

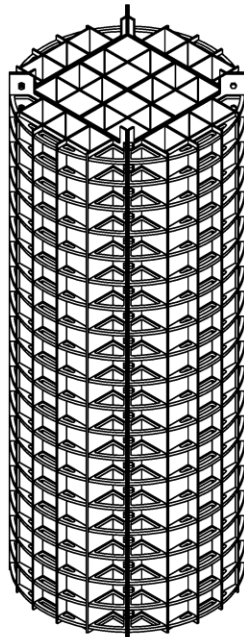
**APPENDIX E - CASK INTERNAL FUEL BASKETS DESIGN CONCEPT DRAWINGS**

**GENERAL NOTES:** (UNLESS OTHERWISE SPECIFIED)

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

2. COAT EXPOSED SURFACES OF CARBON STEEL COMPONENTS WITH ELECTROLESS NICKEL IN ACCORDANCE WITH ASTM B733.

3. BORATED ALUMINUM ALLOY OR METAL MATRIX COMPOSITE (MMC) MATERIAL HAVING A MINIMUM <sup>10</sup>B DENSITY OF 0.125 g/cm<sup>3</sup>.



**28P BASKET ASSEMBLY-LONG**  
SCALE: NONE

QTY	NOMENCLATURE/DESCRIPTION	MATERIAL/REFERENCE	ITEM
4	CENTER EGG-CRATE ANGLE #1, 1/4 INCH THK	ASME SA-537 CLASS 1	1
4	CENTER EGG-CRATE ANGLE #2, 1/4 INCH THK	ASME SA-537 CLASS 1	2
8	CENTER EGG-CRATE 1-CELL PLATE, 1/4 INCH THK	ASME SA-537 CLASS 1	3
4	CENTER EGG-CRATE 2-CELL PLATE, 1/4 INCH THK	ASME SA-537 CLASS 1	4
4	BRIDGE PLATE, 1/2 INCH THK	ASME SA-537 CLASS 1	5
8	EDGE SUPPORT PLATE #1, 1/2 INCH THK	ASME SA-537 CLASS 1	6
8	EDGE SUPPORT PLATE #2, 1/2 INCH THK	ASME SA-537 CLASS 1	7
8	CELL EDGE PLATE #1, 1/2 INCH THK	ASME SA-537 CLASS 1	8
4	CELL EDGE PLATE #2, 1/2 INCH THK	ASME SA-537 CLASS 1	9
80	GUSSET PLATE #1, 1 INCH THK	ASME SA-537 CLASS 1	10
160	GUSSET PLATE #2, 1 INCH THK	ASME SA-537 CLASS 1	11
160	GUSSET PLATE #3, 1 INCH THK	ASME SA-537 CLASS 1	12
1	CENTER NEUTRON ABSORBER PLATE, LONG, 1/2 INCH THK	BORATED ALUMINUM	13
2	CENTER NEUTRON ABSORBER PLATE, SHORT, 1/2 INCH THK	BORATED ALUMINUM	14
4	PERIMETER NEUTRON ABSORBER PLATE, 1/2 INCH THK	BORATED ALUMINUM	15
16	NEUTRON ABSORBER ANGLE, 1/8 INCH THK	BORATED ALUMINUM	16
8	NEUTRON ABSORBER SHEET, 1/8 INCH THK	BORATED ALUMINUM	17
80	BOLT, HEX 1-8 UNC-2A X 2 1/2 LG	ASTM A563, GR. DH	18
80	NUT, HEAVY HEX 1-8 UNC-2B	ASTM A563, GR. DH	19

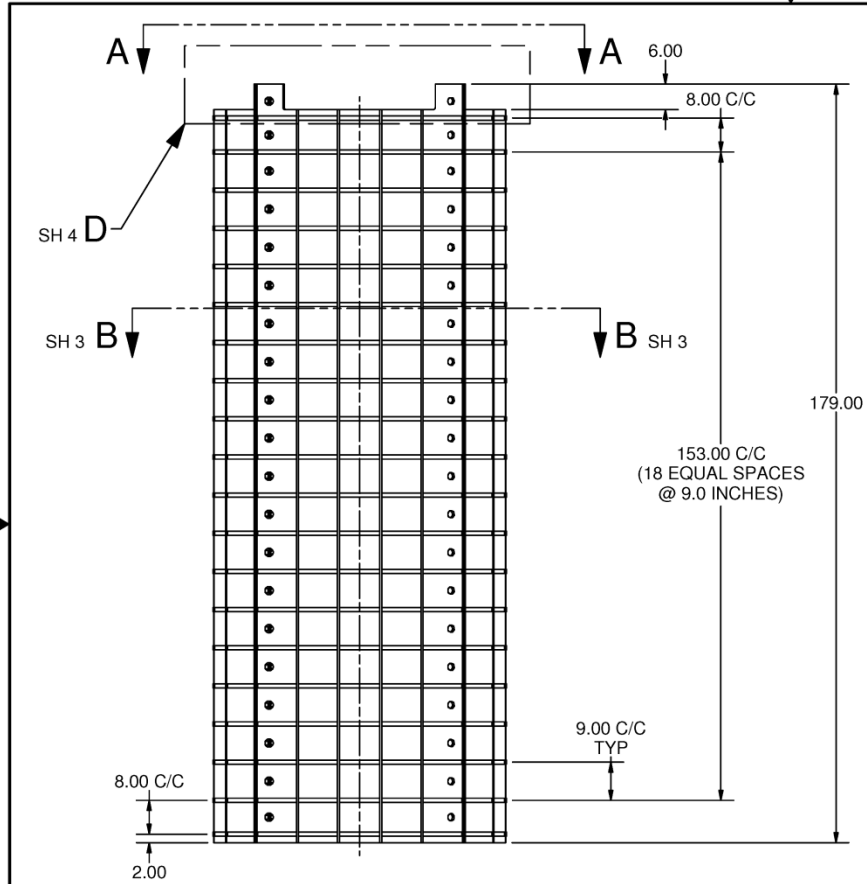
**CONCEPTUAL DESIGN SHOWN IS NOT INTENDED FOR FABRICATION**

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A	PRELIMINARY DESIGN ISSUE						

N/A		Booz   Allen   Hamilton	
Exelon Nuclear Partners		NAC INTERNATIONAL	
BY	F. CHAVEZ	DATE	25/15
ENGINEER	S. SISLEY		25/15
CHECKER			
APPROVED			
IDV	N/A		N/A
DRGM	N/A		
NEXT USED ON	N/A		

ENERGYSOLUTIONS		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99554	
CONTRACT NO.	DE-NE-0000293	PROJECT NO.	205590
TASK ORDER 17 TRANSPORTATION CASK STUDY 28P BASKET ASSEMBLY-LONG			
SIZE	B	DWG NO.	DWG-205590-ME-0005
SCALE	SHOWN	SHEET	1 OF 4

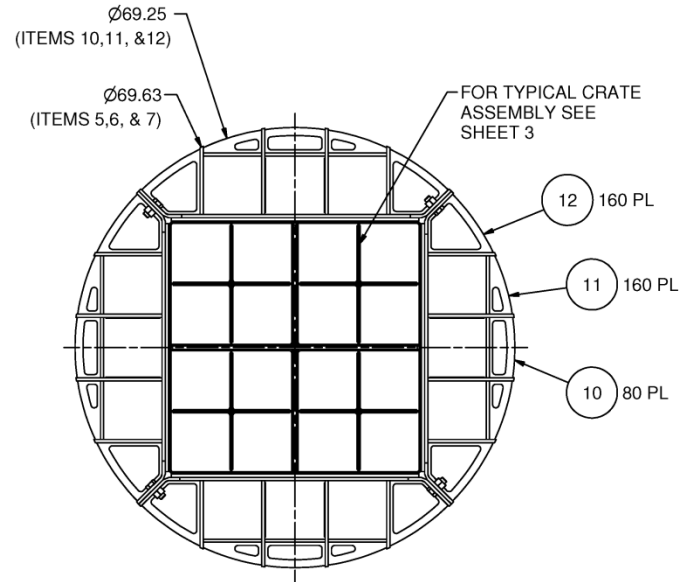
# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



**ELEVATION VIEW**  
SCALE: 1/24

## NOTES:

FOR GENERAL NOTES AND PARTS LIST SEE SHEET 1.



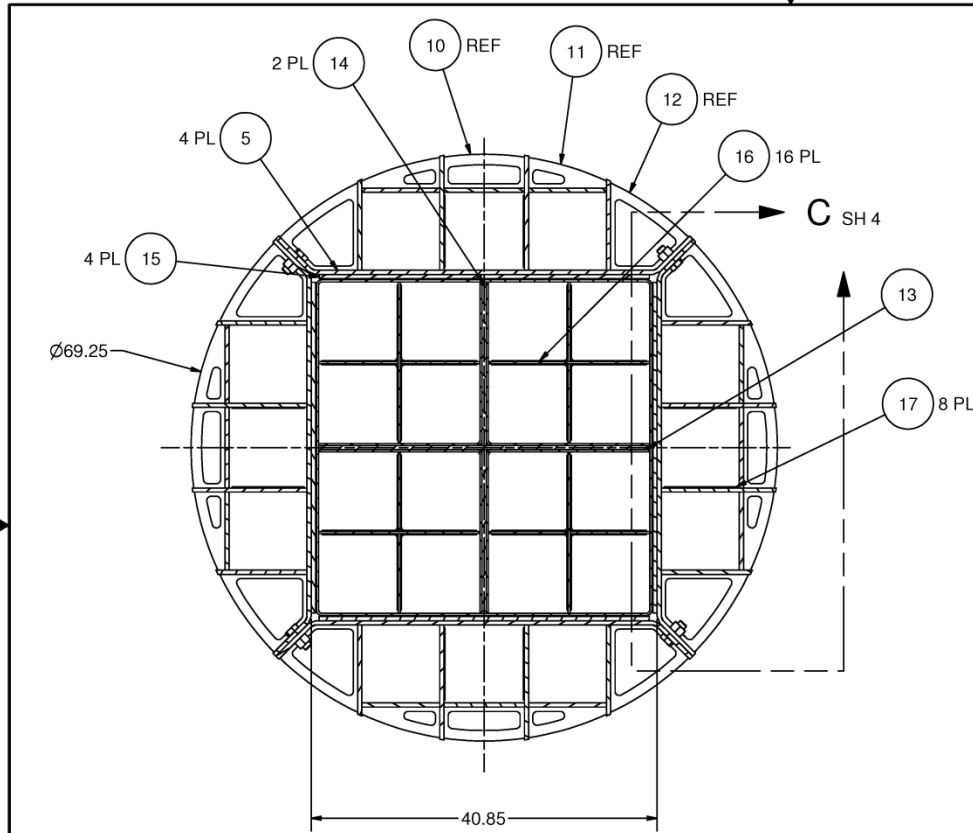
**VIEW A-A**  
SCALE: 1/16

**CONCEPTUAL DESIGN  
SHOWN IS NOT INTENDED  
FOR FABRICATION**

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A	PRELIMINARY DESIGN ISSUE		FC				
REVISIONS							

N/A	Booz   Allen   Hamilton		ENERGYSOLUTIONS		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354
	Exelon Nuclear Partners	NAC INTERNATIONAL	CONTRACT NO. DE-NE-000293	PROJECT NO. 205590	
BY	F. CHAVEZ	DATE	25/15		
ENGINEER	S. SISLEY	DATE	25/15		
CHECKER					
APPROVED					
IDV	N/A		N/A		
DRWN	N/A		N/A		
TEXT USED ON	N/A		N/A		
SIZE	B	DWG NO.	DWG-205590-ME-0005	REV	B
SCALE	SHOWN	SHEET	2	OF	4

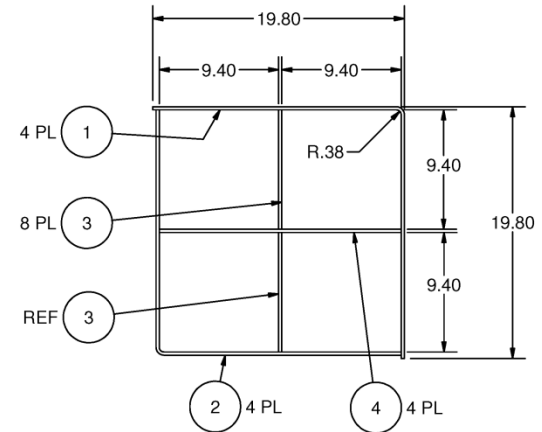
# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



**SECTION B-B**  
SCALE: 1/12

## NOTES:

FOR GENERAL NOTES AND PARTS LIST SEE SHEET 1.



**TYPICAL QUADRANT  
BASKET ASSEMBLY**

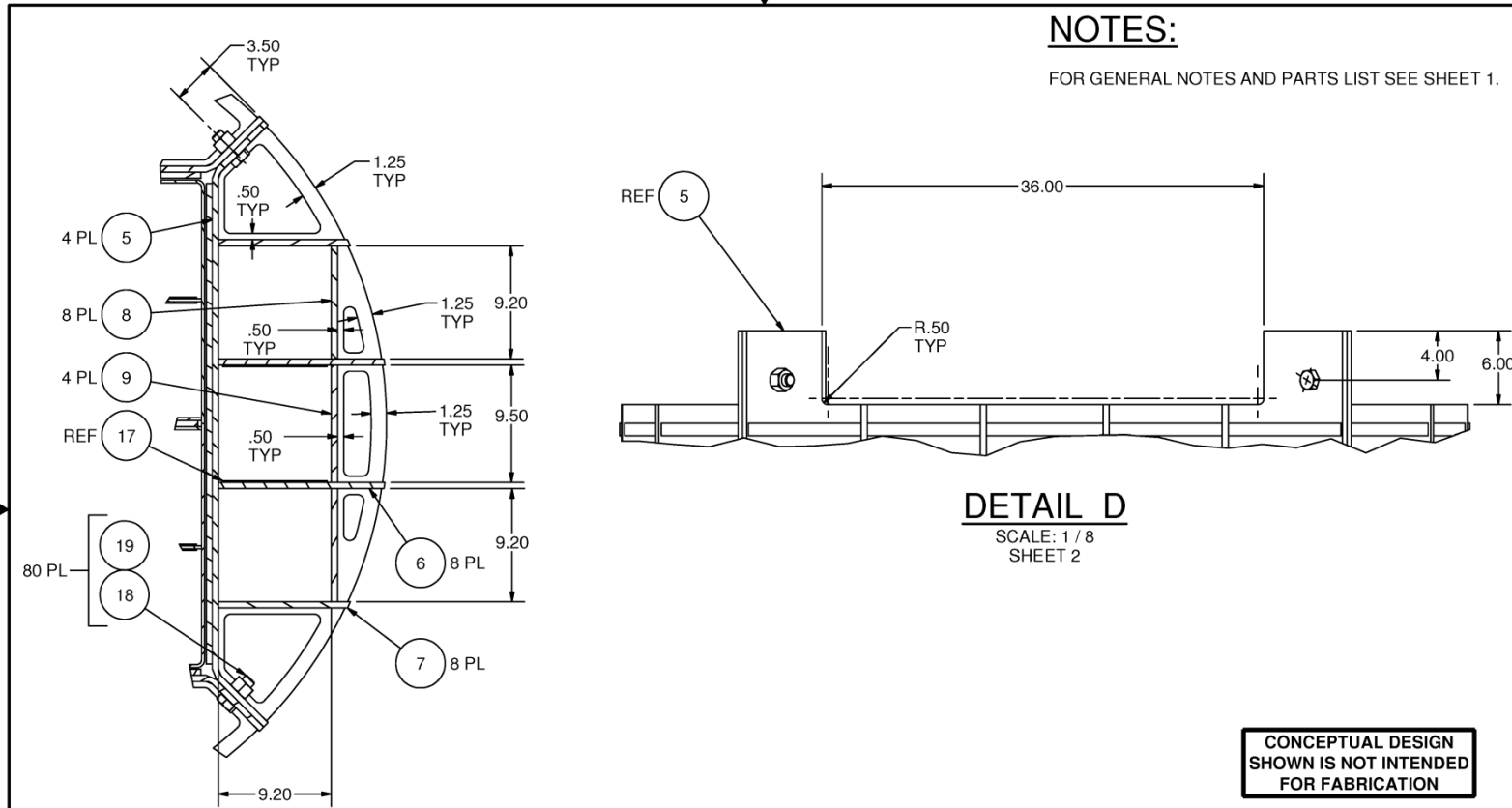
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(ITEM 16 NOT SHOWN FOR CLARITY)

**CONCEPTUAL DESIGN  
SHOWN IS NOT INTENDED  
FOR FABRICATION**

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A	PRELIMINARY DESIGN ISSUE		FC				
REVISIONS							

N/A	TALISMAN		Booz   Allen   Hamilton		ENERGYSOLUTIONS		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354	
	Exelon <small>Nuclear Partners</small>		NAC <small>INTERNATIONAL</small>		CONTRACT NO. DE-NE-000293		PROJECT NO. 205590	
DRAWN: F. CHAVEZ		DATE: 2/5/15		TASK ORDER 17 TRANSPORTATION CASK STUDY 28P BASKET ASSEMBLY-LONG				
ENGINEER: S. SISLEY		DATE: 2/5/15						
CHECKER: [ ]		DATE: [ ]						
APPROVED: [ ]		DATE: [ ]		REV B		REV B		
IDV: N/A		DATE: N/A		SIZE B		DWG NO. DWG-205590-ME-0005		
ORCM: N/A		DATE: N/A		SCALE: SHOWN		SHEET 3 OF 4		
NEXT USED ON: N/A		DATE: N/A						

Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



**NOTES:**  
FOR GENERAL NOTES AND PARTS LIST SEE SHEET 1.

**DETAIL D**  
SCALE: 1 / 8  
SHEET 2

**DETAIL C**  
SCALE: 1 / 8  
SHEET 3

**CONCEPTUAL DESIGN  
SHOWN IS NOT INTENDED  
FOR FABRICATION**

N/A		Booz   Allen   Hamilton		ENERGYSOLUTIONS		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354			
Exelon Nuclear Partners		NAC INTERNATIONAL		CONTRACT NO. DE-NE-000293	PROJECT NO. 205590				
BY:	F. CHAVEZ	DATE:	2/5/15	<b>TASK ORDER 17 TRANSPORTATION CASK STUDY 28P BASKET ASSEMBLY-LONG</b>					
ENGINEER:	S. SISLEY	DATE:	2/5/15						
CHECKER:									
APPROVED:									
IDV:	N/A		N/A						
DRCM:	N/A		N/A	SIZE:	B	DWG NO.:	DWG-205590-ME-0005	REV:	B
NEXT USED ON:	N/A		N/A	SCALE:	SHOWN	SHEET:	4	OF:	4

REV	DESCRIPTION	DRWN	ENG	CHK	APVD	IDV	DATE
A	PRELIMINARY DESIGN ISSUE	FC					
REVISIONS							

# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study

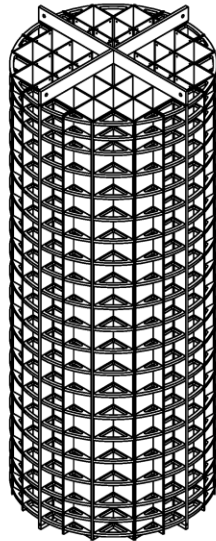
## GENERAL NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

2. COAT EXPOSED SURFACES OF CARBON STEEL COMPONENTS WITH ELECTROLESS NICKEL IN ACCORDANCE WITH ASTM B733.

3. BORATED ALUMINUM ALLOY OR METAL MATRIX COMPOSITE (MMC) MATERIAL HAVING A MINIMUM 19 B DENSITY OF 0.125 g/cm<sup>3</sup>.

4. THE EIGHT(8) PERIMETER CELLS INDICATED MAY ACCOMMODATE FUEL ASSEMBLIES IN DAMAGE FUEL CANS (DFC's).



**32P BASKET  
ASSEMBLY-LONG**  
SCALE: NONE

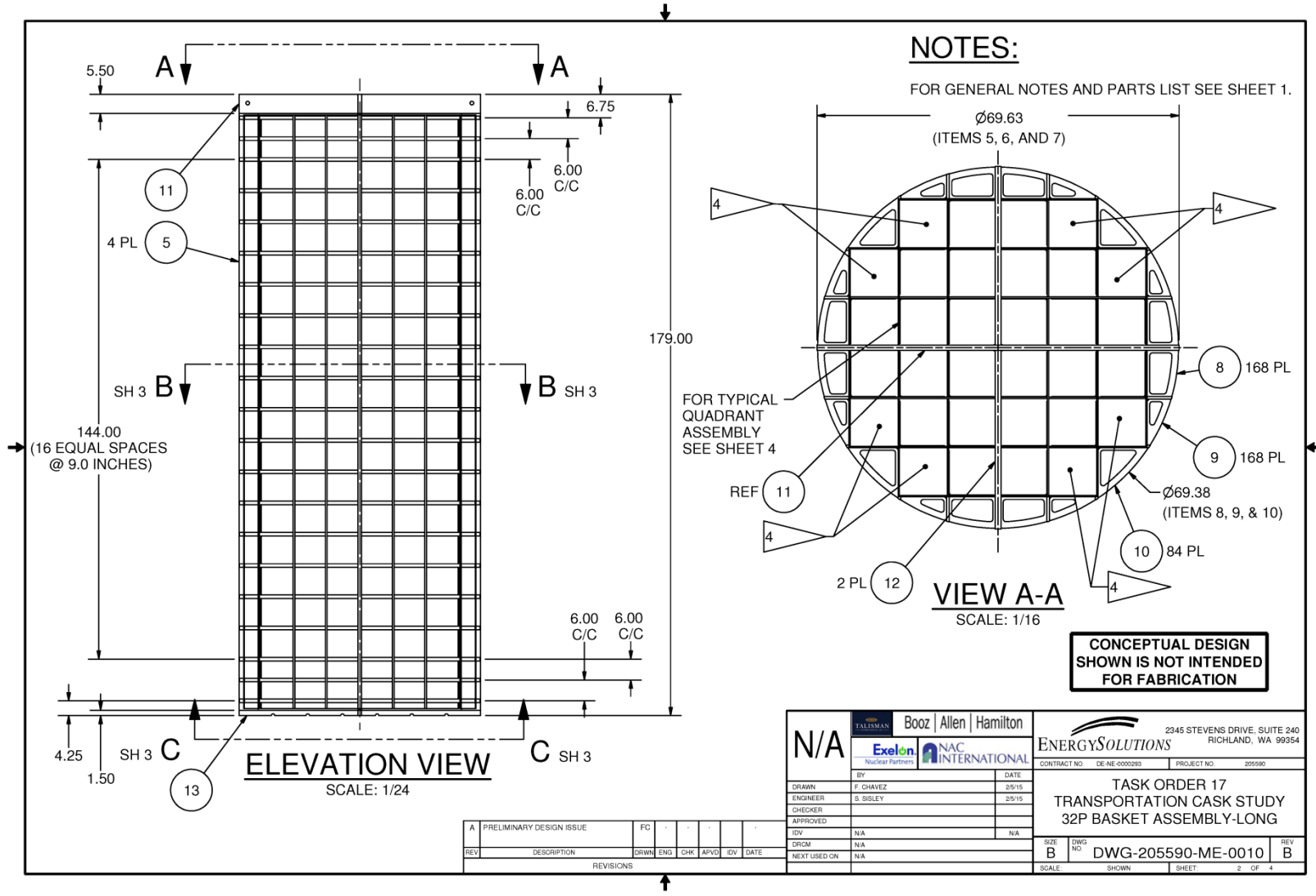
QTY	NOMENCLATURE/DESCRIPTION	MATERIAL/REFERENCE	ITEM
4	EGG-CRATE ANGLE, 1/4 INCH THK	SA-537 CLASS 1	1
8	EGG-CRATE 3-CELL PLATE, 1/4 INCH THK	SA-537 CLASS 1	2
8	EGG-CRATE 2-CELL PLATE, 1/4 INCH THK	SA-537 CLASS 1	3
24	EGG-CRATE 1-CELL PLATE, 1/4 INCH THK	SA-537 CLASS 1	4
4	EDGE SUPPORT #1, 1 INCH THK	SA-537 CLASS 1	5
8	EDGE SUPPORT #2, 1/2 INCH THK	SA-537 CLASS 1	6
8	EDGE SUPPORT #3, 1/2 INCH THK	SA-537 CLASS 1	7
168	GUSSET PLATE #1, 1 INCH THK	SA-537 CLASS 1	8
168	GUSSET PLATE #2, 1 INCH THK	SA-537 CLASS 1	9
84	GUSSET PLATE #3, 1 INCH THK	SA-537 CLASS 1	10
1	TOP SUPPORT, LONG 1 INCH THK	SA-537 CLASS 1	11
2	TOP SUPPORT, SHORT 1 INCH THK	SA-537 CLASS 1	12
1	BOTTOM SUPPORT, LONG, 1 INCH THK	SA-537 CLASS 1	13
2	BOTTOM SUPPORT, SHORT, 1 INCH THK	SA-537 CLASS 1	14
1	CENTER PLATE, LONG, 1/2 INCH THK	BORATED ALUMINUM	15
2	CENTER PLATE, SHORT, 1/2 INCH THK	BORATED ALUMINUM	16
24	NEUTRON ABSORBER ANGLE, 1/8 INCH THK	BORATED ALUMINUM	17

**CONCEPTUAL DESIGN  
SHOWN IS NOT INTENDED  
FOR FABRICATION**

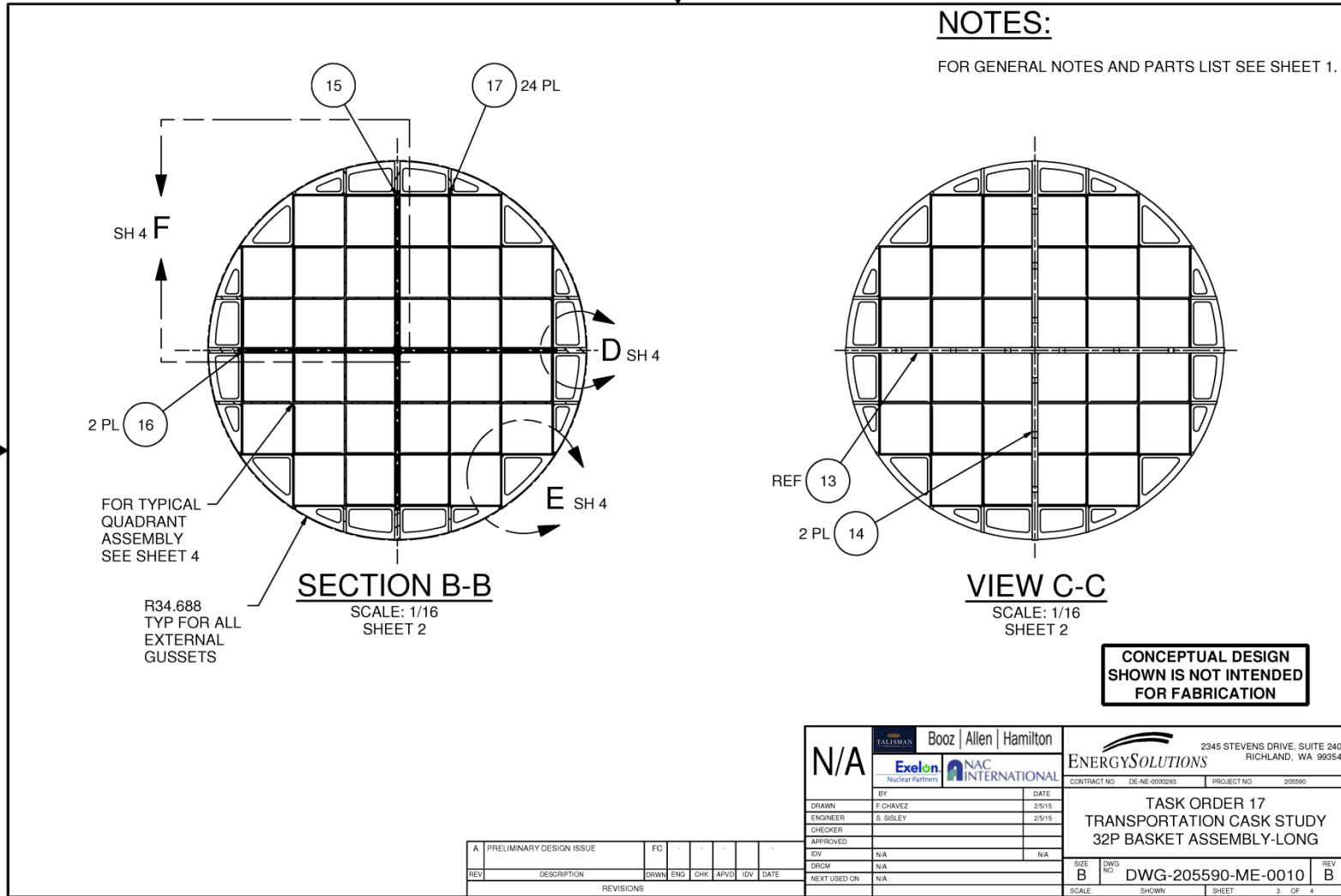
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REVISIONS							

N/A	Booz   Allen   Hamilton		ENERGYSOLUTIONS		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354
	Exelon Nuclear Partners		NAC INTERNATIONAL		CONTRACT NO. DE-NE-000293
	PROJECT NO. 205590		TASK ORDER 17 TRANSPORTATION CASK STUDY 32P BASKET ASSEMBLY-LONG		
	BY: F. CHAVEZ	DATE: 2/5/15	ENGINEER: S. SISLEY	DATE: 2/5/15	SIZE: B
CHECKER:		APPROVED:		DWG NO: DWG-205590-ME-0010	
IDV: N/A		TDRM: N/A		REVISIONS: 1 OF 4	
TEXT USED ON: N/A				SCALE: SHOWN	

# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



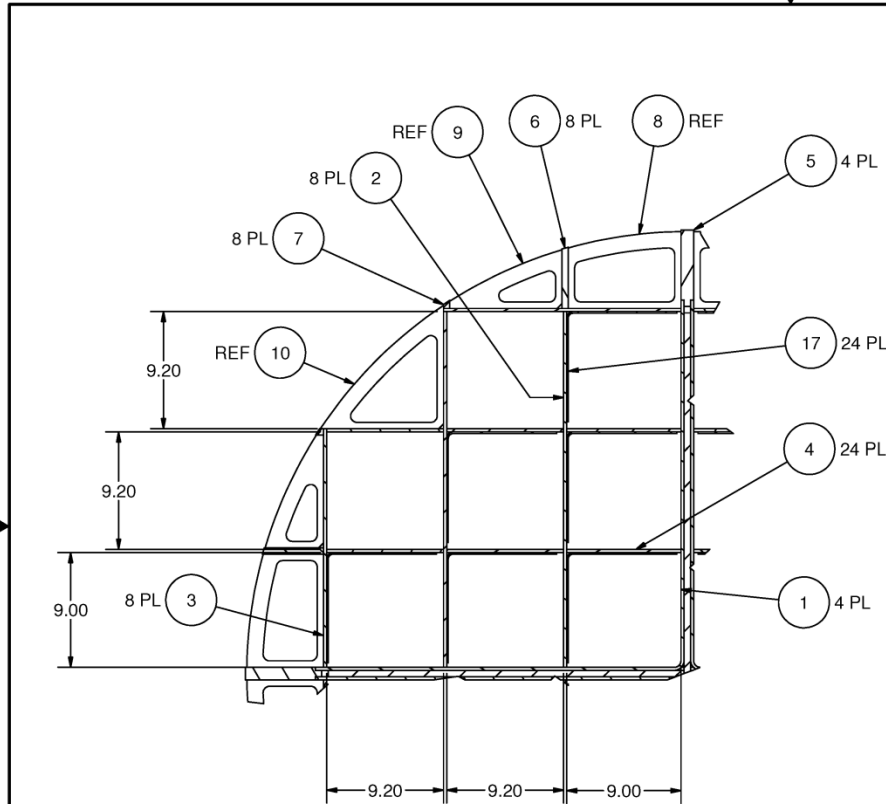
# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



REV	DESCRIPTION	DRWN	ENGR	CHK	APVD	IDV	DATE
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REVISIONS							

N/A	TALISMAN		Booz   Allen   Hamilton		ENERGYSOLUTIONS		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354	
	Exelon <small>Nuclear Partners</small>		NAC <small>INTERNATIONAL</small>		CONTRACT NO. DE-NE-000293		PROJECT NO. 205990	
	BY F. CHAVEZ		DATE 2/5/15		<b>TASK ORDER 17</b> <b>TRANSPORTATION CASK STUDY</b> <b>32P BASKET ASSEMBLY-LONG</b>			
	ENGINEER S. SISLEY		DATE 2/5/15					
CHECKER		DATE						
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DRCM N/A				TEXT USED ON N/A		SCALE: SHOWN		
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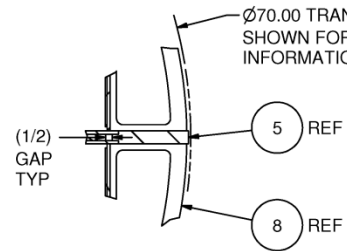
# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



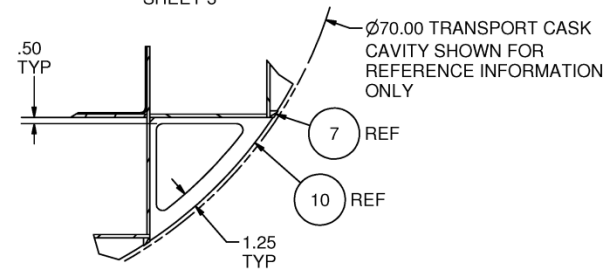
**DETAIL F**  
SCALE: 1 / 8  
SHEET 3

## NOTES:

FOR GENERAL NOTES AND PARTS LIST SEE SHEET 1.



**DETAIL D**  
SCALE: NONE  
SHEET 3



**DETAIL E**  
SCALE: NONE  
SHEET 3

**CONCEPTUAL DESIGN  
SHOWN IS NOT INTENDED  
FOR FABRICATION**

REV	DESCRIPTION	DRWN	ENG	CHK	APVD	LDV	DATE
A	PRELIMINARY DESIGN ISSUE						
REVISIONS							

N/A	Booz   Allen   Hamilton		ENERGYSOLUTIONS		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354	
	Exelon <small>Nuclear Partner</small>		NAC <small>INTERNATIONAL</small>		CONTRACT NO. DE-NE-000293    PROJECT NO. 205590	
	BY: F. CHAVEZ		DATE: 2/5/15		TASK ORDER 17 TRANSPORTATION CASK STUDY 32P BASKET ASSEMBLY-LONG	
	ENGINEER: S. SISLEY		DATE: 2/5/15			
CHECKER:		DATE:				
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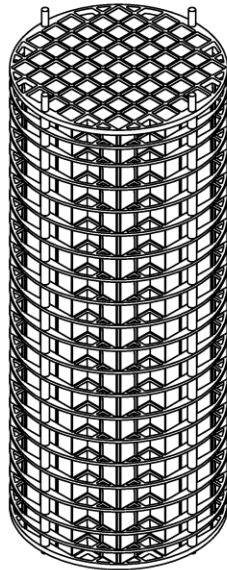
# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study

## GENERAL NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

2. COAT EXPOSED SURFACES OF CARBON STEEL COMPONENTS WITH ELECTROLESS NICKEL IN ACCORDANCE WITH ASTM B733.

3. BORATED ALUMINUM ALLOY OR METAL MATRIX COMPOSITE (MMC) MATERIAL HAVING A MINIMUM  $10^8$  B DENSITY OF 0.125 g/cm<sup>3</sup>.



**61B BASKET  
ASSEMBLY-LONG**

SCALE: NONE

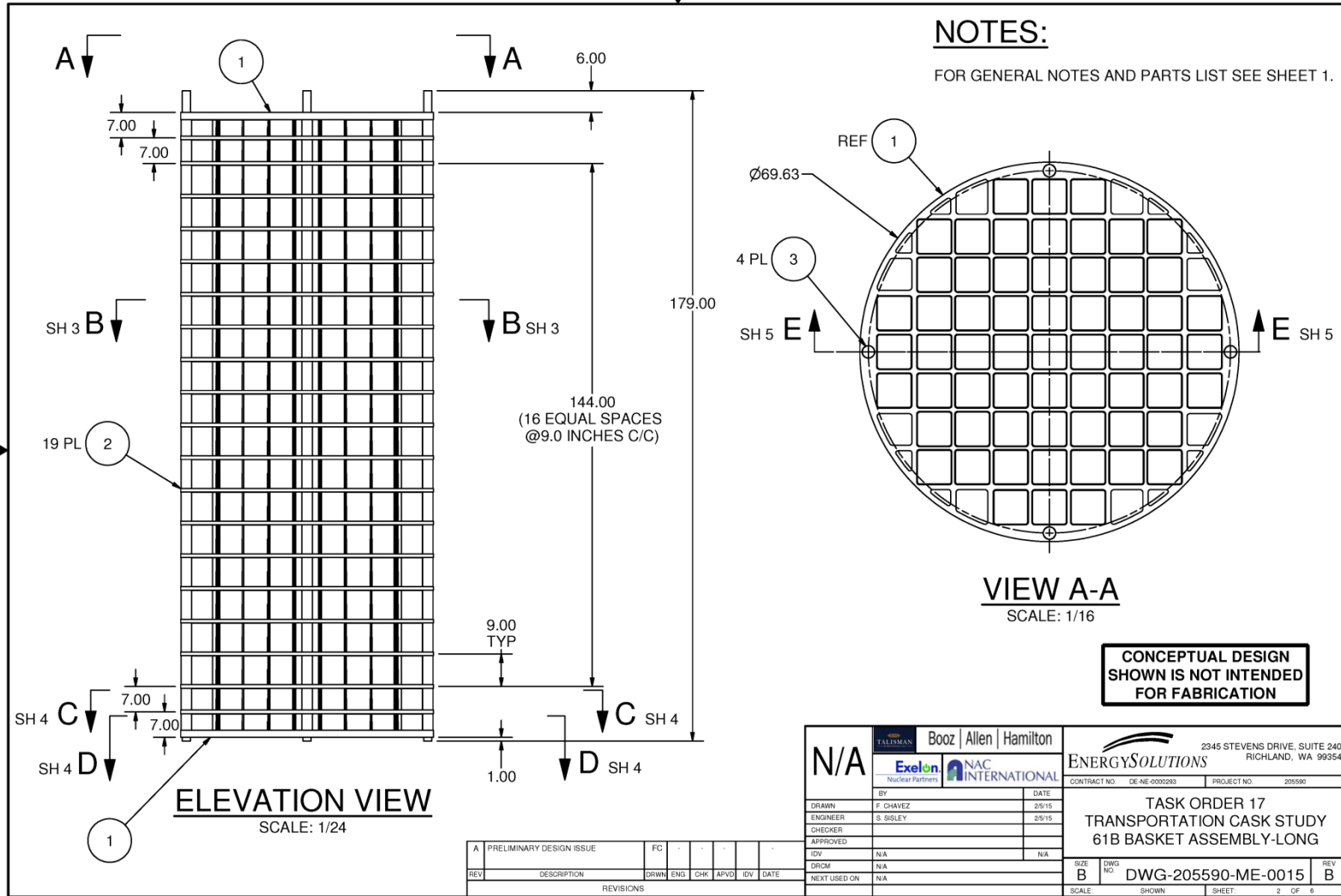
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2	END SPACER PLATE, 2 INCH THK	SA-240, TYPE XM-19	1
19	SPACER PLATE, 1 INCH THK	SA-517, GR. F OR P	2
4	SUPPORT ROD, 2 1/4 INCH DIA	SA-479, TYPE XM-19	3
61	GUIDE TUBE, 16 GUAGE	SA-240, TYPE 316L	4
128	NEUTRON ABSORBER PL #1, 63 1/2" LG X 7 15/16" HT X 3/8" THK	BORATED ALUMINUM	5
64	NEUTRON ABSORBER PL #2, 52" LG X 7 15/16" HT X 3/8" THK	BORATED ALUMINUM	6
64	NEUTRON ABSORBER PL #3, 48" LG X 7 15/16" HT X 3/8" THK	BORATED ALUMINUM	7
16	NEUTRON ABSORBER PL #1, 63 1/2" LG X 5 15/16" HT X 3/8" THK	BORATED ALUMINUM	8
8	NEUTRON ABSORBER PL #2, 52" LG X 5 15/16" HT X 3/8" THK	BORATED ALUMINUM	9
8	NEUTRON ABSORBER PL #3, 48" LG X 5 15/16" HT X 3/8" THK	BORATED ALUMINUM	10
16	NEUTRON ABSORBER PL #1, 63 1/2" LG X 4 7/16" HT X 3/8" THK	BORATED ALUMINUM	11
8	NEUTRON ABSORBER PL #2, 52" LG X 4 7/16" HT X 3/8" THK	BORATED ALUMINUM	12
8	NEUTRON ABSORBER PL #3, 48" LG X 4 7/16" HT X 3/8" THK	BORATED ALUMINUM	13
8	SUPPORT SLEEVE #1, 2 1/2 INCH SCHED 80 X 4 1/2 INCH LG	SA-312 OR SA-376, TYPE 316	14
8	SUPPORT SLEEVE #2, 2 1/2 INCH SCHED 80 X 6 INCH LG	SA-312 OR SA-376, TYPE 316	15
64	SUPPORT SLEEVE #3, 2 1/2 INCH SCHED 80 X 8 INCH LG	SA-312 OR SA-376, TYPE 316	16

**CONCEPTUAL DESIGN  
SHOWN IS NOT INTENDED  
FOR FABRICATION**

REV	DESCRIPTION	DRWN	ENG	CHK	APVD	IDV	DATE
A	PRELIMINARY DESIGN ISSUE	FC					
REVISIONS							

N/A	TALISMAN		Booz   Allen   Hamilton		ENERGYSOLUTIONS		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354	
	Exelon <small>Nuclear Partners</small>		NAC <small>INTERNATIONAL</small>		CONTRACT NO. DE-NE-0002293		PROJECT NO. 205590	
	BY: F. CHAVEZ		DATE: 2/5/15		TASK ORDER 17 TRANSPORTATION CASK STUDY 61B BASKET ASSEMBLY-LONG			
	ENGINEER: S. SISLEY		DATE: 2/5/15		SIZE: B		DWG NO: DWG-205590-ME-0015	
CHECKER:		DATE:		SCALE:		SHEET: 1 OF 6		
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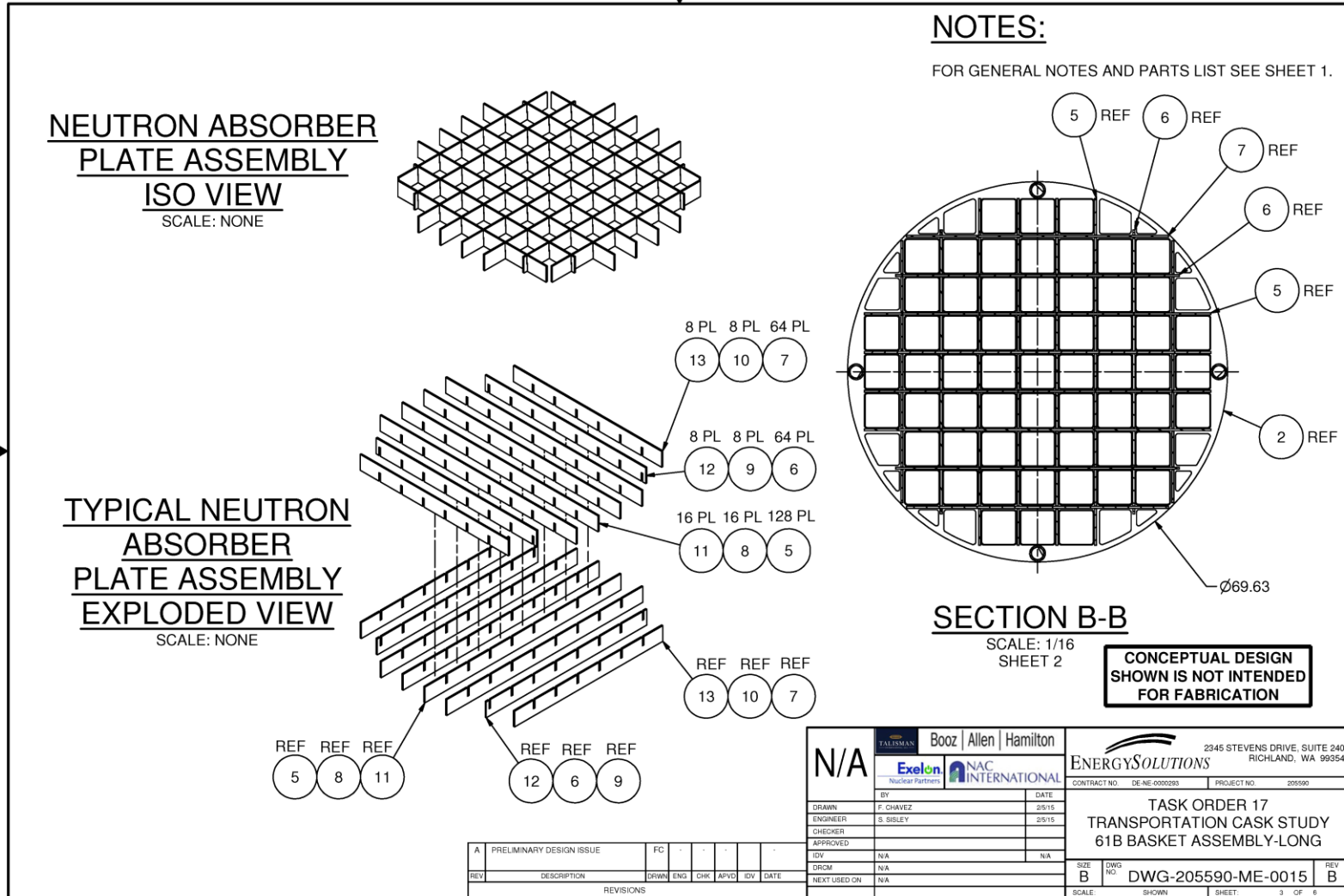
# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



REV	DESCRIPTION	DRWN	ENG	CHK	APVD	IDV	DATE
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REVISIONS							

N/A	Booz   Allen   Hamilton		ENERGYSOLUTIONS	
	Exelon Nuclear Partners		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354	
	NAC INTERNATIONAL		CONTRACT NO. DE-NE-0002293	PROJECT NO. 205590
	TASK ORDER 17 TRANSPORTATION CASK STUDY 61B BASKET ASSEMBLY-LONG			
BY	F. CHAVEZ	DATE	25/15	
ENGINEER	S. SISLEY	DATE	25/15	
CHECKER				
APPROVED				
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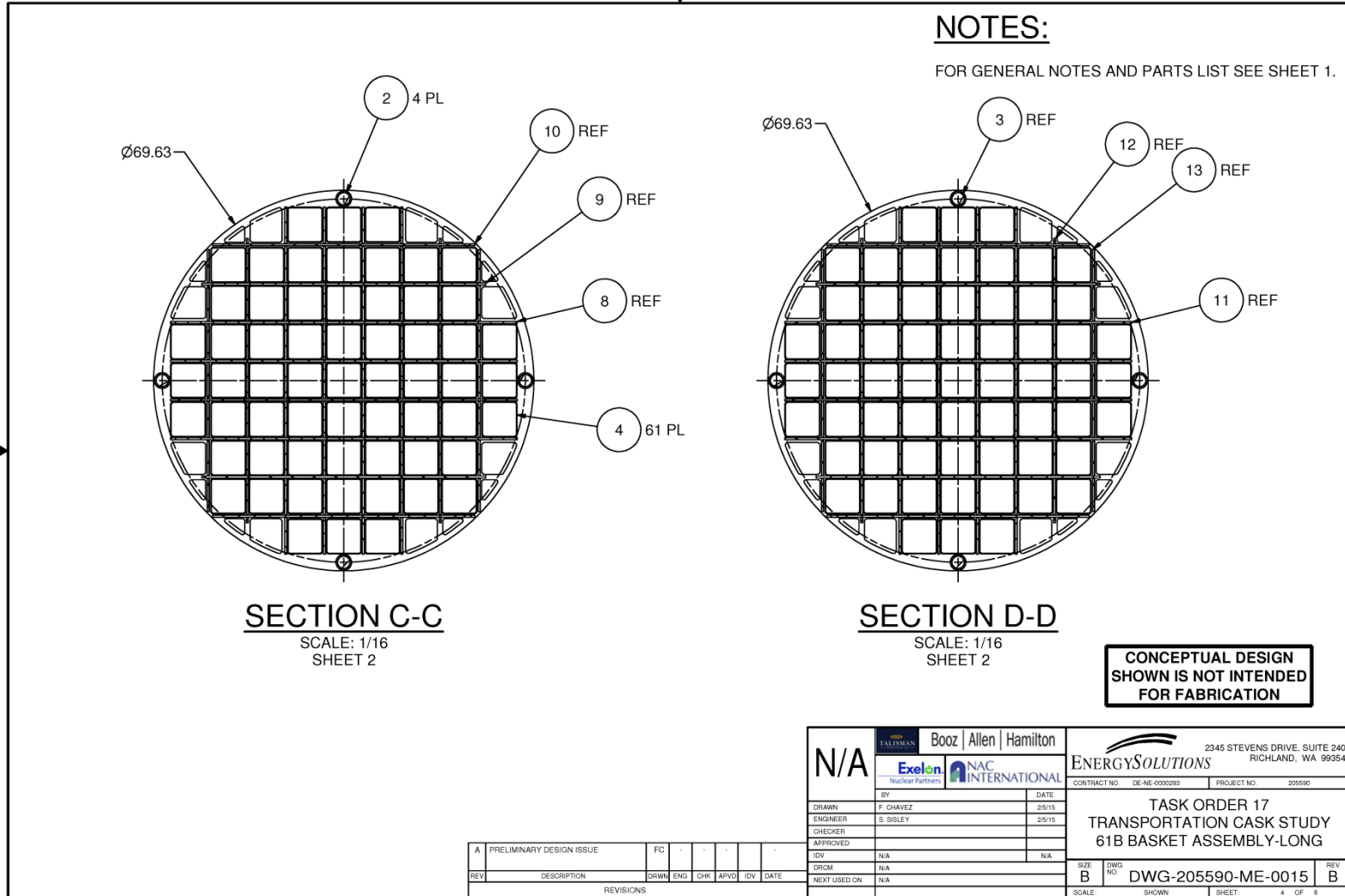
Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



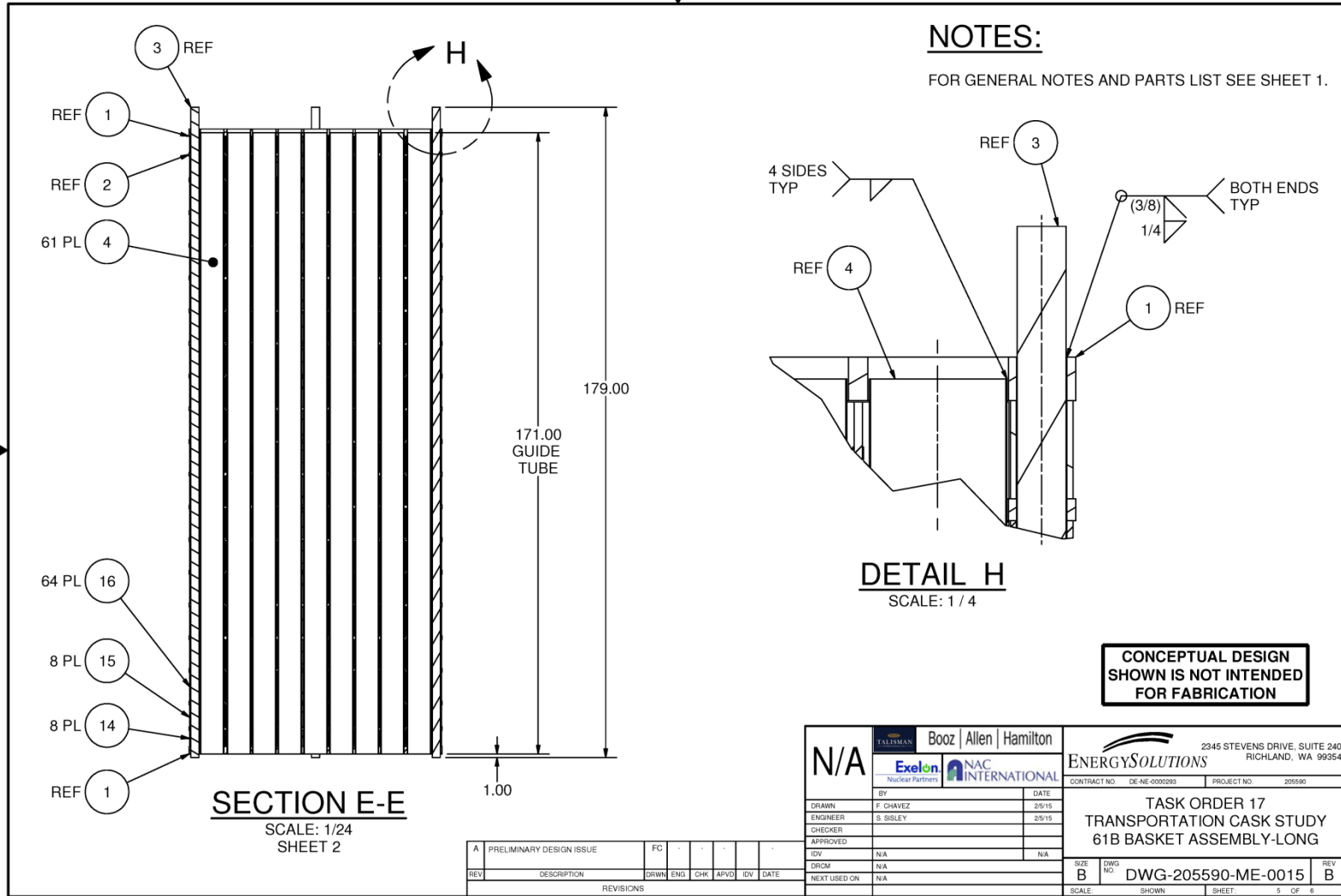
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REVISIONS							

N/A	Booz   Allen   Hamilton		ENERGYSOLUTIONS	
	Exelon <small>Nuclear Partners</small>		NAC INTERNATIONAL	
BY	F. CHAVEZ	DATE	2/5/15	
ENGINEER	S. SISLEY	DATE	2/5/15	
CHECKER				
APPROVED				
IDV	N/A		N/A	
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TEXT USED ON	N/A		N/A	
CONTRACT NO. DE-NE-0002293			PROJECT NO. 205590	
TASK ORDER 17 TRANSPORTATION CASK STUDY 61B BASKET ASSEMBLY-LONG				
SIZE	DWG NO.	DWG NO.	REV	REV
B	DWG-205590-ME-0015		B	B
SCALE	SHOWN	SHEET	3 OF 6	

# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



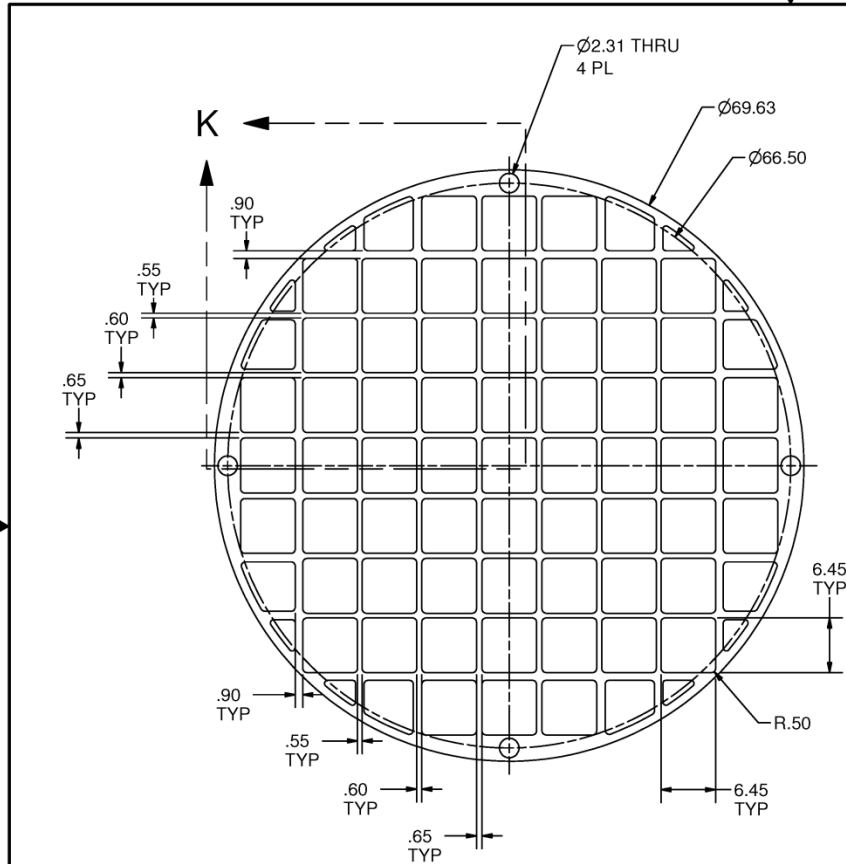
Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



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A	PRELIMINARY DESIGN ISSUE		FC				
REVISIONS							

N/A	TALISMAN		Booz   Allen   Hamilton		ENERGYSOLUTIONS		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354		
	Exelon <small>Nuclear Partners</small>		NAC <small>INTERNATIONAL</small>		CONTRACT NO. DE-NE-000293		PROJECT NO. 205590		
BY: F. CHAVEZ		DATE: 2/5/15		TASK ORDER 17 TRANSPORTATION CASK STUDY 61B BASKET ASSEMBLY-LONG					
ENGINEER: S. SISLEY		DATE: 2/5/15							
CHECKER:		DATE:							
APPROVED:		DATE:							
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TEXT USED ON: N/A		DATE: N/A							

# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study

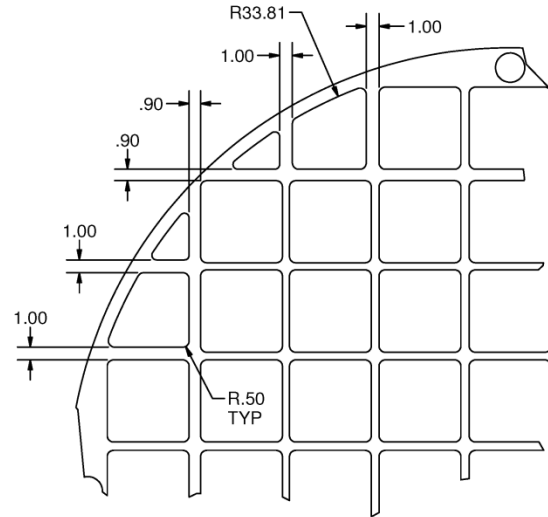


**1 2 SPACER PLATE**  
SCALE: 1/12

REV	DESCRIPTION	DRWN	ENG	CHK	APVD	LDV	DATE
A	PRELIMINARY DESIGN ISSUE						
REVISIONS							

## NOTES:

FOR GENERAL NOTES AND PARTS LIST SEE SHEET 1.



**DETAIL K**  
SCALE: 1 / 8

**CONCEPTUAL DESIGN  
SHOWN IS NOT INTENDED  
FOR FABRICATION**

<b>N/A</b>	Booz   Allen   Hamilton		ENERGY SOLUTIONS 2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354	
	Exelon <small>Nuclear Partner</small>		NAC INTERNATIONAL	
	BY:	F. CHAVEZ	DATE:	2/5/15
	ENGINEER:	S. SISLEY	DATE:	2/5/15
CHECKER:				
APPROVED:				
IDV:	N/A		N/A	
DRCM:	N/A			
NEXT USED ON:	N/A			
CONTRACT NO. DE-NE-000293		PROJECT NO. 205590		
<b>TASK ORDER 17 TRANSPORTATION CASK STUDY 61B BASKET ASSEMBLY-LONG</b>				
SIZE:	B	DWG NO.:	DWG-205590-ME-0015	
SCALE:	SHOWN	SHEET:	8 OF 8	

# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study

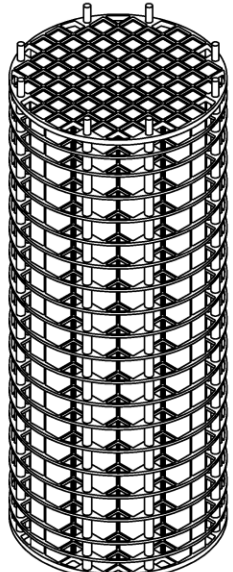
## GENERAL NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED

2. COAT EXPOSED SURFACES OF CARBON STEEL COMPONENTS WITH ELECTROLESS NICKEL IN ACCORDANCE WITH ASTM B733.

3. BORATED ALUMINUM ALLOY OR METAL MATRIX COMPOSITE (MMC) MATERIAL HAVING A MINIMUM B-10 DENSITY OF 0.125 g/cm<sup>3</sup>.

4. CELLS INDICATED CAN ACCOMODATE BWR FUEL ASSEMBLIES IN DAMAGED FUEL CANS



**68B BASKET  
ASSEMBLY - LONG**  
SCALE: NONE

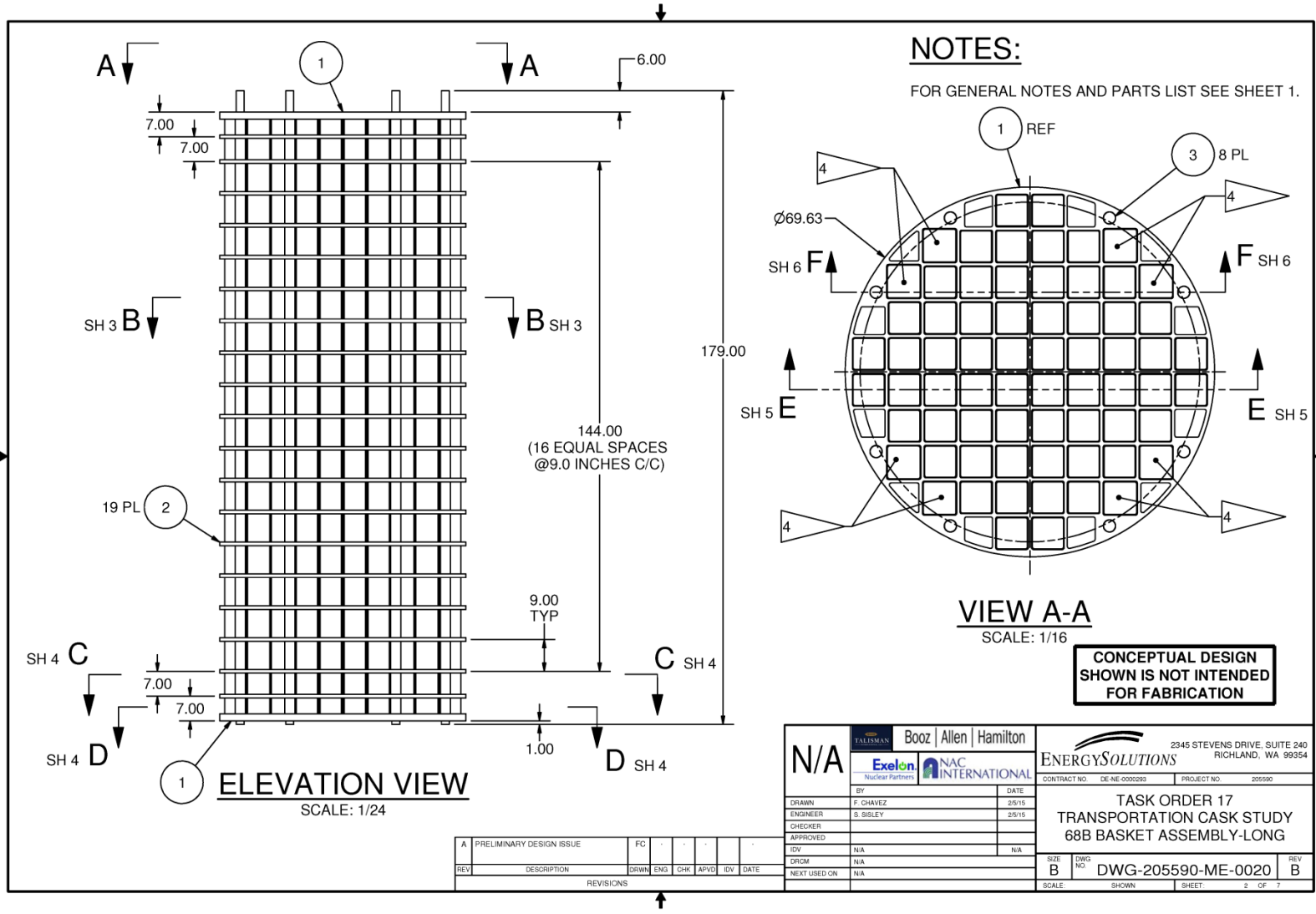
QTY	NOMENCLATURE/DESCRIPTION	MATERIAL/REFERENCE	ITEM
2	END SPACER PLATE, 2 INCH PLATE	SA-240, TYPE XM-19	1
19	SPACER PLATE, 1 INCH THK	SA-517, GR. F OR P	2
8	SUPPORT ROD, 2 1/4 INCH DIA	SA-479, TYPE XM-19	3
60	GUIDE TUBE #1, 16 GUAGE	SA-240, TYPE 316L	4
8	GUIDE TUBE #2, 16 GUAGE	SA-240, TYPE 316L	5
32	NEUTRON ABSORBER PL #1, 66.2" LG X 7 15/16" HT x 3/8" THK	BORATED ALUMINUM	6
128	NEUTRON ABSORBER PL #2, 52.8" LG X 7 15/16" HT x 3/8" THK	BORATED ALUMINUM	7
64	NEUTRON ABSORBER PL #3, 39.4" LG X 7 15/16" HT x 3/8" THK	BORATED ALUMINUM	8
64	NEUTRON ABSORBER PL #4, 12.6" LG X 7 15/16" HT x 3/8" THK	BORATED ALUMINUM	9
4	NEUTRON ABSORBER PL #1, 66.2" LG X 5 15/16" HT x 3/8" THK	BORATED ALUMINUM	10
16	NEUTRON ABSORBER PL #2, 52.8" LG X 5 15/16" HT x 3/8" THK	BORATED ALUMINUM	11
8	NEUTRON ABSORBER PL #3, 39.4" LG X 5 15/16" HT x 3/8" THK	BORATED ALUMINUM	12
8	NEUTRON ABSORBER PL #4, 12.6" LG X 4 7/16" HT x 3/8" THK	BORATED ALUMINUM	13
16	NEUTRON ABSORBER PL #2, 52.8" LG X 4 7/16" HT x 3/8" THK	BORATED ALUMINUM	15
8	NEUTRON ABSORBER PL #3, 39.4" LG X 4 7/16" HT x 3/8" THK	BORATED ALUMINUM	16
8	NEUTRON ABSORBER PL #4, 12.6" LG X 4 7/16" HT x 3/8" THK	BORATED ALUMINUM	17
16	SUPPORT SLEEVE #1, 2 1/2 INCH SCHED 80 X 4 1/2 INCH LG	SA-312 OR SA-376, TYPE 316	18
128	SUPPORT SLEEVE #2, 2 1/2 INCH SCHED 80 X 6 INCH LG	SA-312 OR SA-376, TYPE 316	19
16	SUPPORT SLEEVE #3, 2 1/2 INCH SCHED 80 X 8 INCH LG	SA-312 OR SA-376, TYPE 316	20
4	NEUTRON ABSORBER PL #1, 66.2" LG X 4 7/16" HT x 3/8" THK	BORATED ALUMINUM	14

**CONCEPTUAL DESIGN  
SHOWN IS NOT INTENDED  
FOR FABRICATION**

REV	DESCRIPTION	DRWN	ENG	CHK	APVD	IDV	DATE
A	PRELIMINARY DESIGN ISSUE	FC					
REVISIONS							

N/A	Booz   Allen   Hamilton		ENERGYSOLUTIONS		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354
	Exelon Nuclear Partners	NAC INTERNATIONAL	CONTRACT NO. DE-NE-0002293	PROJECT NO. 205590	
BY: F. CHAVEZ			DATE: 2/5/15		
ENGINEER: S. SISLEY			DATE: 2/5/15		
CHECKER:					
APPROVED:					
TDV: N/A			N/A		
TDRCM: N/A			N/A		
TEXT USED ON: N/A			N/A		
SIZE: B	DWG NO: DWG-205590-ME-0020	REV: B	SCALE: SHOWN SHEET: 1 OF 7		

# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



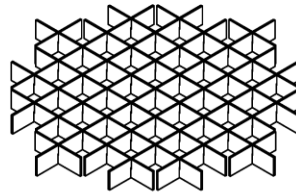
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A	PRELIMINARY DESIGN ISSUE		FC				
REVISIONS							

N/A	Booz   Allen   Hamilton		ENERGYSOLUTIONS	
	Exelon Nuclear Partners		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354	
	NAC INTERNATIONAL		CONTRACT NO. DE-NE-0002293	PROJECT NO. 205590
	TASK ORDER 17 TRANSPORTATION CASK STUDY 68B BASKET ASSEMBLY-LONG			
BY	F. CHAVEZ	DATE	25/15	
ENGINEER	S. SISLEY	DATE	25/15	
CHECKER				
APPROVED				
IDV	N/A		N/A	
DRCM	N/A			
TEXT USED ON	N/A			
SIZE	B	DWG NO.	DWG-205590-ME-0020	REV B
SCALE	SHOWN	SHEET	2	OF 7



Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study

**TYPICAL NEUTRON  
ABSORBER  
PLATE ASSEMBLY  
ISO VIEW**  
SCALE: NONE



4 PL 4 PL 32 PL  
14 10 6

4 PL 4 PL 4 PL  
15 11 7

8 PL 8 PL 64 PL  
16 12 8

8 PL 8 PL 64 PL  
17 13 9

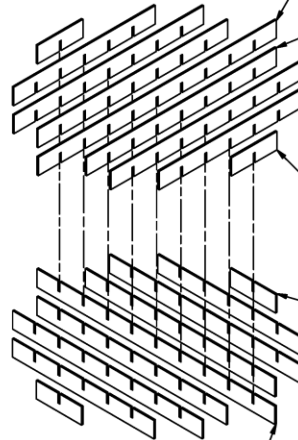
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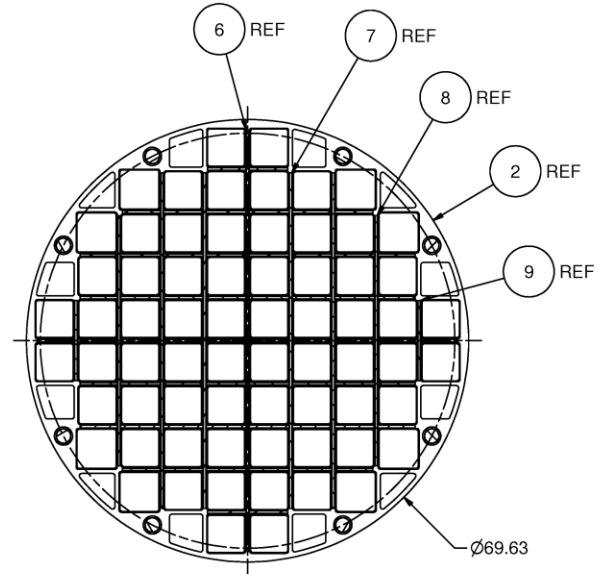
REF REF REF  
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**TYPICAL NEUTRON  
ABSORBER  
PLATE ASSEMBLY  
EXPLODED VIEW**  
SCALE: NONE



**NOTES:**

FOR GENERAL NOTES AND PARTS LIST SEE SHEET 1.



**SECTION B-B**

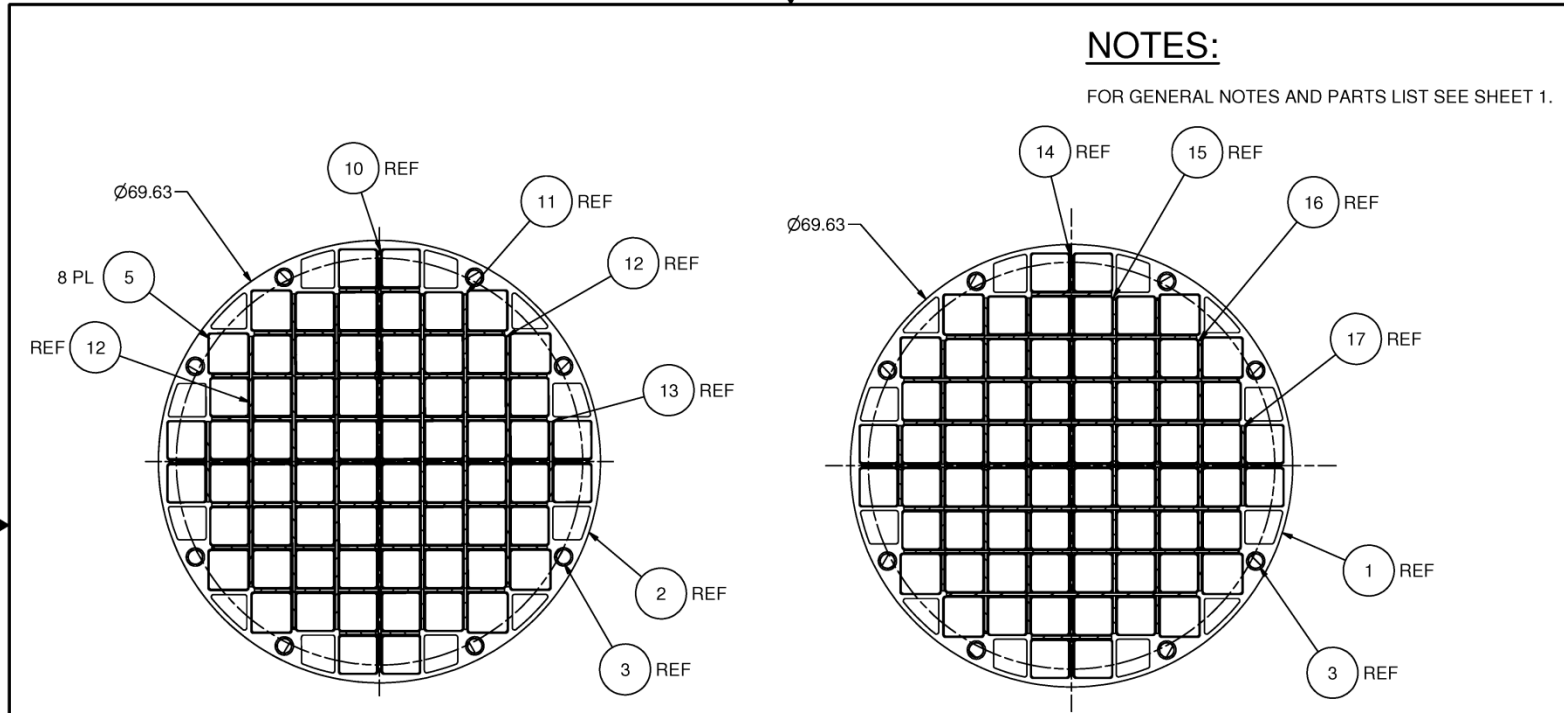
SCALE: 1/16  
SHEET 2

**CONCEPTUAL DESIGN  
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FOR FABRICATION**

REV	DESCRIPTION	DRWN	ENG	CHK	APVD	IDV	DATE
A	PRELIMINARY DESIGN ISSUE		FC				
REVISIONS							

N/A	TALISMAN		Booz   Allen   Hamilton		ENERGYSOLUTIONS 2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354	
	Exelon <small>Nuclear Partners</small>		NAC <small>INTERNATIONAL</small>		CONTRACT NO. DE-NE-000293	PROJECT NO. 205590
	BY	F. CHAVEZ	DATE	2/5/15	TASK ORDER 17 TRANSPORTATION CASK STUDY 68B BASKET ASSEMBLY-LONG	
	ENGINEER	S. SISLEY	DATE	2/5/15	SIZE	B
CHECKER				DWG NO.	DWG-205590-ME-0020	
APPROVED				SCALE	SHOWN	
IDV	N/A			SHEET	3 OF 7	
DRCM	N/A			REV	B	
NEXT USED ON	N/A					

# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



## NOTES:

FOR GENERAL NOTES AND PARTS LIST SEE SHEET 1.

**SECTION C-C**  
SCALE: 1/16  
SHEET 2

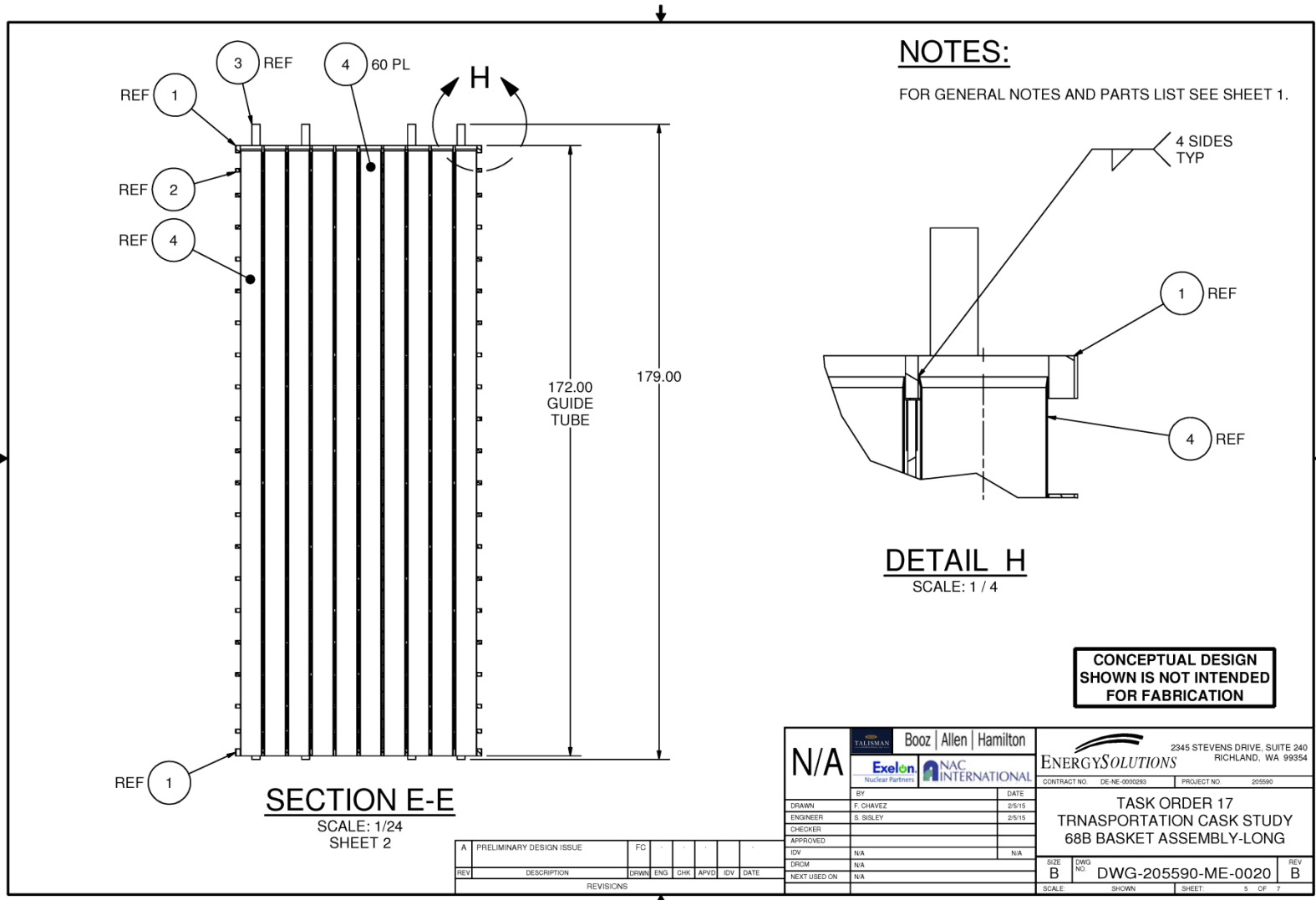
**SECTION D-D**  
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SHEET 2

**CONCEPTUAL DESIGN  
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FOR FABRICATION**

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A	PRELIMINARY DESIGN ISSUE		FC				
REVISIONS							

N/A	TALISMAN		Booz   Allen   Hamilton		ENERGYSOLUTIONS 2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354	
	Exelon <small>Nuclear Partners</small>		NAC <small>INTERNATIONAL</small>		CONTRACT NO. DE-NE-000293    PROJECT NO. 205590	
	BY: F. CHAVEZ		DATE: 2/5/15		<b>TASK ORDER 17 TRANSPORTATION CASK STUDY 68B BASKET ASSEMBLY-LONG</b>	
	ENGINEER: S. SISLEY		DATE: 2/5/15			
CHECKER:		DATE:				
APPROVED:		DATE:		SIZE: B    DWG NO: DWG-205590-ME-0020    REV: B SCALE:    SHOWN:    SHEET: 4 OF 7		
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TEXT USED ON:		DATE:				

Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



**NOTES:**  
FOR GENERAL NOTES AND PARTS LIST SEE SHEET 1.

**SECTION E-E**  
SCALE: 1/24  
SHEET 2

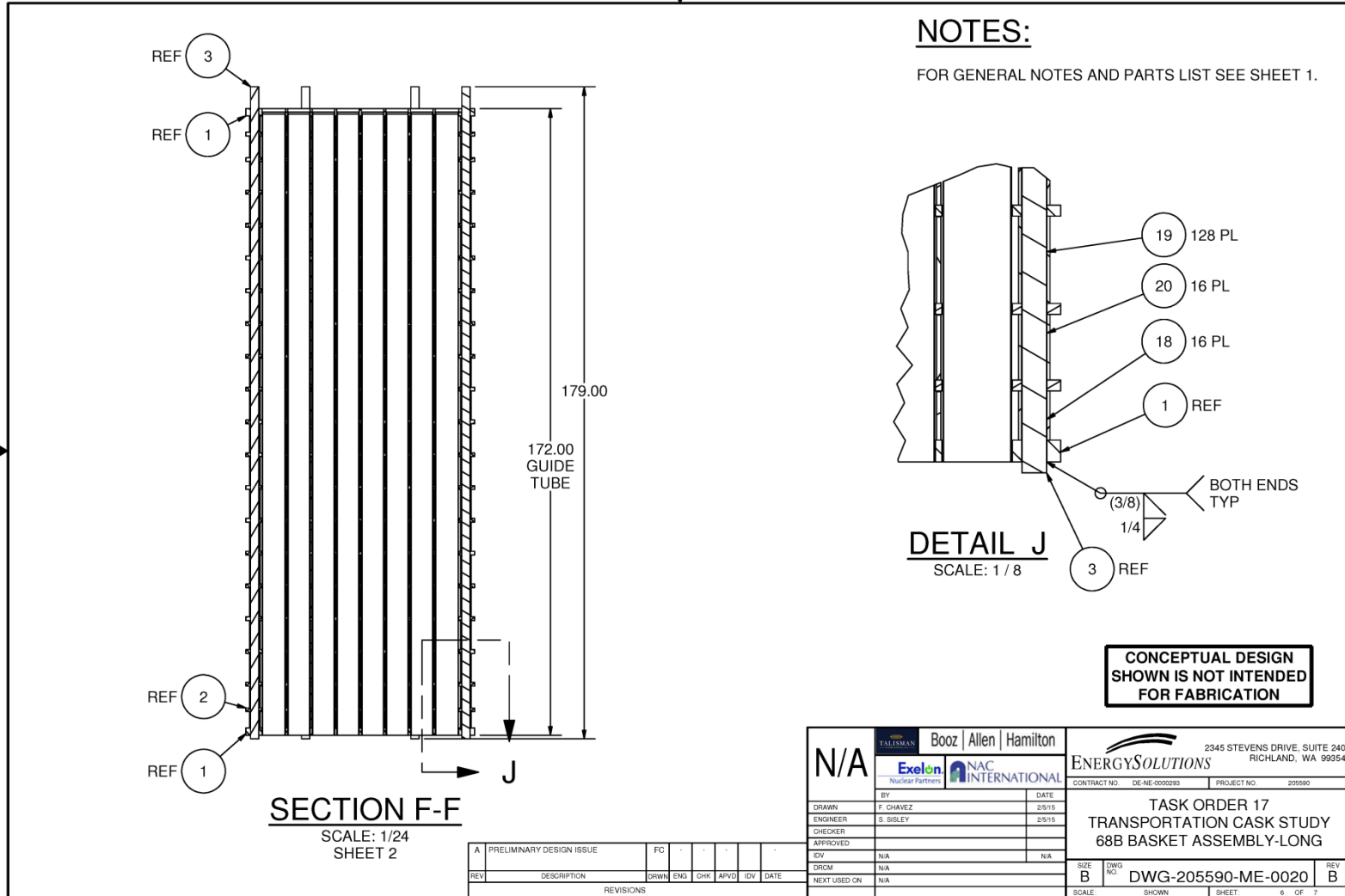
**DETAIL H**  
SCALE: 1 / 4

**CONCEPTUAL DESIGN  
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FOR FABRICATION**

REV	DESCRIPTION	DRWN	ENG	CHK	APVD	SDV	DATE
A	PRELIMINARY DESIGN ISSUE		FC				
REVISIONS							

N/A	Booz   Allen   Hamilton		ENERGYSOLUTIONS		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354		
	Exelon <small>Nuclear Partner</small>		NAC <small>INTERNATIONAL</small>		CONTRACT NO. DE-NE-000293    PROJECT NO. 205690		
	BY: F. CHAVEZ		DATE: 2/5/15		TASK ORDER 17 TRANSPORTATION CASK STUDY		
	ENGINEER: S. SISLEY		DATE: 2/5/15		68B BASKET ASSEMBLY-LONG		
CHECKER:		APPROVED:		SIZE: B		DWG NO: DWG-205590-ME-0020	
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TEXT USED ON:		DATE:		SCALE:		SHEET:	

# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study

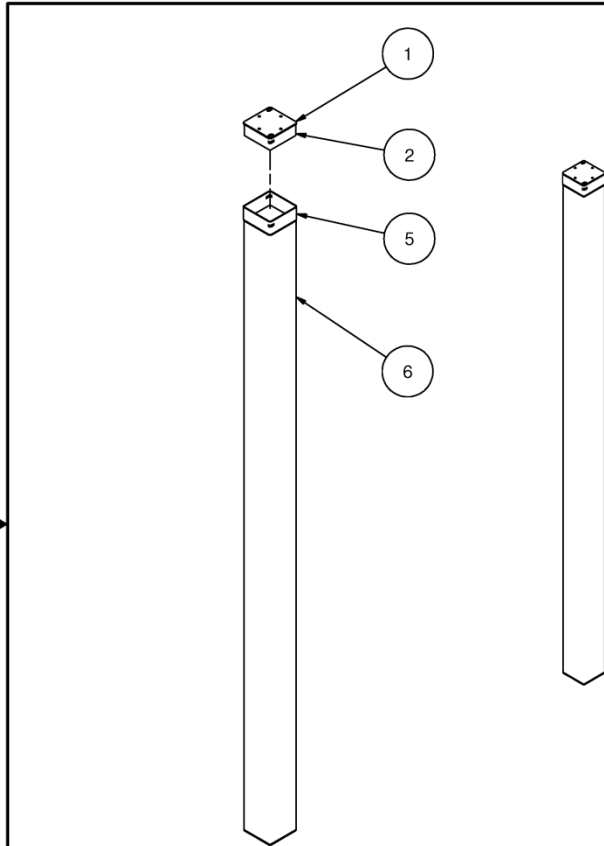


REV	DESCRIPTION	DRWN	ENGR	CHK	APVD	IDV	DATE
A	PRELIMINARY DESIGN ISSUE		FC				
REVISIONS							

N/A	TALISMAN		Booz   Allen   Hamilton		ENERGYSOLUTIONS		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354		
	Exelon <small>Nuclear Partners</small>		NAC <small>INTERNATIONAL</small>		CONTRACT NO. DE-NE-000293		PROJECT NO. 205590		
BY: F. CHAVEZ		DATE: 2/5/15		<b>TASK ORDER 17</b> <b>TRANSPORTATION CASK STUDY</b> <b>68B BASKET ASSEMBLY-LONG</b>					
ENGINEER: S. SISLEY		DATE: 2/5/15							
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DRCM: N/A		DATE: N/A		SCALE: SHOWN		SHEET: 6 OF 7			
TEXT USED ON: N/A									



# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



QTY	NOMENCLATURE/DESCRIPTION	MATERIAL/REFERENCE	ITEM
1	LID TOP PLATE, 1/4 INCH THK	ASME SA-240, TYPE 316L	1
1	LID SKIRT PLATE, 11 GA.	ASME SA-240, TYPE 316L	2
2	LID BOSS	ASME SA-240, TYPE 316L	3
2	LID BOSS SEAL PLATE	ASME SA-240, TYPE 316L	4
1	TOP COLLAR, 8 GA.	ASME SA-240, TYPE 316L	5
1	MAIN BODY TUBE, 16 GAUGE	ASME SA-240, TYPE 316L	6
1	BOTTOM PLATE, 1/2 INCH	ASME SA-240, TYPE 316L	7
8	MESH SCREEN, 3/4 INCH DIA Z 0.05 INCH MAX OPENING	STAINLESS STEEL	8

### GENERAL NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

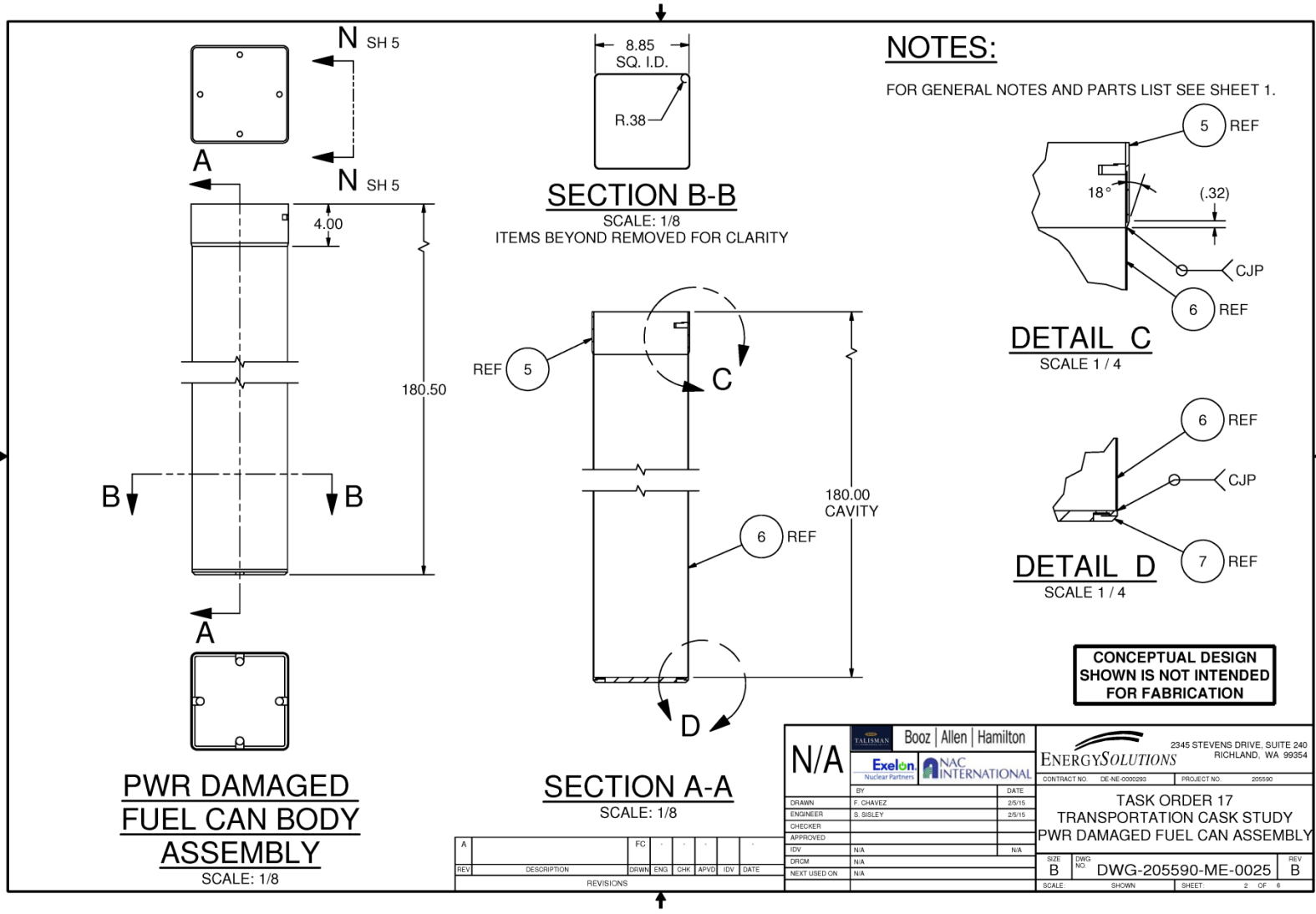
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SHOWN IS NOT INTENDED  
FOR FABRICATION**

**PWR DAMAGED  
FUEL CAN  
ASSEMBLY**  
(EXPANDED VIEW)  
SCALE: NONE

REV	DESCRIPTION	DRWN	ENG	CHK	APVD	IDV	DATE
A	PRELIMINARY DESIGN ISSUE	FC	-	-	-	-	-

N/A	Booz   Allen   Hamilton		ENERGYSOLUTIONS		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354
	Exelon <small>Nuclear Partners</small>		NAC INTERNATIONAL		CONTRACT NO. DE-NE-0002293
	PROJECT NO. 205590		<b>TASK ORDER 17 TRANSPORTATION CASK STUDY PWR DAMAGED FUEL CAN ASSEMBLY</b>		
	BY: F. CHAVEZ				
ENGINEER: S. SISLEY		DATE: 25/15	SIZE: B		
CHECKER:		APPROVED:			DWG NO: DWG-205590-ME-0025
IDV: N/A		TRCN: N/A			REV: B
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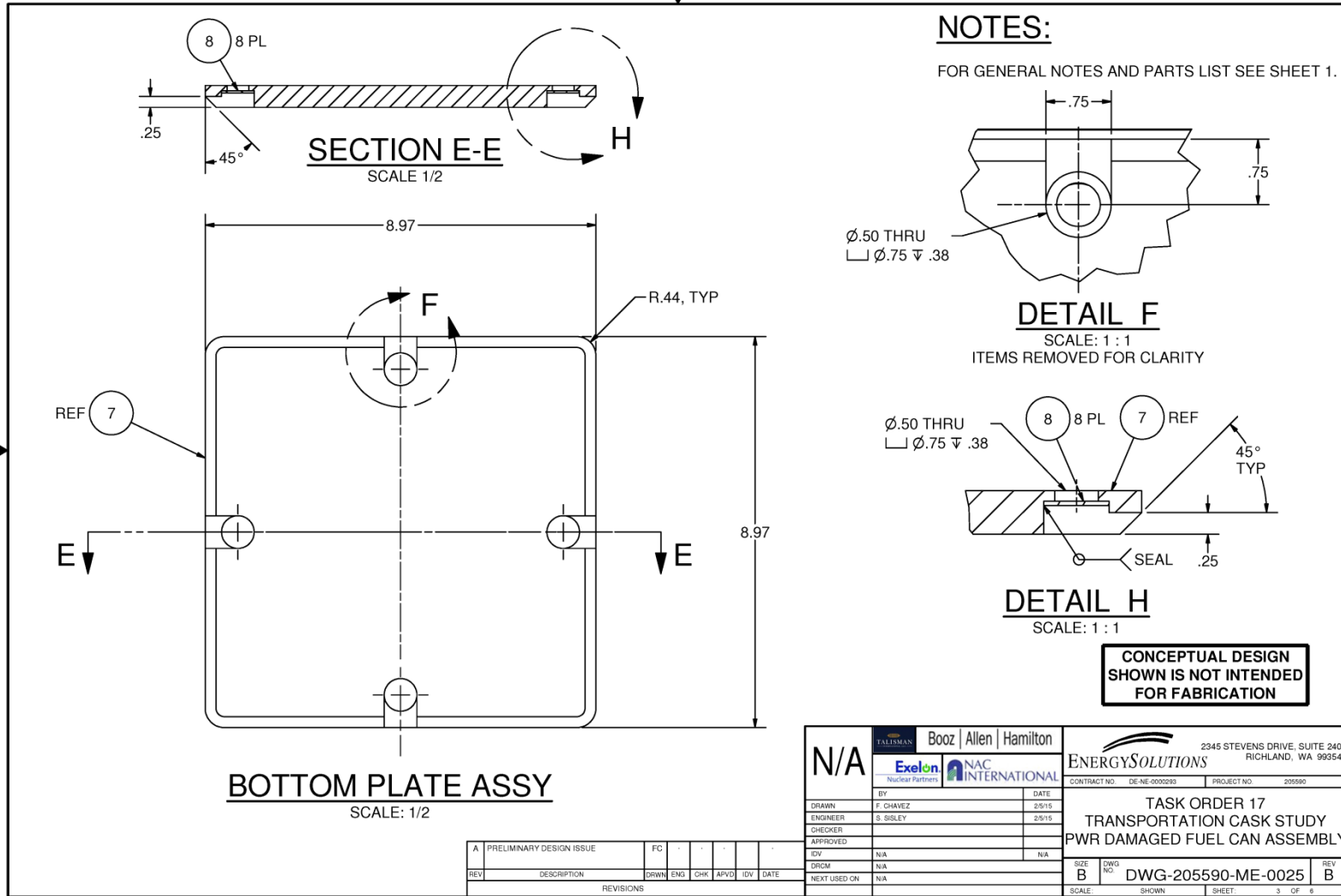
Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



REV	DESCRIPTION	DRWN	ENG	CHK	APVD	IDV	DATE
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REVISIONS							

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	Exelon <small>Nuclear Partners</small>		NAC INTERNATIONAL	
	BY	F. CHAVEZ	DATE	25/15
	ENGINEER	S. SISLEY	DATE	25/15
CHECKER				
APPROVED				
IDV	N/A		N/A	
TRCN	N/A			
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CONTRACT NO. DE-NE-000293		PROJECT NO. 205590		
TASK ORDER 17 TRANSPORTATION CASK STUDY PWR DAMAGED FUEL CAN ASSEMBLY				
SIZE	DWG NO.	REV		
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# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study

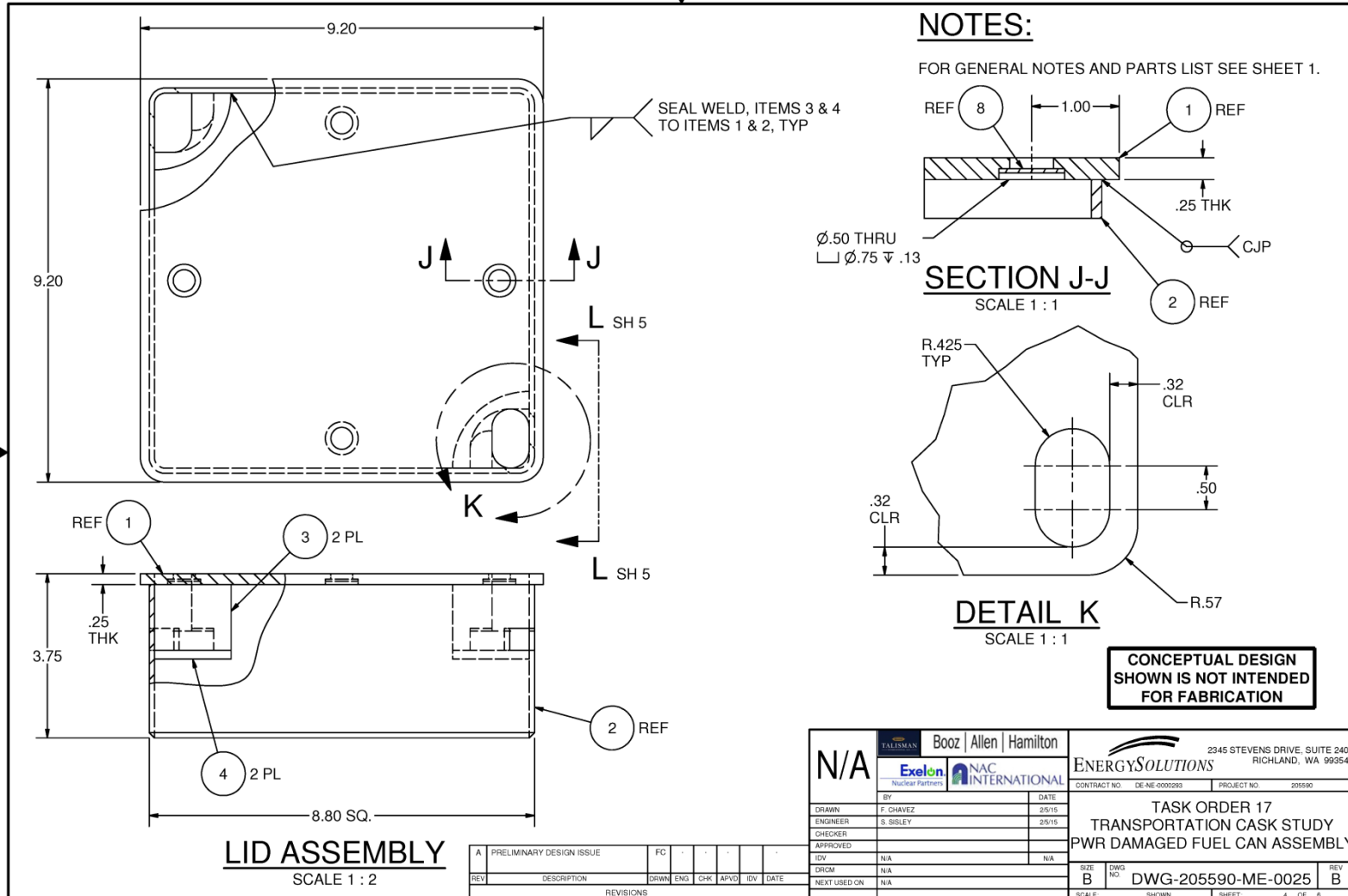


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REVISIONS							

N/A	TALISMAN		Booz   Allen   Hamilton		ENERGYSOLUTIONS		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354		
	Exelon <small>Nuclear Partners</small>		NAC <small>INTERNATIONAL</small>		CONTRACT NO. DE-NE-000293		PROJECT NO. 205990		
BY F. CHAVEZ		DATE 2/5/15		TASK ORDER 17 TRANSPORTATION CASK STUDY PWR DAMAGED FUEL CAN ASSEMBLY					
ENGINEER S. SISLEY		DATE 2/5/15							
CHECKER									
APPROVED									
IDV N/A		DATE N/A		SIZE B		DWG NO. DWG-205590-ME-0025		REV B	
DRCW N/A				SCALE		SHOWN		SHEET 3 OF 8	
TEXT USED ON N/A									



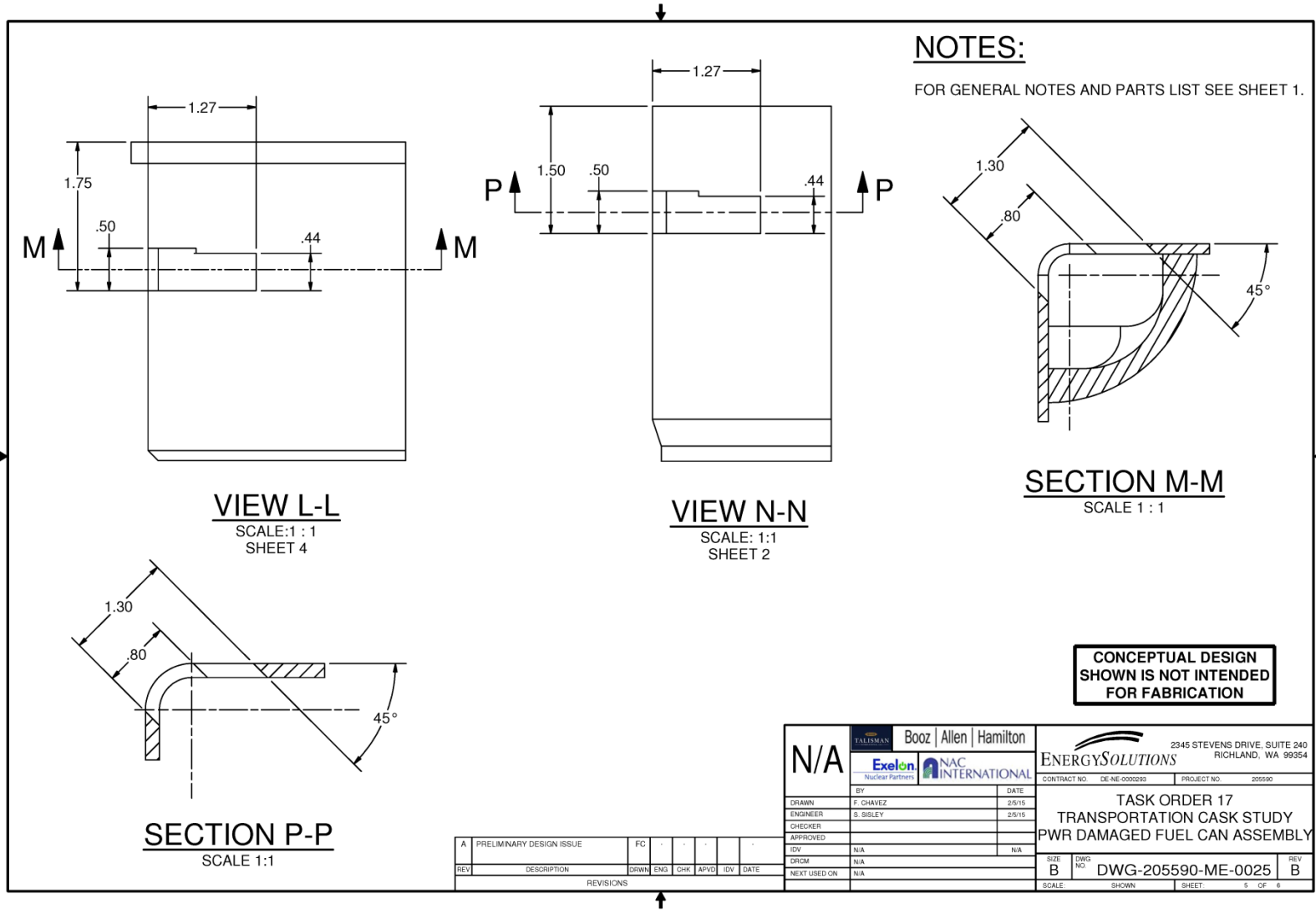
Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



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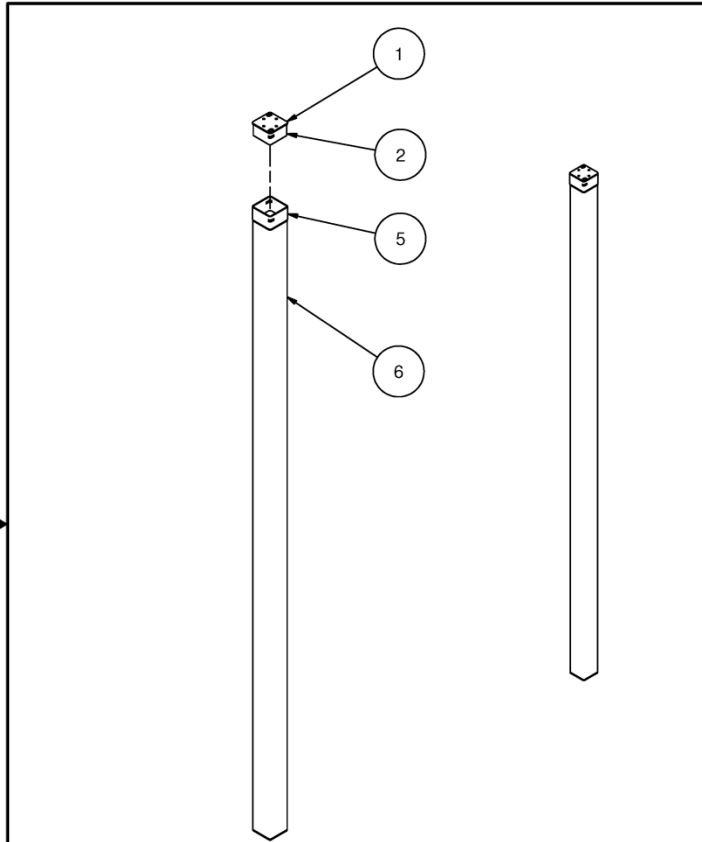
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BY	F. CHAVEZ	DATE	25/15				
ENGINEER	S. SISLEY	DATE	25/15				
CHECKER							
APPROVED							
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SCALE	SHOWN		SHEET	4		OF	6

Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study





# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



QTY	NOMENCLATURE/DESCRIPTION	MATERIAL/REFERENCE	ITEM
1	LID TOP PLATE, 1/4 INCH THK	ASME SA-240, TYPE 316L	1
1	LID SKIRT PLATE, 11 GA.	ASME SA-240, TYPE 316L	2
2	LID BOSS	ASME SA-240, TYPE 316L	3
2	LID BOSS SEAL PLATE	ASME SA-240, TYPE 316L	4
1	TOP COLLAR, 8 GA.	ASME SA-240, TYPE 316L	5
1	MAIN BODY TUBE, 16 GAUGE	ASME SA-240, TYPE 316L	6
1	BOTTOM PLATE, 1/2 INCH	ASME SA-240, TYPE 316L	7
8	MESH SCREEN, 3/4 INCH DIA Z 0.05 INCH MAX OPENING	STAINLESS STEEL	8

### GENERAL NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL DIMENSIONS ARE INCHES UNLESS OTHERWISE NOTED.

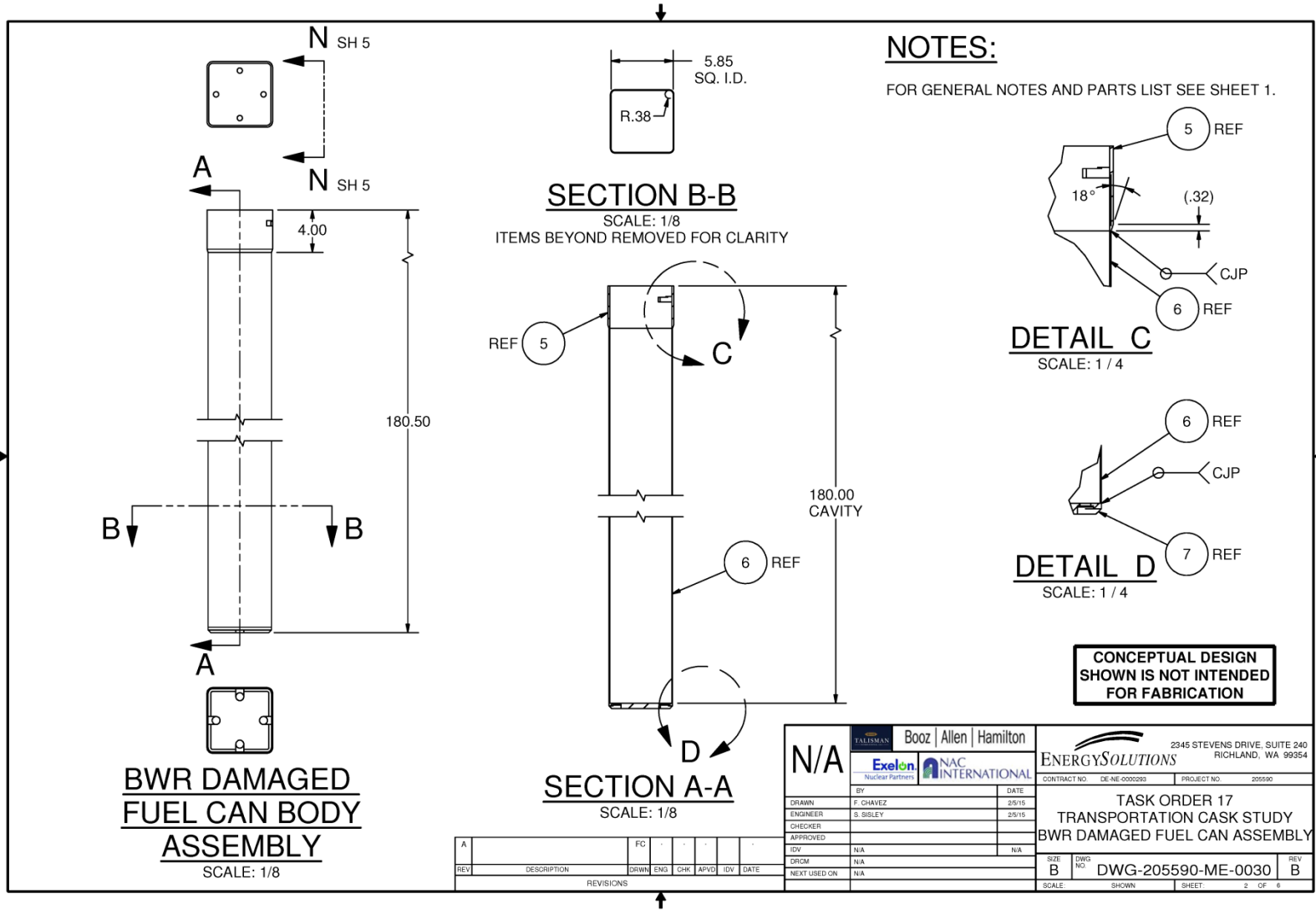
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FOR FABRICATION**

**BWR DAMAGED  
FUEL CAN  
ASSEMBLY**  
(EXPANDED VIEW)  
SCALE: NONE

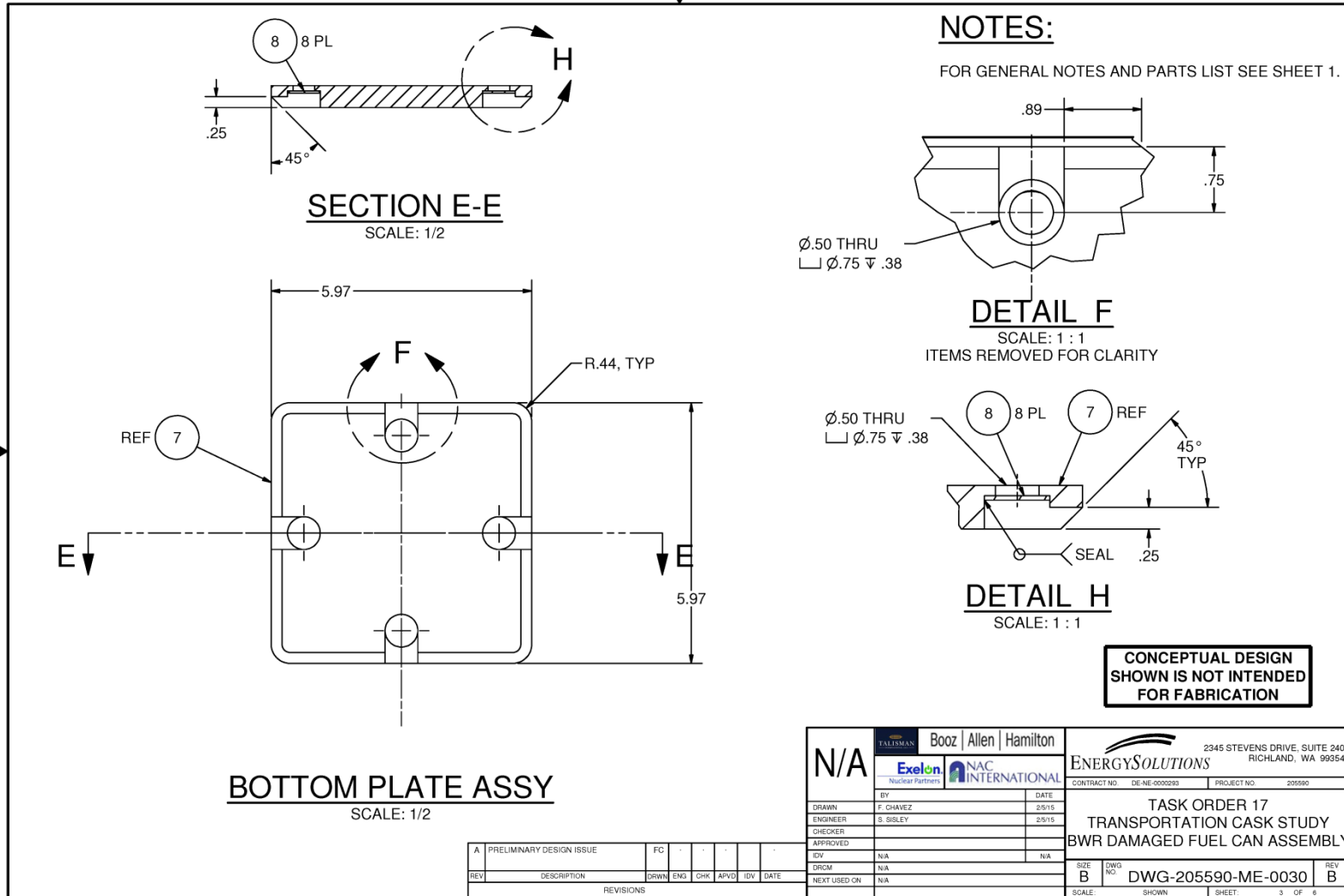
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N/A	Booz   Allen   Hamilton		ENERGYSOLUTIONS		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354
	Exelon <small>Nuclear Partners</small>		NAC INTERNATIONAL		CONTRACT NO. DE-NE-000293
	PROJECT NO. 205590		<b>TASK ORDER 17 TRANSPORTATION CASK STUDY BWR DAMAGED FUEL CAN ASSEMBLY</b>		
	DATE				
BY	F. CHAVEZ	DATE	25/15		
ENGINEER	S. SISLEY	DATE	25/15		
CHECKER					
APPROVED					
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TRCN	N/A				
NEXT USED ON	N/A				
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SCALE	SHOWN	SHEET	1	OF	6

Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



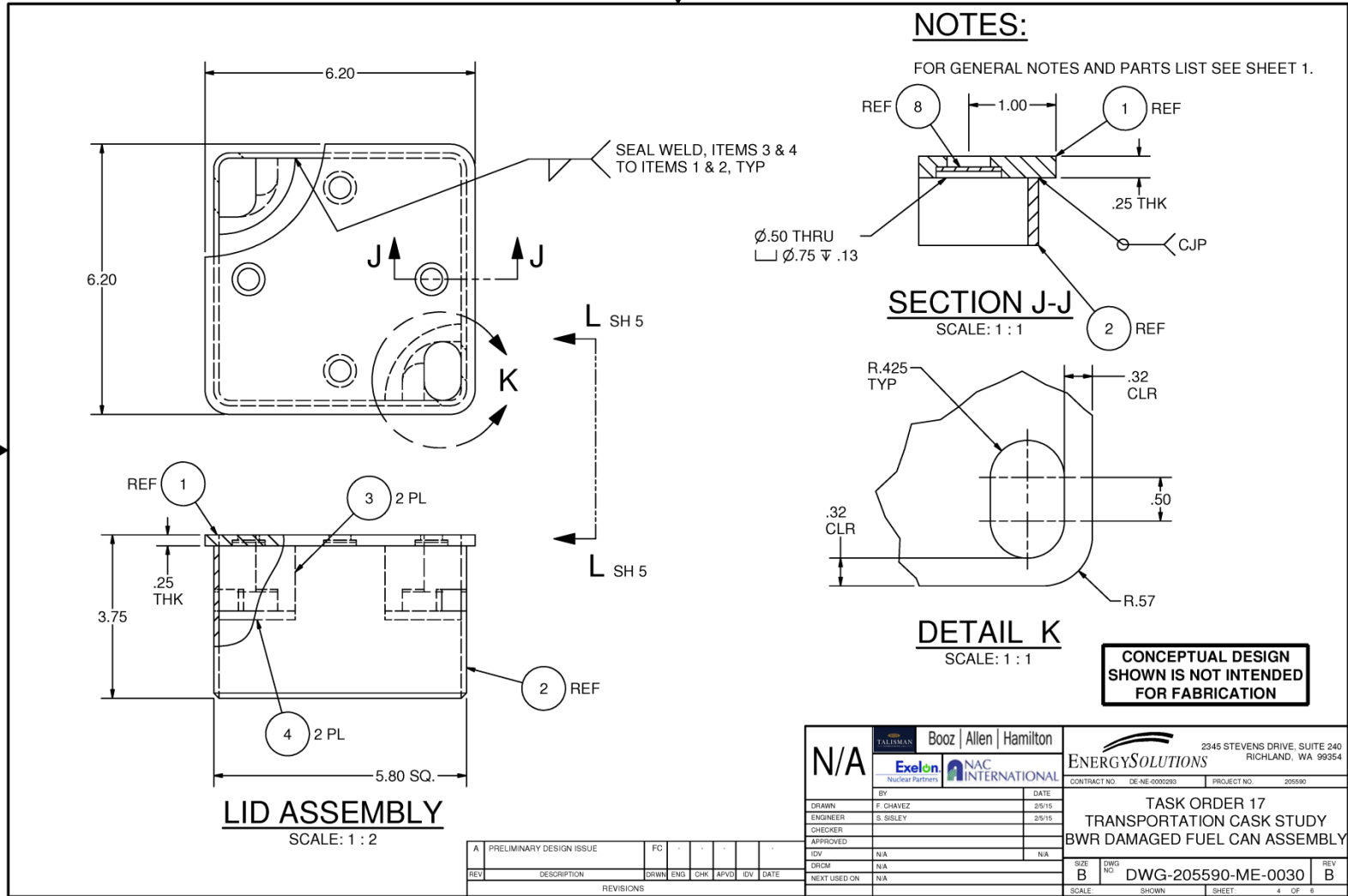
# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



REV	DESCRIPTION	DRWN	ENGR	CHK	APVD	IDV	DATE
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REVISIONS							

N/A	TALISMAN	Booz   Allen   Hamilton	2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354
	Exelon <small>Nuclear Partners</small>	NAC <small>INTERNATIONAL</small>	ENERGYSOLUTIONS
BY	F. CHAVEZ	DATE	2/5/15
ENGINEER	S. SISLEY	DATE	2/5/15
CHECKER			
APPROVED			
IDV	N/A		N/A
TRCN	N/A		
TEXT USED ON	N/A		
CONTRACT NO.	DE-NE-000293	PROJECT NO.	205990
TASK ORDER 17 TRANSPORTATION CASK STUDY BWR DAMAGED FUEL CAN ASSEMBLY			
SIZE	B	DWG NO.	DWG-205590-ME-0030
SCALE	SHOWN	SHEET	3 OF 8

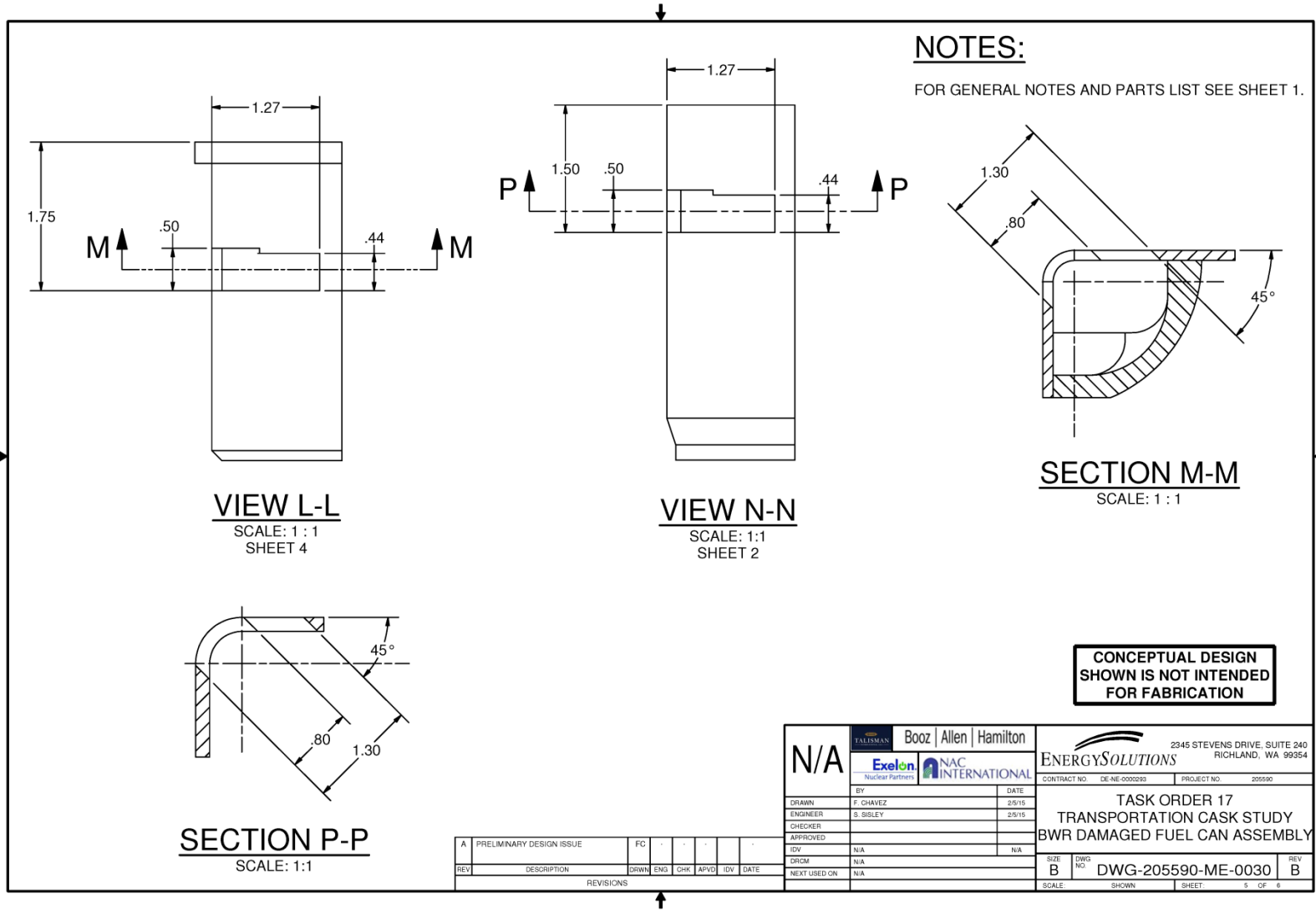
# Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



REV	DESCRIPTION	DRWN	ENG	CHK	APVD	IDV	DATE
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REVISIONS							

N/A	Booz   Allen   Hamilton		ENERGYSOLUTIONS	
	Exelon <small>Nuclear Partners</small>		NAC INTERNATIONAL	
	BY: F. CHAVEZ		DATE: 25/15	
	ENGINEER: S. SISLEY		DATE: 25/15	
CHECKER:		DATE:		
APPROVED:		DATE:		
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CONTRACT NO: DE-NE-000293		PROJECT NO: 205590		
TASK ORDER 17 TRANSPORTATION CASK STUDY BWR DAMAGED FUEL CAN ASSEMBLY				
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SHEET: 4		OF: 6		

Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study

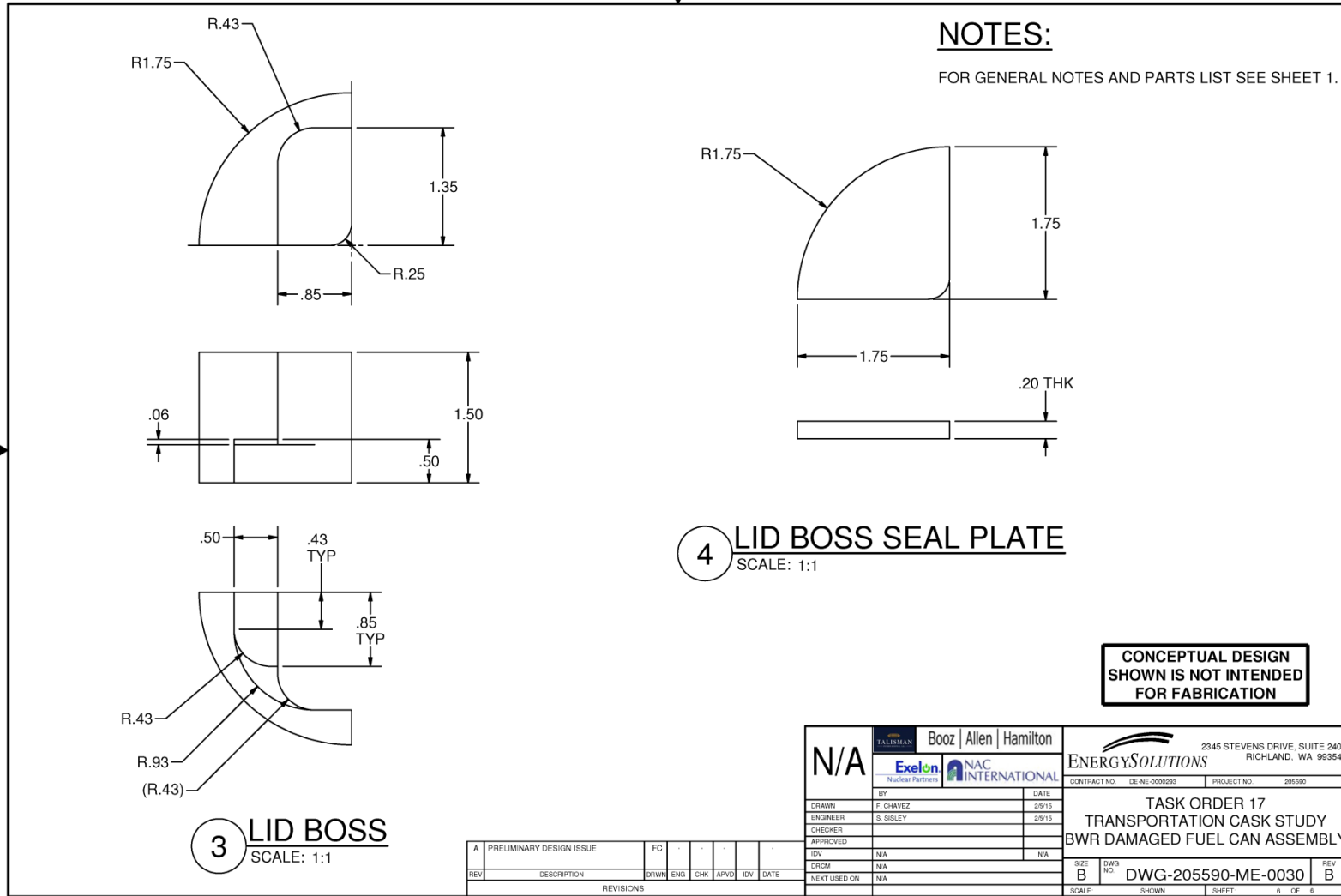


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REVISIONS							

N/A	Booz   Allen   Hamilton		ENERGYSOLUTIONS		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354	
	Exelon <small>Nuclear Partners</small>		NAC <small>INTERNATIONAL</small>		CONTRACT NO. DE-NE-000293    PROJECT NO. 205590	
	BY: F. CHAVEZ		DATE: 2/5/15		<b>TASK ORDER 17</b> <b>TRANSPORTATION CASK STUDY</b> <b>BWR DAMAGED FUEL CAN ASSEMBLY</b>	
	ENGINEER: S. SISLEY		DATE: 2/5/15			
CHECKER:		DATE:				
APPROVED:		DATE:		SIZE: <b>B</b> DWG NO: <b>DWG-205590-ME-0030</b> REV: <b>B</b> SCALE:    SHOWN:    SHEET:    9    OF    6		
IDV: N/A		DATE: N/A				
TRCN: N/A		DATE: N/A				
TEXT USED ON:		DATE:				



Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study



REV	DESCRIPTION	DRWN	ENG	CHK	APVD	IDV	DATE
A	PRELIMINARY DESIGN ISSUE		FC				
REVISIONS							

N/A	Booz   Allen   Hamilton		ENERGYSOLUTIONS		2345 STEVENS DRIVE, SUITE 240 RICHLAND, WA 99354	
	Exelon <small>Nuclear Partners</small>		NAC <small>INTERNATIONAL</small>		CONTRACT NO. DE-NE-0002293 PROJECT NO. 205590	
BY	F. CHAVEZ	DATE	25/15			
ENGINEER	S. SISLEY	DATE	25/15			
CHECKER						
APPROVED						
IDV	N/A		N/A			
DRCM	N/A		N/A			
NEXT USED ON	N/A		N/A			
SIZE	B	DWG NO.	DWG-205590-ME-0030		REV	B
SCALE	SHOWN		SHEET	0 OF 6		

**APPENDIX F - CALCULATIONS (NOT USED)**

This section was reserved for back-up information for calculations.

Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study

**APPENDIX G – BASIS OF ESTIMATES**

Up-Front Costs Basis of Estimate

TABLE G-1. UP-FRONT COSTS BY PHASE AND STAFF/ACQUISITION TYPE																													
(Current Year 2015 \$)																													
Engineer - Nuclear					Engineer - Structural					Engineer - Materials					Project Manager					Other Staff					Total Staff	Total Staff	Total Costs		
#	FTE	Hours	\$/hr	Total	#	FTE	Hours	\$/hr	Total	#	FTE	Hours	\$/hr	Total	#	FTE	Hours	\$/hr	Total	#	FTE	Hours	\$/hr	Total	#	FTE	\$		
<b>Up-Front Costs</b>																													
<i>Design</i>																													
	Licensee	2	1.00	940.0	\$200.00	\$376,000	2	1.00	940.0	\$200.00	\$376,000	1	0.50	940.0	\$200.00	\$188,000	1	0.50	940.0	\$225.00	\$211,500	1	0.50	940.0	\$75.00	\$70,500	7	3.50	\$1,222,000
<i>Analysis</i>																													
	Licensee	1	0.50	940.0	\$200.00	\$188,000	1	0.50	940.0	\$200.00	\$188,000	1	0.50	940.0	\$200.00	\$188,000	1	0.50	940.0	\$225.00	\$211,500	1	0.50	940.0	\$75.00	\$70,500	5	2.50	\$846,000
<i>Testing</i>																													
	Licensee	1	0.25	470.0	\$200.00	\$94,000	1	0.25	470.0	\$200.00	\$94,000	1	0.25	470.0	\$200.00	\$94,000	1	0.25	470.0	\$225.00	\$105,750	1	0.25	470.0	\$75.00	\$35,250	5	1.25	\$423,000
<i>Licensing</i>																													
	NRC	3	1.00	626.7	\$279.00	\$524,520	1	0.33	626.7	\$279.00	\$174,840	1	0.33	626.7	\$279.00	\$174,840	1	0.33	626.7	\$279.00	\$174,840	0	0.00	626.7	\$0.00	\$0	6	2.00	\$1,049,040
	NRC Contractor	1	0.25	470.0	\$200.00	\$94,000	1	0.25	470.0	\$200.00	\$94,000	1	0.25	470.0	\$200.00	\$94,000	1	0.25	470.0	\$200.00	\$94,000	0	0.00	470.0	\$75.00	\$0	4	1.00	\$376,000
	Licensee - Q&A	1	0.25	470.0	\$200.00	\$94,000	1	0.25	470.0	\$200.00	\$94,000	1	0.25	470.0	\$200.00	\$94,000	1	0.25	470.0	\$200.00	\$94,000	1	0.25	470.0	\$75.00	\$35,250	5	1.25	\$411,250
<b>Sub-Total Staff</b>																										11.50	\$4,327,290		
<b>Cask Prototype</b>																													
																										\$7,211,736			
<b>Contingency</b>																													
																										\$2,740,534			
																										(20% cask 30% other)			
<b>Total Up-front Costs</b>																										\$14,279,560			

Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study

Cask System Acquisition Costs Basis of Estimate

<b>TABLE G-2. CASK SYSTEM ACQUISITION COMPONENT BASE COSTS</b>			
<b>COST ELEMENT</b> (costs in current year 2015 \$)	<b>QUANTITY</b>	<b>UNIT COST (\$)</b>	<b>NOTES/COMMENTS</b>
<b>Cask System</b>			
<b>Casks</b>			
<u>Long 182" Cask</u>	1	\$1,585,299	45/55 split of cask and internals (based on NAC STC)
<u>Short 174" Cask</u>	1	\$1,515,616	45/55 split cask & internals (based on NAC STC); scaled down for length
<b>Cask Internals (Baskets, DFCs, etc)</b>			
<u>Long 182" Cask (PWR)</u>			
32P	1	\$1,937,588	45/55 split of cask and internals (based on NAC STC)
DFC (up to 8)	8	\$121,026	Estimate from TO 17 Workshop #1, p. 3, item 55; Scaled up by 8.85/5.85 inside dimension for PWR versus BWR
28P	1	\$2,131,347	45/55 split of cask and internals (based on NAC STC); Scaled up 10% to accommodate DFC
DFC (28)	28	\$423,590	Estimate from TO 17 Workshop #1, p. 3, item 55; Scaled up by 8.85/5.85 inside dimension for PWR versus BWR
<u>Long 182" Cask (BWR)</u>			
68B	1	\$3,027,482	45/55 split of cask and internals (based on NAC STC); Scaled up to accommodate 68P
DFC (up to 8)	8	\$80,000	Estimate from TO 17 Workshop #1, p. 3, item 55
61B	1	\$3,387,319	45/55 split of cask and internals (based on NAC STC); Scaled up 10% to accommodate DFC; Scaled up to accommodate 61P
DFC (61)	61	\$610,000	Estimate from TO 17 Workshop #1, p. 3, item 55
<u>Short 174" Cask (PWR)</u>			
32P	1	\$1,830,243	45/55 split of cask and internals (based on NAC STC); Scaled down for fuel assembly length
DFC (up to 8)	8	\$115,602	Estimate from TO 17 Workshop #1, p. 3, item 55; Scaled up by 8.85/5.85 inside dimension for PWR versus BWR; Scaled down for fuel assembly length
28P	1	\$2,035,824	45/55 split of cask and internals (based on NAC STC); Scaled up 10% to accommodate DFC; Scaled down for fuel assembly length
DFC (28)	28	\$404,605	Estimate from TO 17 Workshop #1, p. 3, item 55; Scaled up by 8.85/5.85 inside dimension for PWR versus BWR; Scaled down for fuel assembly length
<b>Ancillary Equipment</b>			
Impact Limiters	1	\$1,891,921	Average for multiple cask types; one set per cask
Mounting Skid	1	\$233,554	Average for multiple cask types; use "skid or trailer" as proxy
Lifting Yokes	1	\$247,907	Average for multiple cask types; use "lifting yoke or beam" as proxy
Leak Test Equipment	1	\$93,509	Average for multiple cask types; use "vacuum drying system" as proxy
Removable Lift Trunnions & Other	1	\$314,287	Average for multiple cask types; use "lift rigging & misc. equipment" as proxy

Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study

Loading Costs Basis of Estimate

Table G-3. Loading Costs Basis of Estimate

TABLE G-3. LOADING COSTS BASIS OF ESTIMATE																										
Step #	Step Description	Mechanics		Riggers		Supervisor		Operations		HP		QA/QC		Crane		Heavy Eq. Operator		Security		Total Personnel	Duration	Cum. Dur.	Staff Cost by Activity	Staff/Other Cost Totals		
		#	\$	#	\$	#	\$	#	\$	#	\$	#	\$	#	\$	#	\$	#	\$	#	hrs	hrs	\$	\$		
<b>BARE CASK LOADING AND TRANSFER OF CASK TO TRAIN</b>																										
<b>Prepare &amp; Inspect Empty Cask</b>																										
1)	Unload Empty Cask from Train/Prepare for Transport	3	\$75	0	\$75	1	\$100	0	\$75	0	\$100	1	\$75	1	\$75	1	\$75	2	\$75	9	3.0	3.0	\$2,100			
2)	Empty Cask Transport to Rx Building	4	\$75	2	\$75	1	\$100	0	\$75	0	\$100	0	\$75	1	\$75	1	\$75	0	\$75	9	4.0	7.0	\$2,800			
3)	Cask Movement from Rx Bldg Ground Floor to Rx Bldg RFF	5	\$75	2	\$75	1	\$100	0	\$75	1	\$100	0	\$75	1	\$75	0	\$75	0	\$75	10	3.5	10.5	\$2,800			
4)	Cask Disassembly (Protective Cover and Neutron Shield)	3	\$75	2	\$75	1	\$100	0	\$75	2	\$100	0	\$75	1	\$75	0	\$75	0	\$75	9	3.0	13.5	\$2,250			
5)	Disassemble Cask (Covers and Lid)	3	\$75	2	\$75	1	\$100	0	\$75	1	\$100	1	\$75	1	\$75	0	\$75	0	\$75	9	4.0	17.5	\$2,900			
6)	Cask Lid, Drain, Vent and OP Port Seal Replacement & Misc. Inspections	3	\$75	2	\$75	1	\$100	0	\$75	1	\$100	1	\$75	1	\$75	0	\$75	0	\$75	9	3.0	20.5	\$2,175			
7)	Inspection of Flange, Alignment Pins and Cask Cavity	2	\$75	2	\$75	1	\$100	0	\$75	1	\$100	1	\$75	1	\$75	0	\$75	0	\$75	8	1.0	21.5	\$650	\$15,675		
<b>Insert Cask into Pool &amp; Load Fuel</b>																										
8)	Cask Insertion into Fuel Pool	4	\$75	2	\$75	1	\$100	2	\$75	2	\$100	0	\$75	1	\$75	0	\$75	0	\$75	12	3.0	24.5	\$2,925			
9)	Cask Fuel Loading	0	\$75	0	\$75	1	\$100	3	\$75	1	\$100	0	\$75	0	\$75	0	\$75	0	\$75	5	8.0	32.5	\$3,400	\$6,325		
<b>Remove (from Pool) &amp; Close Loaded Cask</b>																										
10)	Basket Hold Down Ring and Lid Installation	0	\$75	3	\$75	1	\$100	4	\$75	2	\$100	0	\$75	1	\$75	0	\$75	0	\$75	11	3.0	35.5	\$2,700			
11)	Cask Removal from Fuel Pool and Draining	4	\$75	3	\$75	1	\$100	2	\$75	3	\$100	0	\$75	1	\$75	0	\$75	0	\$75	14	6.0	41.5	\$6,900			
12)	Cask Placement on Fuel Floor and Decon	4	\$75	2	\$75	1	\$100	0	\$75	2	\$100	0	\$75	1	\$75	0	\$75	0	\$75	10	3.0	44.5	\$2,475			
13)	Lid Bolt Installation	4	\$75	0	\$75	1	\$100	0	\$75	1	\$100	1	\$75	0	\$75	0	\$75	0	\$75	7	3.0	47.5	\$1,725	\$13,800		
<b>Complete Cask Drying &amp; Testing</b>																										
14)	Cask Drying	3	\$75	0	\$75	1	\$100	0	\$75	1	\$100	1	\$75	0	\$75	0	\$75	0	\$75	6	10.0	57.5	\$5,000			
15)	Helium Fill	2	\$75	0	\$75	1	\$100	0	\$75	1	\$100	1	\$75	0	\$75	0	\$75	0	\$75	5	2.5	60.0	\$1,063			
16)	Preliminary Leak Task	2	\$75	0	\$75	1	\$100	1	\$75	1	\$100	1	\$75	0	\$75	0	\$75	0	\$75	6	2.0	62.0	\$1,000			
17)	Cask Reassembly	4	\$75	0	\$75	1	\$100	0	\$75	2	\$100	1	\$75	1	\$75	0	\$75	0	\$75	9	5.0	67.0	\$3,750			
18)	Cask Leak Test	3	\$75	0	\$75	1	\$100	0	\$75	1	\$100	1	\$75	0	\$75	0	\$75	0	\$75	6	3.0	70.0	\$1,500			
19)	Cask Preparation for Transport	2	\$75	0	\$75	1	\$100	0	\$75	1	\$100	1	\$75	0	\$75	0	\$75	0	\$75	5	1.0	71.0	\$425	\$12,738		
<b>Move Cask to Rail Area &amp; Place on Rail Car</b>																										
20)	Cask Movement from Rx Bldg RFF to Rx Bldg Ground Floor	4	\$75	3	\$75	1	\$100	0	\$75	2	\$100	0	\$75	1	\$75	0	\$75	0	\$75	11	2.0	73.0	\$1,800			
21)	Preparation for Cask Transport	3	\$75	1	\$75	1	\$100	0	\$75	1	\$100	0	\$75	0	\$75	0	\$75	0	\$75	6	1.0	74.0	\$500			
22)	Cask Transport from Rx Bldg to Train Loading Area	4	\$75	2	\$75	1	\$100	0	\$75	2	\$100	0	\$75	0	\$75	1	\$75	4	\$75	14	4.0	78.0	\$4,500			
23)	Cask Placement on Rail Car	4	\$75	2	\$75	1	\$100	0	\$75	2	\$100	0	\$75	0	\$75	1	\$75	3	\$75	13	2.0	80.0	\$2,100	\$8,900		
	Other Costs (consumables - 50% of total)																							\$28,719		
	Sub-Total (one Cask)																							\$86,156		
	Number of Casks per Loading																				4			4		
	Total (Campaign)																							\$344,625		
	Sub-Total (one Cask) with Contingency @ 40%																							\$120,619		
	Number of Casks per Loading																							4		
	Total (Campaign) (with Contingency @ 40%)																							\$482,475		

Task Order 17: Spent Nuclear Fuel Transportation Cask Design Study

Unloading Costs Basis of Estimate

Table G-4. Unloading Costs Basis of Estimate

Step #	Step Description	Mechanics		Riggers		Supervisor		Operations		HP		QA/QC		Crane		Heavy Eq. Operator		Security		Total Personnel	Duration	Cum. Dur.	Staff Cost by Activity	Staff/Other Cost Totals																				
<b>CASK UNLOADING OPERATIONS</b>																																												
<b>Unload &amp; Prepare Loaded Cask</b>																																												
1)	Unload Loaded Cask from Train/Prepar for Transport	4	\$75	2	\$75	1	\$100	1	\$75	2	\$100	0	\$75	1	\$75	1	\$75	5	\$75	17	5.0	5.0	\$6,750																					
2)	Loaded Cask Transport to Rx Bldg	4	\$75	2	\$75	1	\$100	0	\$75	2	\$100	0	\$75	0	\$75	1	\$75	5	\$75	15	3.0	8.0	\$3,600																					
3)	Cask Movement from Rx Bldg Ground Floor to RFF	4	\$75	2	\$75	1	\$100	0	\$75	2	\$100	0	\$75	1	\$75	0	\$75	0	\$75	10	3.0	11.0	\$2,475																					
4)	Cask Disassembly (Protective Cover and Neutron Shield)	4	\$75	2	\$75	1	\$100	0	\$75	2	\$100	0	\$75	1	\$75	0	\$75	0	\$75	10	2.0	13.0	\$1,650																					
5)	Cask Venting/Sampling and Preparation for Installation into Fuel Pool	4	\$75	2	\$75	1	\$100	1	\$75	2	\$100	1	\$75	0	\$75	0	\$75	0	\$75	11	12.0	25.0	\$10,800	\$25,275																				
<b>Insert Cask into Pool &amp; Unload Fuel</b>																																												
6)	Cask Installation into Fuel Pool	4	\$75	2	\$75	1	\$100	2	\$75	3	\$100	0	\$75	1	\$75	0	\$75	0	\$75	13	4.0	29.0	\$4,300																					
7)	Cask Flooding and Cask Lid Removal	4	\$75	2	\$75	1	\$100	2	\$75	3	\$100	0	\$75	1	\$75	0	\$75	0	\$75	13	5.0	34.0	\$5,375																					
8)	Cask Fuel Unloading	0	\$75	0	\$75	1	\$100	3	\$75	2	\$100	1	\$75	1	\$75	0	\$75	0	\$75	8	9.0	43.0	\$6,075	\$15,750																				
<b>Remove Empty Cask from Pool</b>																																												
9)	Empty Cask Removal from Fuel Pool and Drainin	4	\$75	2	\$75	1	\$100	2	\$75	3	\$100	0	\$75	1	\$75	0	\$75	0	\$75	13	5.0	48.0	\$5,375	\$5,375																				
<b>Decon &amp; Return Empty Cask to Rail Car</b>																																												
10)	Empty Cask Placement on Fuel Floor and Decon	4	\$75	2	\$75	1	\$100	0	\$75	3	\$100	0	\$75	1	\$75	0	\$75	0	\$75	11	3.0	51.0	\$2,775																					
11)	Transfer Empty Cask to Train Loading Area	4	\$75	2	\$75	1	\$100	0	\$75	0	\$100	0	\$75	1	\$75	1	\$75	0	\$75	9	4.0	55.0	\$2,800																					
12)	Place Empty Cask on Rail Car	0	\$75	2	\$75	1	\$100	0	\$75	0	\$100	0	\$75	1	\$75	1	\$75	2	\$75	7	2.0	57.0	\$1,100	\$6,675																				
																						Other Costs (consumables - 25% of total)																						\$13,269
																						Sub-Total (one Cask)																						\$66,344
																						Number of Casks per Unloading																						4
																						Total (Campaign)																						\$265,375
																						Sub-Total (one Cask) with Contingency @ 30%																						\$86,247
																						Number of Casks per Loading																						4
																						Total (Campaign) (with Contingency @ 30%)																						\$344,988
<b>Step Execution Safety Risk:</b>																																												
		= Low (Minimal)																																										
		= Moderate (Moderate)																																										
		= High (Greatest)																																										

**APPENDIX H – UNIT COSTS (COST PORTION)**

**Table H-1. Unit Costs.**

<b>TABLE H-1. UNIT COSTS</b>						
<b>COST ELEMENT</b> (costs in current year 2015 \$)	<b>QUANTITY</b>		<b>UNIT COST (\$)</b>	<b>Contingency @ 20% Equipment or 30% Other</b>	<b>TOTAL COST (\$)</b>	
<b>Unit Costs</b>						
<i>Cask Purchase (Initial) (Long 182" Cask, PWR, 32 Intact (up to 8 DFCs)) - (unit = one cask system)</i>	1	NA	\$7,211,736	\$1,442,347	\$8,654,083	
<i>Cask Purchase (Full-up Production) (Long 182", PWR, 32 Intact (up to 8 DFCs)) - (unit = one cask system)</i>	1	NA	\$5,769,389	\$1,153,878	\$6,923,267	
<i>Ancillary Equipment - Loading (one set)</i>	1	NA	\$655,703	\$131,141	\$786,843	
<b>Loading Operation</b>						
<i>Mobilization (per campaign)</i>	1	NA	\$297,098	\$89,129	\$386,227	
<i>Loading (per cask)</i>	1	NA	\$86,156	\$34,463	\$120,619	
<i>De-Mobilization (per campaign)</i>	1	NA	\$258,590	\$77,577	\$336,167	
<i>Ancillary Equipment - Unloading (one set)</i>	1	NA	\$562,194	\$112,439	\$674,633	
<b>Unloading Operation</b>						
<i>Mobilization (per campaign)</i>	1	NA	\$228,777	\$68,633	\$297,411	
<i>Unloading (per cask)</i>	1	NA	\$66,344	\$19,903	\$86,247	
<i>De-Mobilization (per campaign)</i>	1	NA	\$199,125	\$59,737	\$258,862	
<i>Inspection (per campaign)</i>	1	NA	\$24,000	\$7,200	\$31,200	
<i>Maintenance (per campaign)</i>	1	NA	\$65,000	\$19,500	\$84,500	
<i>Refurbishment (per cask system)</i>	1	NA	\$14,000	\$4,200	\$18,200	