NCSX Work Approval Form (WAF)

WBS Number: 63
WBS Title: Utility Systems
Job Number: 6301
Job Title: Utility Systems
Job Manager: Larry Dudek

Description:

The Utility Systems (WBS 63) are required to provide service manifolds around the NCSX stellarator for compressed air, vacuum pump venting and gaseous nitrogen. Utility Systems are comprised of three (3) service manifolds around the NCSX vacuum vessel: one for vacuum venting; one for GN2 service; and one for compressed air. The WBS element only consists of the effort to provide the design, fabrication and installation of a manifold system around the NCSX stellarator for compressed air, vacuum pump venting and gaseous nitrogen.

Schedule:

See Attached

Approvals:

Lawrence E. Dudek — Digitally signed by Lawrence E. Dudek, DN: cn=Lawrence E. Dudek, c=US, Date: 2007.07.06 09:41:01 -04'00'
Job Manager — Date

Wayne Reiersen — Digitally signed by Wayne Reiersen, DN: cn=Wayne Reiersen, c=US, o=PPPL, Reason: I have reviewed this document, Date: 2007.07.06 09:53:07 -04'00'
Responsible Line Manager — Date

Hutch Neilson — Digitally signed by Hutch Neilson, DN: CN = Hutch Neilson, C = US, O = PPPL, Date: 2007.07.06 10:32:54 -04'00'
Project Manager — Date

Mike Williams — Digitally signed by Mike Williams, DN: cn=Mike Williams, o=PPPL, ou=Engineering, email=williams@pppl.gov, c=US, Date: 2007.07.06 11:31:56 -04'00'
Engineering Department Head — Date

NCSX June 2007 ETC
TABLE I - DESIGN LABOR

WBS Number: 63
WBS Title: Utility Systems
Job Number: 6301
Job Title: Utility Systems
Job Manager: Larry Dudek

	FY07$K					HOURS												
	$1	$1,000	$1,716	$1,716	$1,716	168.7	168.7	156.5	128.59	108.44	78.33	180.79	116.7	168.88	138.6	138.6	78.33	
TASK DESCRIPTION	41MS	48MS	37STK	35TRVL	31OT	ORNLEM	ORNLDSN	EMEM	EMSM	EMSB	EMTB	EAEM	EASB	EEEM	EESM	EESB	EETB	Basis of Estimae
Design																		
Preliminary Design								60					80					Engineering judgement based on NSTX experience
PDR																		
Final design								20					80					Engineering judgement based on NSTX experience
FDR																		
Procurement & Fabrication/Installation																		
Procurement lead time and award																		
Vent System Procurements	$22,207							40			322							**See Material Take Offs in Table V**
Air System Procurements	$2,191																	**See Material Take Offs in Table V**
PTP Testing								8			40							Engineering judgement based on NSTX experience
TOTALS	**$24,398**	**$0**	**$0**	**$0**	**$0**	**0**	**0**	**128**	**0**	**0**	**362**	**0**	**160**	**0**	**0**	**0**	**0**	

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TABLE II - Materials and Subcontracts

WBS Number: 63								
WBS Title: Utility Systems								
Job Number: 6301								
Job Title: Utility Systems								
Job Manager: Larry Dudek								
Materials and Subcontracts (M&S)								**Basis of Estimate**
M&S in Table I								

NCSX June 2007 ETC
TABLE III - Fabrication/Assembly Installation

In-house Fabrication and Assembly and Installation														
Fabrication & Installation in Table I														

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TABLE IV - Uncertainty of Estimate and Residual Risk Assessment

WBS Number: 63
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Uncertainty of the Estimate

	High	Medium	Low	Uncertainty Range (%)	Comments/Other Considerations
Design Maturity		X			Design not complicated, but still in a conceptual stage.
Design Complexity			X	-10%/+15%	Standard piping -- off-the-shelf components

Note: High/Medium/Low uncertainty assessment from Job Manager. Uncertainty range based on AACEI recommended practice 18R-97 as amended for NCSX.

Residual Impacts

Job	Risk Description	Likelihood of Occurring	Mitigation Plan	Basis of estimate	Cost Impact Low	Cost Impact High	Schedule Impact Low	Schedule Impact High
NONE								

Notes:
[1] Low cost and schedule impacts are considered the minimum (0-percentile) impacts should the event occur.
High cost and schedule impacts are considered the maximum (100-percentile) impacts should the event occur
[2] Cost impacts should be entered as man-hours (by demographic) and M&S direct cost under basis of estimate.
Cost impacts should NOT include standing army costs which are separately calculated from the schedule impact
Project control is reponsible for quantifying the low and high cost impacts based on the labor hours and M&S identified
[3] The schedule impacts should be entered as the min and max impacts on the critical path.
If there is no critical path impact then the schedule entries should be zero.
[4] Likelihood of occurrence should be entered consistent with our risk classification methodology, i.e.
VL= Very Likely (P>80%), L=Likely (80%>P>40%), U=Unlikley (40%>P>10%), VU=Very Unlikely (P<10%), NC=Non-credible (P<1%)

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TABLE V - Basis of Estimate

WBS Number: 63
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Job Number: 6301
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Backup Data

Vent Systems Material Takeoffs

Vent

Size		Labor Manhours	Material Cost ($)	Total Labor (Mhours)	M&S ($)
Material: 304 SS					(in 1991 $)
Sch10 with Clevis hangers					
	Linear Feet				
1"		0.160	$5	0	$0
1-1/4"		0.176	$6	0	$0
1-1/2"		0.193	$7	0	$0
2"		0.239	$9	0	$0
1-1/2"		0.314	$11	0	$0
3"		0.348	$13	0	$0
4"	300	0.381	$17	114	$4,983
Sch 5 and 10	NO. JOINTS				
1"		1.000		0	$0
ELBOWS	Quantity				
3"		2.670	$20	0	$0
4"	12	4.000	$39	48	$468
45 Deg. ELBOWS	Quantity				
3"		2.670	$18	0	$0
4"	4	4.000	$39	16	$156
5"		5.330	$215	0	$0
TEES	Quantity				
4"	10	8.000	$71	80	$710
5"		8.000	$285	0	$0
FLANGES, SLIP ON 15	Quantity				
1"		0.296	$20	0	$0
VALVES					
4" (Motorized)		8.000	$2,000	0	$0
6"		12.000	$500	0	$0
16"		16.000	$800	0	$0

Size		Labor Manhours	Material Cost ($)	Total Labor (Mhours)	M&S ($)
Material: 304 SS					(in 1991 $)
Ball VALVES 150 #, Threaded (Bronze)				0	$0
1/2"		0.364	$4.45	0	$0
1"		0.421	$9.25	3.368	$74
2"	9	0.727	$25.00	0	$0
Pipe					
1"		0.160	$5	0	$0
Install Pump		32.000	$10,000	0	$0
Instll Ht Xchgr		40.000	$0	0	$0
Install Instru	0	16.000	$200	0	$0
Totals					
				3.22	$6,391
For Small Quantities M&S add:10%					$639
Subtotal (1991$)					$7,030
Escalation from 1991$ to 2007$ for 304SS					3.16
Approximate Cost of M&S in 2007$					$22,207

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TABLE V - Basis of Estimate

WBS Number: 63
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Air Systems Material Takeoffs

Air

Size		Labor Manhours	Material Cost ($)	Total Labor (Mhours)	M&S ($) (in 1991 $)
Cu Type K					
Type L, couplings with Clevis hangers @ 10' intervals					
	Linear Feet				
1/2"		0.103	$1.18	0	$0
3/4"		0.108	$1.77	0	$0
1"	200	0.121	$2.45	24.2	$490
1-1/4"		0.143	$3.35	0	$0
	NO. JOINTS				
1"		0		0	$0
ELBOWS, Cu Wrought	Quantity				
1/2"		0.4	$0.29	0	$0
3/4"		0.421	$0.49	0	$0
1"	20	0.5	$0.99	10	$20
1-1/4"		0.533	$2.04	0	$0
45 Deg. ELBOWS (Cu)	Quantity				
1/2"		0.4	$0.53	0	$0
3/4"		0.421	$0.90	0	$0
1"	8	0.5	$2.31	4	$18
1-1/4"		0.533	$3.18	0	$0
1-1/2"		0.615	$3.83	0	$0
2"		0.727	$6.35	0	$0
2-1/2"		1.23	$13.60	0	$0
0		0	$0.00	0	$0
TEES, Cu Wrought	Quantity				
1/2"		0.615	$0.49	0	$0
3/4"		0.667	$1.22	0	$0
1"	8	0.8	$3.55	6.4	$28
				0	$0
			For Small Quantities M&S add:10%		$0
			TOTAL	44.6	$557
			ManWeeks	1.115	
			M&S in FY 2007 $		$1,758.45
				M&S	$1,800

Size		Labor Manhours	Material Cost ($)	Total Labor (Mhours)	M&S ($) (in 1991 $)
Cu Type K					
Ball VALVES 150 #, Threaded (				0	$0
1/2"		0.364	$4.45	0	$0
1"	8	0.421	$9.25	3.368	$74
2"		0.727	$25.00	0	$0
Pipe					
Install Pump		16	$500	0	$0
2" (3hp		6.96	$1,320	0	$0
Instll Ht Xchgr		40	$0	0	$0
Install Instru		16	$200	0	$0
Install Pwr		24	$1,000	0	$0
Install Tank		96	$5,000	0	$0
Totals					
				48	$631
For Small Quantities M&S add:10%					$63
Subtotal (1991$)					$694
Escalation from 1991$ to 2007$ for 304SS					3.16
Approximate Cost of M&S in 2007$					$2,191

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