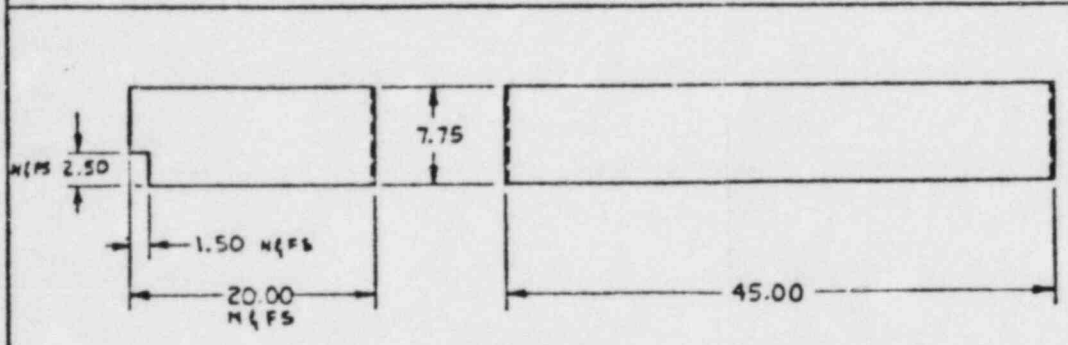


ITEM 24 & 25
3 MATL; LEAD-1.00 THK
STEEL-HRS .25 THK
1 ITEM 24 REQD
1 ITEM 25 REQD

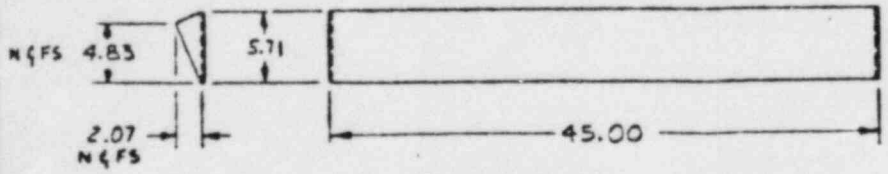
REVISIONS			
ZONE	LTR	DESCRIPTION	DATE / APPROVED
	B	ADDED SHT 2 TO AS BUILT REV.	



3 ITEM 26
MATL; LEAD - 1.00 THK
STEEL - HRS .25 THK
1 REQD



ITEM 27
MATL; HRS SHT. 11GA.
1 REQD



ITEM 28
MATL; HRS SHT. 11GA.
1 REQD

ITEM	QTY	CODE IDENT	NOMENCLATURE OR DESCRIPTION	PART NO.

PARTS LIST

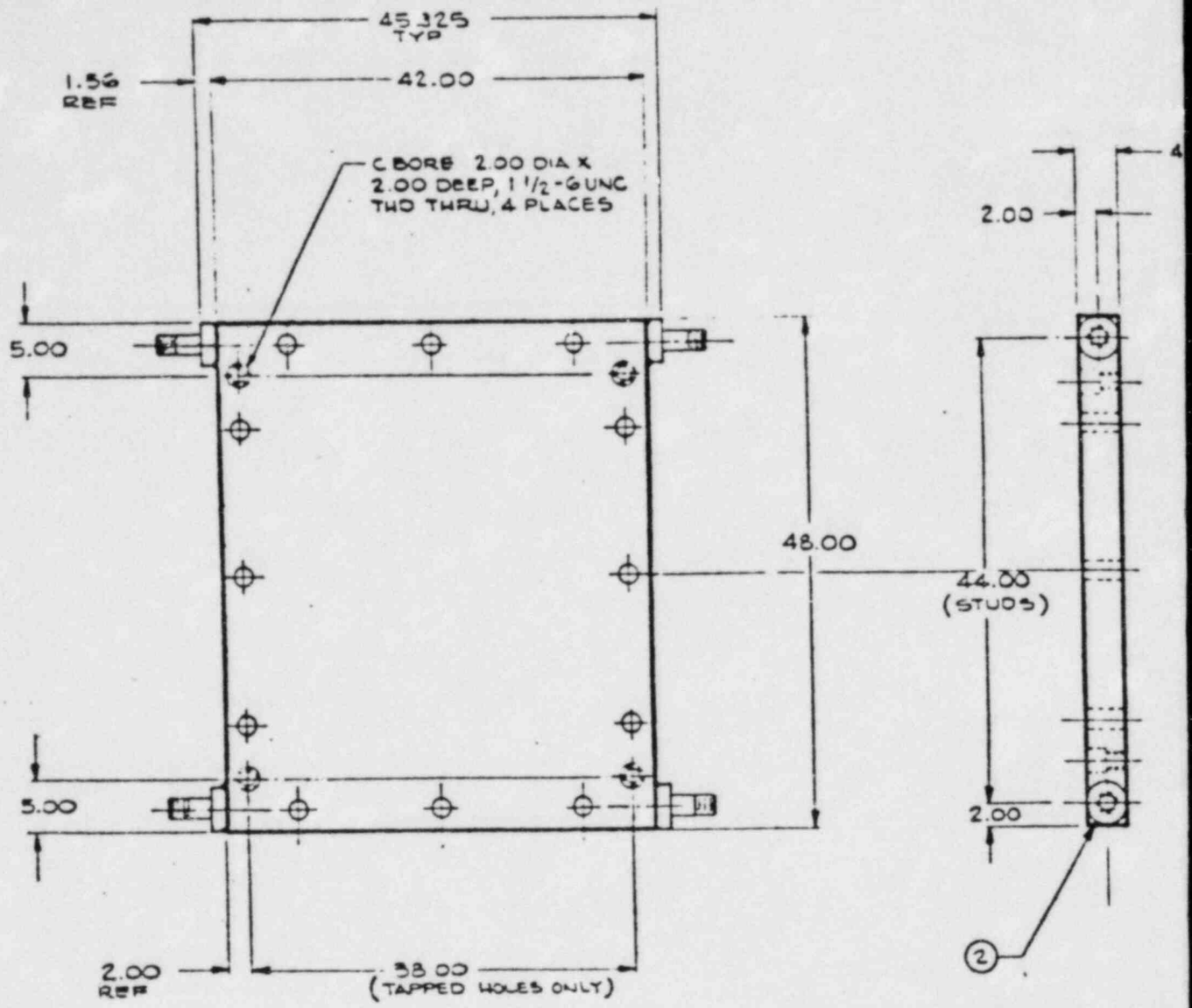
CONTRACT NO	
DRAWN TANIS	DATE 1-18-78
CHECKED L HETTMAN	1-27-78
MATERIAL	
FINISH	

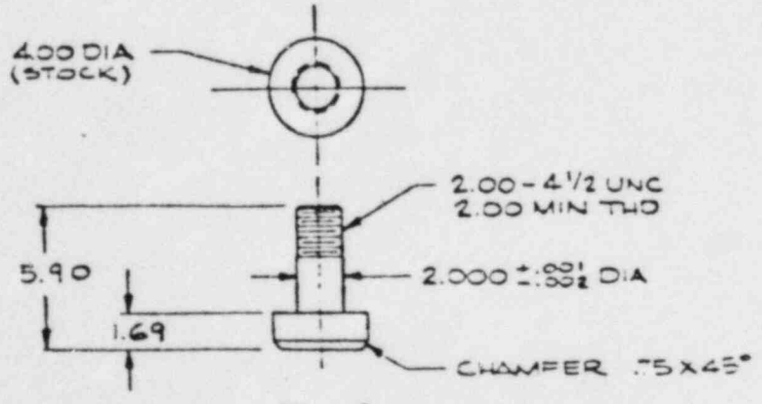
CHEM-NUCLEAR SYSTEMS, INC.

TITLE: SHIELD, CONTAINER RADWASTE CARRIER I

SIZE D | 2000-D-201 | QTY B

SCALE 1:6 | SHEET 2 OF —





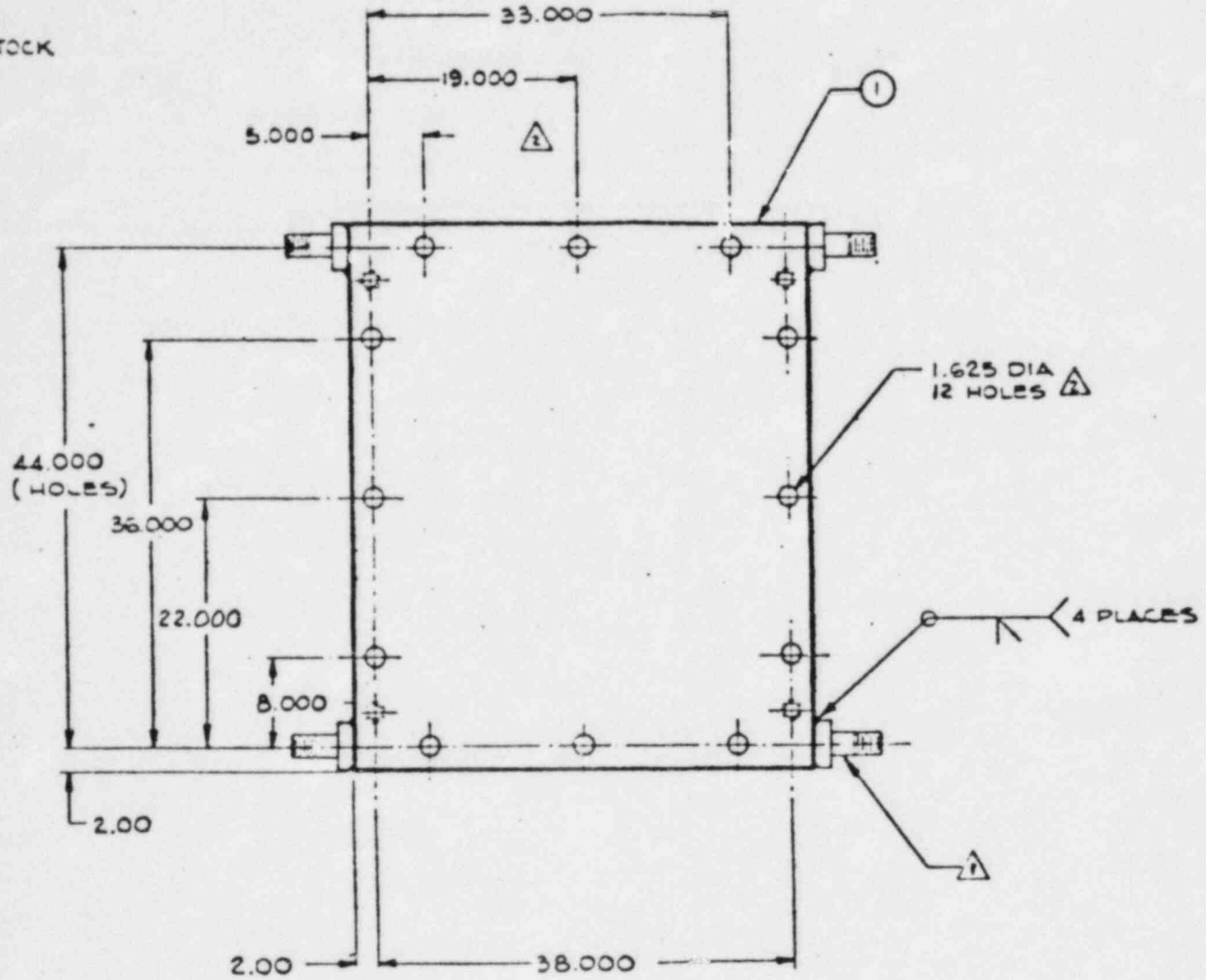
ITEM 2
(SCALE 1/1)
4 REQD
MATL - RS

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
	[illegible]		
	[illegible]		
	[illegible]		
F	REVISED AS BUILT		

LIST OF MATERIALS			
ITEM	DESCRIPTION		WEIGHT
1	PLATE HRS		2257
2	STLD	.53	38
3	WASHER FLAT	.08	
4	[illegible]		

2321

00 STOCK



.09	.030	CHEM-NUCLEAR SYSTEMS, INC.
		DOOR SHIELD CONTAINER
		RADWASTE CARRIER I
HRS ASTM A 36		D 2000-D-202 F

1.3 Appendix

CNS 6-101 Shipping Cask Drawing

2.0 STRUCTURAL EVALUATION

2.1 Structural Design

Structural Design is addressed in other areas of this package.

2.2 Weights and Centers of Gravity

Weights

The weights for the 6-101 cask were calculated and submitted under previous SAR Docket No. 9105. Tnese calculations have been summarized in the following table with the actual calculations included as Appendix 2.8. Item numbers refer to part numbers on Drawing 2000-D-201.

TABLE

Item No.	Weight (lbs.)
1	7982
2	7982
3	7272
4	7272
5	315
6	2087
7	376
8	41
9	50
10	17
11	120
12	1133
13	1133
14	1113
15	2(262)
16 and 17	69
18	7
19	14
20	2
21	2(44)
22	2(97)
23	2(49)
24	1808
25	1808
26	510
27	23
28	10
Subtotal (Items 1-28)	42048
Total plus door weight (2325 lbs)	44373
Total (including door, contents, and misc. mechanical)	58,373

2.3 Mechanical Properties of Materials

The cask is constructed out of mild carbon steel and lead. A nominal yield stress of 36,000 psi is used for base material or otherwise as specified in the appropriate analysis.

2.4 General Standards for All Packages

2.4.1 Chemical and Galvanic Reactions

The cask is constructed of mild carbon steel and lead in a welded and bolted construction. The cask is not prone to any significant chemical or galvanic reaction in the environment that would normally be seen.

2.4.2 Positive Closure

Positive closure of the 4 inch thick by 38 inch by 48 inch hydraulically actuated door is accomplished with twelve 1.5 inch bolts.

2.4.3 Lifting Devices

Two sling pickup:

$$I = \frac{bh^3}{12}; \frac{45(49)^3}{12} - \frac{37(41)^3}{12} = 229{,}000 \text{ in}^4$$

$$M_{max} = \frac{WL}{8} \quad \text{where} \quad \begin{array}{l} W = \text{calculated total weight} \\ L = \text{length} \end{array}$$

$$M_{max} = \frac{(58{,}000)(160)}{8} = 1{,}160{,}000 \text{ in-lbs.}$$

$$\sigma_{bend} = \frac{Mv}{I} \text{ (bending stress)} \quad \begin{array}{l} \text{maximum when} \\ v \text{ is maximum distance} \\ \text{from neutral axis} = D/2 \end{array}$$

$$\sigma_{bend} = \frac{(1{,}116{,}000)(24.5)}{229{,}000} = 124 \text{ psi at 1 G}$$

$$f_{bend} = 3(\sigma_{bend}) = 3(124) = 372 \text{ psi} \ll \text{yield}$$

therefore, lifting devices are adequate.

2.5 Standards for Type B and Large Quantity Packaging

This container is not intended for use with Type B or large quantity materials.

2.6 Normal Conditions of Transport

The normal conditions of transport have been addressed for secondary containers for heat, cold, pressure, vibration and water spray as required by 10CFR71.35. These conditions need not be addressed for the CNS 6-101 transport cask.

DROP ANALYSIS

The C-101 cask is evaluated for a one foot free drop in the attitudes detailed in this section

Five Drop Attitudes to be investigated:

1) flat bottom drop
2) long edge impact (160 in)
3) flat end drop
4) short edge drop impact (45 or 49 in)
5) corner drop

1) FLAT BOTTOM DROP

Impact surface 160 x 45 inches

Energy = 58,000 (12) = 696,000 in-lbs.

$$\text{Volume steel} = \frac{696,000}{36,000} = 19.3 \text{ in}^3$$

$$\text{Body area} = 2(4)(160) = 1280 \text{ in}^2$$

$$\Delta = \frac{19.3 \text{ in}^3}{1280 \text{ in.}^2} = .015 \text{ in.}$$

Note that Δ = 0.015 in. is very conservative (i.e. high load factor results) value since crushing of appendages is neglected.

$$\text{"G" factor} = \frac{h}{\Delta} = \frac{12}{.015} = 796 \text{ G}$$

Check bending top plate under own weight:

Partial fixity at ends = $\frac{wl^2}{16}$

$W_{steel} = \frac{490}{1728}(4) = 1.13$ psi

$\frac{wl^2}{16} = \frac{1.13\ (34.5)^2}{16} = 84.4$ in-lbs/in.

$f_{bend} = \frac{M}{\sigma} = \frac{84.4\ (6)}{(4)^2} = 31.6$ psi at 1G

Impact stress = 796(31.6) = 25,187 psi < yield

Check weldment at end:

Item 6 weight = 2087 lbs.

1 inch fillet 16(0.928) = 14.85 kips/in. allowed

body length = (40 + 46) 2 = 172 in.

capacity one side = (14.85) (172) = 2554 kips

actual = 2087 lbs (796) = 1661 kips < 2554 kips

therefore, end weld is adequate.

12 bolts in door:

1-1/2" - 6 UNC σ = 130,000 psi yield

For SAE 429, Grade 8, shear area = 1.7671 in.^{2}

$F_v = 0.3F_y = 0.3\ (130{,}000) = 39{,}000$ psi = 39 ksi

Capacity at shear yield = $\frac{130{,}000\ (1.7671)}{2}$

= 115 kips each at $\frac{Y}{2}$

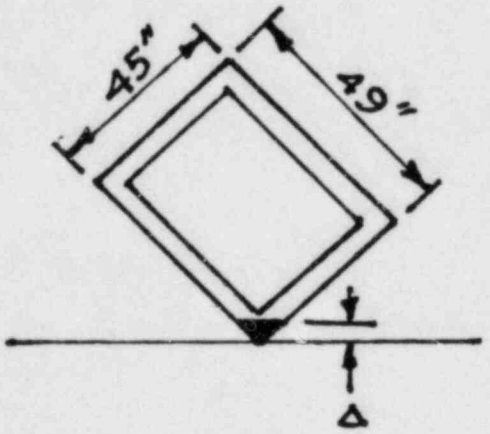
Allowed strength = $\sqrt{\frac{130,000}{3}}$ = 75.1 ksi

Bolt capacity - 75.1 ksi x (area) = 133 kips

total 12 bolts = 1592 kips

Since very conservative "G" factor used, bolts are adequate.

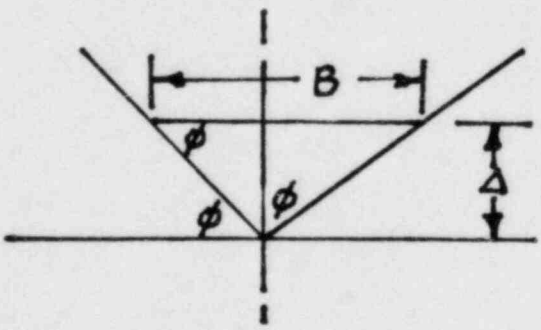
2) LONG EDGE IMPACT



$\tan\phi = \frac{49}{45} = 1.09$

$\tan^{-1} 1.09 = \phi = 47.44°$

Deformation Sketch - material volume calculation



$$\frac{\Delta}{\tan\phi} + \Delta \tan\phi = B = \frac{\Delta}{1.09} + 1.09\Delta = 2.01\Delta$$

$$\text{Volume} = \frac{\Delta\,(2.01)}{2}\ \Delta\ (160) = 160\Delta^2 = 19.3\ \text{in}^3$$

$$\Delta^2 = \frac{19.3}{160}$$

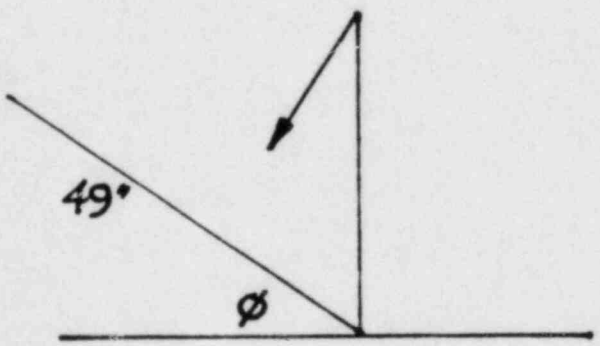
$\Delta = 0.35$ inch

$$\text{"G" factor} = \frac{12}{0.35} = 34.5$$

$$F_I = 2.01(0.35)(160)(36000) = 4052 \text{ kips}$$

$$\text{"G" factor} = \frac{4052}{58} = 70$$

Check sidewall strength with contents:



$6000 \cos\phi = 4058$

$$\text{Design moment value} = \frac{Wl^2}{16}$$

$$W_{\text{dead weight}} = \frac{490\ (4)\ \cos\phi}{1728} = 0.77 \text{ psi}$$

$$W_{\text{contents}} = \frac{4058}{144(36)} = 0.78 \text{ psi}$$

$W_{dead\ weight} + W_{contents} = 1.55$ psi at 1G vertical

$$\frac{wl}{16} = \frac{1.55(41)^2(70)}{16} = 11{,}420 \text{ in-lbs/in at 70G.}$$

where 70 = load factor

$$f_{bend} = \frac{M}{\sigma} = \frac{11{,}420(6)}{(4)^2} = 4282 \text{ psi} < \text{yield}$$

therefore, edge bend is adequate

Weld check at corners.

M = 11,420 in-lbs/in

1 inch fillet weld good 14.85 k/in

4(14.85) = 59.4 in-kips/in > 11.4

therefore, weld is adequate.

3) FLAT END IMPACT

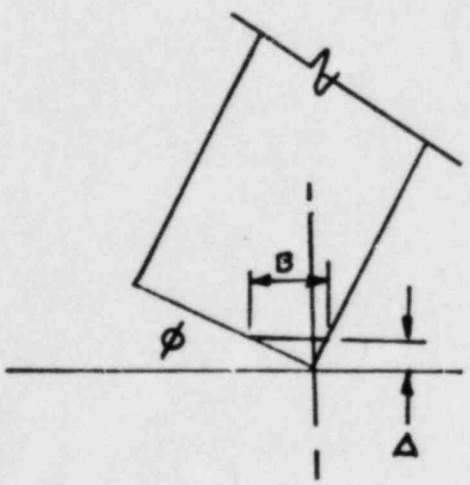
Body area = (45 + 45 + 41 +41)4 = 688^2in.

$$\Delta = \frac{19.3}{688} = 0.028 \text{ in}$$

$$\text{"G" factor} = \frac{12}{0.028} = 428$$

Flat end impact less critical than flat bottom drop.

4) SHORT EDGE IMPACT



$$\phi = \tan^{-1} \frac{49}{160} = 17.03^{o}$$

$$B = \frac{\Delta}{\tan\phi} + \Delta\tan\phi = \frac{\Delta}{0.31} + 0.31\Delta = 3.58\Delta$$

$$\text{Volume} = \frac{3.58\Delta^2\ (45)}{2} = 80.4\Delta$$

$$\Delta = \sqrt{\left[\frac{19.3}{80.4}\right]} = 0.49 \text{ in.}$$

$$\frac{2h}{\Delta} = \frac{2(12)}{0.49} = 49\ G$$

$$F_I = B(45)\ (\text{yield}) = 3.58(0.49)(45)(36{,}000) = 2842 \text{ kips}$$

$$G = \frac{2842}{58} = 49\ G$$

$$W = 1.13 + \frac{6000}{24(36)} = 8 \text{ psi, which is conservative}$$

$$W = 8(49) = 396 \text{ psi}$$

Two-way plate action:

$$\beta \frac{qb^2}{t^2} = \beta \frac{396(34.5)^2}{(4)^2} = 29.432\beta \text{ psi}$$

$\beta = 0.38$, for $\frac{a}{\beta} = \frac{41}{34.5} = 1.2$

Maximum stress = 11,200 psi < yield

therefore, the plate strength is adequate

Check weld/bolts:

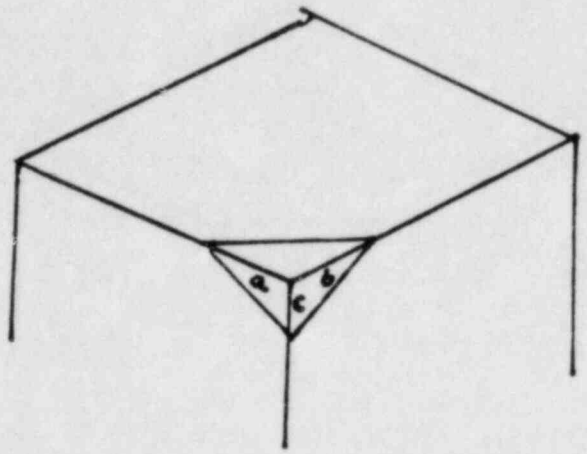
load at 49 G = 49(6000 + 2325) = 408 kips

12 bolts at 130(1.7671) each = 2757 kips > 408

therefore, bolts are adequate

welds not critical at 14.85 k/in (other end)

5) CORNER DROP IMPACT



$Ax + By + Cz + D = 0$

A,B,C are direction cosines of a normal to the plane.

CG taken as 0,0,0

Corner point P taken as $\frac{45}{2}, \frac{49}{2}, \frac{160}{2}$

Length of CG to Point P = $\sqrt{[(22.5)^2 + (24.5)^2 + (80)^2]} = 86.64$

$\cos = \frac{22.5}{86.64} = 0.26$

$\cos\beta = \frac{24.5}{} = 0.28$

$\cos = \frac{80}{86.4} = 0.92$

therefore, $0.26x + 0.28y + 0.92z + D = 0$

volume = $\frac{abc}{6}$ = 19.3 in^3

Intercepts along edges:

$x = \frac{-D}{0.26} = a =$ 7.654 inches

$y = \frac{-D}{0.28} = b =$ 7.03 inches

$z = \frac{-D}{0.92} = c =$ 2.153 inches

Equal volume

$$19.3 = \frac{abc}{6} = \frac{-D^3}{(0.068)(6)}$$

$$-D^3 = 6(0.068)(19.3) = 7.852$$

$$D = -1.99$$

2.7 Check Hypothetical Accident Conditions.

Not applicable for Type A container.

APPENDIX 2.8

LOADS

Weights

Item 1: $\frac{156.38(45.0)(4)(490)}{1728}$ = 7982 lbs. each

Item 3: $\frac{156.38(41.0)(4)(490)}{1728}$ = 7272 lbs. each

Type of material - A36 plate.

Item 6: $\frac{40(46)(4)(490)}{1728}$ = 2087 lbs.

Total open end box excluding accessories

7982 (2)	=	15,964
7272 (2)	=	14,544
2087	=	2,098
		32,595 lbs.

Additional steel plate and lead:

Top steel plate

Item 14: $\frac{109(36)(1)(490)}{1728}$ = 1113 lbs.

Side steel plate (extension)

Items 12,13: $\frac{108(37)(1)(490)}{1728}$ = 1133 lbs.

Interior 1" lead + 1/4" steel lining

Items 24,25: $\frac{108(34.75)(1)(710)}{1728}$ = 1542 lbs. each

$$\frac{108(34.75)(0.25)(490)}{1728} = 266 \text{ lbs. each}$$

Additional weight total:

1542(2)	=	3084
266(2)	=	532
1113	=	1113
1133(2)	=	2266
		6995

Items 17, 16:

Wt = 234 lbs/ft.
k = 5/8 inch

Inches cap angle = (34.75) 4 + (108) 2 = 355.0 inches

Total weight $\frac{355.0\ (2.34)}{12}$ = 69.2 lbs.

Front plates L and R, extension

Item 15: $\frac{25(37)(1)(490)}{1728}$ = 262 lbs. each

UNDERSIDE SHIELDING:

Item 21: $\frac{3.5(117)(0.375)(490)}{1728}$ = 43.54 lbs. each

Item 22: S 5 x 10.0 at 116 inches

$\frac{10\ (116)}{12}$ = 97 lbs. each side

Item 23: L 2 1/2 x 2 1/2 x 5/16 at 117 inches

$\frac{5\ (117)}{12}$ = 49 lbs. each

COVERS:

Item 28: $\frac{45.373(6)(0.125)(490)}{1728}$ = 10 lbs.

Item 27: $\frac{(45.375 + 39)(7.75)(0.125)(490)}{1728}$ = 23 lbs

REAR SHIELD - interior

Item 18: $\frac{345}{12}$ (2.34) = 7 lbs.

Item 19: 3/16 $\frac{(1.25)(108)(490)}{1728}$ = 7 lbs. each

Item 20: 3/16 $\frac{(1.25)(34.5)(490)}{1728}$ = 2 lbs. each

Item 26: $\frac{34.5(36)(1)(710)}{1728}$ = 510 lbs.

Totals Excluding Appendages (Items 5, 7-11):

1	7982	18	7
2	7982	19	14
3	7272	20	4
4	7272	21	44 (2)
6	2087	22	97 (2)
12	1133	23	49 (2)
13	1133	24	1542 + 266
14	1113	25	1542 + 266
15	262 (2)	26	510
16	69 (total)	27	23
7		28	10

41131 lbs.

Item 5: Foot manufacturing

8 holes 1-1/4

Details:

1. 24 x 8 x 1/2 plate A-36
2. 1/2 inch plate
3. Tube 8 x 8 - 1/2 ASTM A501

Weight = $\frac{24 \times 8 \times .5}{1728}$ x 490 = 27 lbs.

$\frac{(7)^2(0.5)(490)}{1728}$ = 7 lbs two pieces

$\frac{47.37\ (9.25)}{12}$ = 29 lbs.

Total each item 5 = 63 lbs.

Item 7: Support door lift assembly

Weight = $\frac{(11 + 38.62)(13.8)(2)(490)}{2 \qquad 1728}$ = 194 lbs.

$$\frac{(3\ 1/2 \times 3\ 1/2 \times 11)}{1728}\ 490 = 38 \text{ lbs.}$$

Total each Item 7 = 232 lbs.

Holes $\frac{\pi(7)^2}{4}\ (2)\frac{(490)}{1728}$ = 22 lbs. each

Net each Item 7 = 232 - 44 = 188 lbs.

Item 8: Gasket

Weight = $\frac{(12)^2(1)490}{1728}$ = 41 lbs. (2)

Item 9: Anchor plate

Weight = $\frac{15(17)(2)\ (490)}{2 \qquad 1728}$ = 72 lbs.

Net - 72 - 22 = 50 lbs.

Item 11: Lifting lug Drawing 2000-0-201 Rev. A

Weight = $\frac{(4 + 11)(8)(2)(490)}{2 \qquad 1728}$ = 34 lbs.

$$\frac{1(5)(2)(490)}{1728} = 3 \text{ lbs.}$$

Net = 30 lbs. each.

Door - Drawing 2000-D-202 Rev. F

Weight = $\frac{42(48)(4)\ (490)}{1728}$ = 2287 lbs.

Studs = 38 lbs.

2325 lbs.

SUMMARY

1 - 4, 6, 12 - 28	41.131
5	313
7	376
8	41
9	50
10	17
11	121
Door	2325
	44,375 lbs. excluding contents

Contents

6 drums at 1000 lbs. each = 6000 lbs.

Miscellaneous Mechanical

8000 lbs: Generator, Hydraulic, etc.

3.0 THERMAL

The solid steel construction of this package with lead lining provide an inherent stable structure for the temperature range normally seen by the package, as specified in 10CFR71.35.

4.0 CONTAINMENT

The structural evaluation has demonstrated that there will be no significant reduction in containment for Type A secondary container during normal conditions of transport. The rectangular steel box provides no containment capability, and therefore the use of this cask is based on the containment provided by DOT Type A secondary containers.

5.0 SHIELDING EVALUATION

There will be no significant reduction of shielding effectiveness as a result of normal conditions of transport.

6.0 CRITICALITY EVALUATION

This section is not applicable to the CNS 6-101 cask.

7.0 OPERATING PROCEDURES

This section describes the general procedure for loading and unloading of the CNS 6-101 cask.

7.1 Loading

7.1.1 Position the transport cask on a level surface at the shield door opening at the nuclear facility.

7.1.2 Perform a pre-operational check of hydraulic and electrical systems.

7.1.3 Prepare to open cask door. Remove seal wire from cask door bolt.

CAUTION: TREAT THE INSIDE OF THE SHIELD DOOR, THE INSIDE SURFACES OF THE CASK, THE CONVEYORS, AND ANY BOLTS OR SEALS REMOVED AS CONTAMINATED.

7.1.4 Remove the twelve (12) 1-1/2 inch bolts from the door.

7.1.5 Raise cask door.

7.1.6 Place one of the removed bolts in one of the lower door bolt holes.

7.1.7 Inspect gasket and replace as necessary.

7.1.8 Operate conveyors to load drums to maximum of six (6) drums. Remove bolt placed in lower hole of cask door.

NOTE: AS EACH DRUM MOVES THROUGH THE BUILDING SHIELD DOOR, IT SHALL BE SURVEYED FOR RADIATION AND CONTAMINATION. IF CONTAMINATION IS NOTED, STOP ALL LOADING OPERATIONS AND NOTIFY THE RAD-WASTE SUPERVISOR IMMEDIATELY. CONTAMINATED DRUMS SHALL BE RETURNED FOR DECONTAMINATION.

7.1.9 Close cask door.

7.1.10 Survey cask to assure dose rate does not exceed requirements of 49 CFR 173.393 (j).

7.1.11 Install the twelve (12) 1-1/2 inch bolts in cask door. Torque to 250 ft/lb.

7.1.12 Attach lead wire seal to designated door bolt.

7.1.13 Before cask leaves facility, the following shall be confirmed.

See (a) That trailer placarding and cask labelling meet DOT Specifications (CFR 49, Part 172).

(b) That exterior radiation levels do not exceed 10 mR/nr at 6 feet and 2 mR/hr in the tractor cab, in accordance with 49 CFR 173.393 (j).

(c) That the cask door is sealed with an anti-tamper seal.

7.1.14 Complete the user check-off sheet and appropriate documentation.

7.2 Unloading

NOTE: ALL PERSONNEL HANDLING FILLED DRUMS SHALL OBSERVE ESTABLISHED SITE RADIATION PROTECTION PROCEDURES.

7.2.1 Position cask at disposal area.

7.2.2 Remove lead wire seal.

7.2.3 Loosen and remove cask door bolts.

7.2.4 Open cask door.

7.2.5 Place one of the removed bolts in one of the lower door bolt holes.

7.2.6 Remove contents of cask by operating conveyors allowing the drums to go off the end rollers of the conveyor into the disposal area.

7.2.7 Cask shall be inspected for damage and removed from service when repair is required.

7.2.8 Operate conveyors to load drums to a maximum of six (6) drums. Remove bolt placed in lower hole of cask door.

7.2.9 Close cask door.

7.2.10 Install bolts. Torque to 250 ft/lb.

7.2.11 Attach seal wire to designated door bolt.

7.2.12 Perform cask surveys and complete appropriate documentation.

8.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

A mechanical and electrical check shall be performed on the complete system relative to each use. Maintenance and periodic inspection shall be performed on a routine basis, or as required, after repair or storage.