

NCSX Facility Systems

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NCSX Cost and Schedule Review

August 15-17, 2007

Scope

- WBS 6.1.3 Vacuum System Cooling Water
- WBS 6.3 Utility Gas Systems
 - Air
 - Vent to ambient
- WBS 6.4 VV Bakeout System

Basis for Cost & Schedule Estimates

- Prior experience from NSTX
 - Used to size utility systems
- Means Cost Estimating Guides
- Vendor quotes / estimates for equipment
- Catalog prices

6.1.3 Vacuum Pumping System Water

- Requirements:
 - Load: 5-10 gpm
 - Fluid: Treated Water
 - Pressure: 140 psig
 - Temperature: Ambient
- Estimate
 - Means cost guide

6.1.3 Vacuum Pumping System Cooling Water

- Provide a small loop <10 gpm
 - Includes design, fabrication
 - Instrumentation and add backflow preventer
 - Heat exchanger & pump
- Work performed by PPPL Techs / Engineers
 - EMEM: 92 mhrs
 - EASB: 80 mhrs
 - EMTB: 208 mhrs
 - M&S: \$ 2,970

6.1.3 Materials and Labor

	M&S (\$)	EMTB (hrs)
3/4" Cu Pipe x 50 ft	250	8
Solder Joints (25)		15
Valves	100	8
Elbows	10	8
Tees	10	8
New Instrumentation	1500	80
Backflow preventer	500	16
Heat Exchanger	500	16
Pump	100	8

Schedule



Activity ID	MILEstones (level 2 & 3)	Activity Description	Duration (work days)	Baseline Start	Baseline Finish	Shifts	Total Float	% cmlpt	Proposed Budgeted						
										FY07	FY08	FY09	FY10	FY11	
61 - Water Systems															
Job: 6101 - Water Systems-DUDEK															
613 - Vacuum Pumping System															
6101-100		Design Vac Pmp water sys	20	01OCT08*	28OCT08		258		13,183.60						
6101-105		Procure Hardware and materials Vac Pmp water sys	90	29OCT08	16MAR09		258		7,459.09						
6101-110		Fabricate and Install Vac Pmp water sys	40	20APR09*	15JUN09		234		21,135.28						
6101-115		Test Vac Pmp water sys	22	16JUN09	16JUL09		234		4,622.40						
Subtotal			196	01OCT08	16JUL09		234		46,400.37						

EM/EM =20hr ; EA/EB =80hr ;
 EM/EM =20hr ; 41=03\$K ;
 EM/EM =44hr ; EM/TB =168hr ;
 EM/EM =08hr ; EM/TB =40hr ;

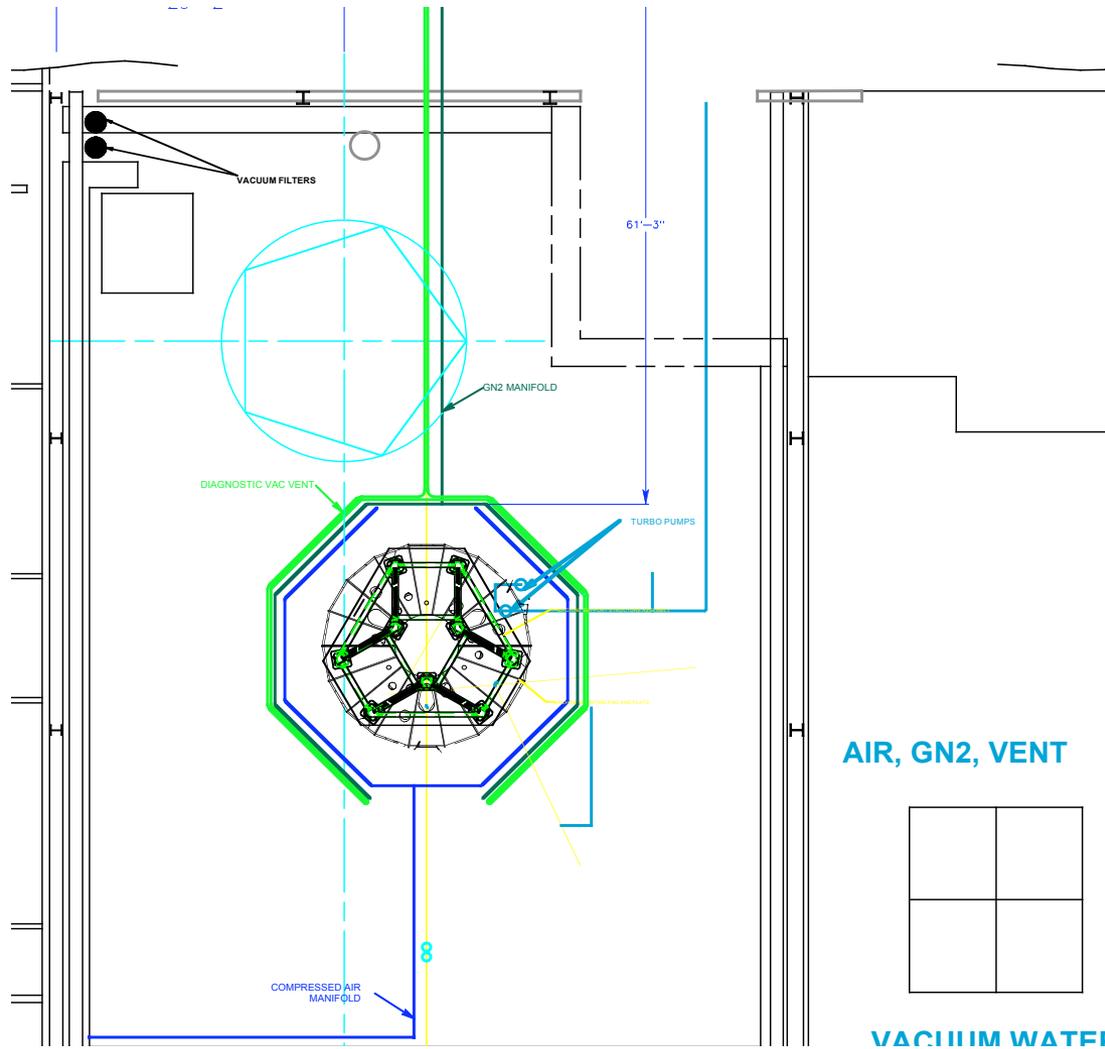
6.3 Utility Gas Systems

- Requirements:
 - Flavors: Compressed Air, Vac.Vent
 - Pressure: 90 psig , 14.7 psia
 - Design: Copper manifold
- Interface: Manifold around machine
- Estimate: Use past experience on NSTX, Cost Estimating Guide

6.3 Utility Gas Systems

- Provide simple gas manifolds and vent
 - Includes: Design, Fabrication
 - Work performed by PPPL Techs
 - Engineer: 128 mhrs
 - Designer: 160 mhrs
 - Technician: 362 mhrs
 - M&S: \$24,398

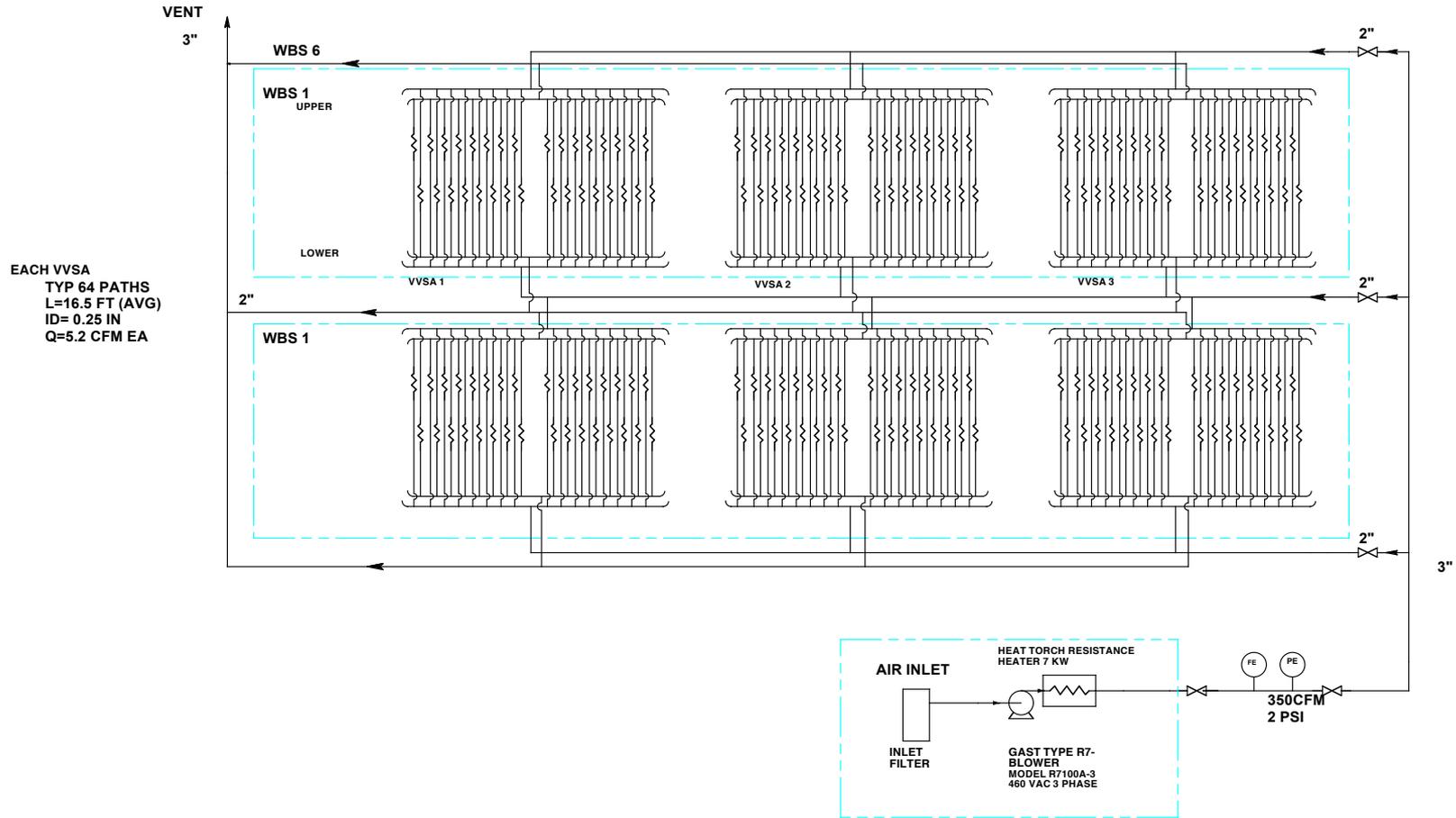
Utility Arrangement



6.4 VV Bakeout System

- VV Bakeout Requirements
 - Steady State Load: 7 kW
 - Flow: 350 CFM
 - Pressure: ~2 psig (once through to atmosphere vent)
 - Temp: 150 C Vessel
- Once through compressed air “dryer” type system
- Interface: Outside cryostat

6.4 VV Bakeout Flow Diagram



6.4 Bakeout Estimate



TASK DESCRIPTION	FY07SK					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
	41MS	48MS	37STK	35TRV L	31OT	ORNL M	ORNL SN	EMEM	EMSM	EMSB	EMTB	EAEM	EASB
Design													
Requirements definition								80					
Preliminary Design & Review								160					120
Final Design & Review								160					120
EA or ORNL VV Analysis to confirm												160	
ACC Review								40			40		
Procurement & Fabrication/Installatic													
Procurement lead time and award													
Piping and Equipment (See Piping Estimate T	\$157,185										1830		
480 VAC Power Service	\$5,000										80		
Local Controls	\$3,000										80		
PTP Testing													
								40			120		
TOTALS													
	\$165,185	\$0	\$0	\$0	\$0	0	0	480	0	0	2150	160	240

6.4 Piping Estimate

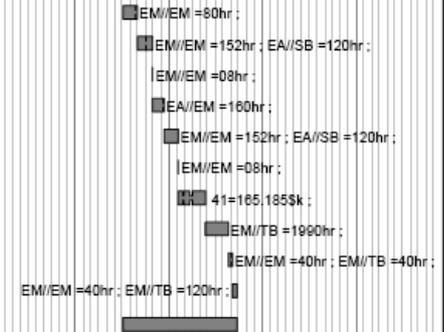


Size	304 SS	Labor Manhours	Material Cost (\$)	Total Labor (Mhours)	M&S (\$) (in 2002 \$)
Sch10 with Clevis hangers					
	Linear Feet				
	1"	0.160	\$8	0	\$0
	1-1/4"	0.176	\$10	0	\$0
	1-1/2"	0.193	\$11	0	\$0
	2" 200	0.239	\$14	48	\$2,700
	2-1/2"	0.314	\$17	0	\$0
	3" 500	0.348	\$21	174	\$10,250
Sch 5 and 10 NO. JOINTS					
	1"	1.000		0	\$0
	1-1/4"	1.250		0	\$0
	1-1/2"	1.500		0	\$0
	2" 30	2.000		60	\$0
	2-1/2"	2.500		0	\$0
	3" 30	3.000		90	\$0
ELBOWS					
	Quantity				
	1"	1.070	\$12	0	\$0
	1-1/4"	1.140	\$18	0	\$0
	1-1/2"	1.230	\$14	0	\$0
	2" 30	1.450	\$19	44	\$555
	2-1/2"	2.000	\$40	0	\$0
	3" 10	2.670	\$48	27	\$475
TEES					
	Quantity				
	1"	1.600	\$33	0	\$0
	1-1/4"	1.780	\$63	0	\$0
	1-1/2"	2.000	\$36	0	\$0
	2" 10	2.290	\$37	23	\$370
	1-1/2"	3.200	\$116	0	\$0
	3" 5	4.000	\$81	20	\$405
Adders					
	Elevated Installation 15%	72.735		73	
	Ceramic Breaks (Fab and Install) 6	8.000	\$2,000	48	\$12,000
	Insulation 10%	48.490	\$1,476	48	\$1,476
VALVES					
	3" Backpressure control valve 1	8.000	\$8,000	8	\$8,000
	2" Ballancing Valvs 6	8.000	\$800	48	\$4,800
	16" 1	16.000	\$800	0	\$0
	3" Ceramic Breaks 24	6.000	\$1,200	144	\$28,800
	3" Bellows 24	6.000	\$135	144	\$3,240
	Gast Blower 1	32.000	\$4,000	32	\$4,000
	Instll Htr 1	40.000	\$6,000	40	\$6,000
	Install Instru 1	16.000	\$200	0	\$0
	Install Pwr 1	120.000	\$5,000	120	\$5,000
	Install Tank 1	96.000	\$5,000	0	\$0
	Piping Support Towers 4	160.000	\$3,000	640	\$12,000
TOTAL				1830	\$100,071
ManWeeks				45.75	
M&S in FY 2007					\$140,354.05

6.4 Bakeout Schedule



Activity ID	MILE-stones (level 2 & 3)	Activity Description	Duration (work days)	Baseline Start	Baseline Finish	Shifts	Total Float	% cmlpt	Proposed Budgeted							
										FY07	FY08	FY09	FY10	FY11	FY12	
64 - PFC/VV Heating & Cooling (Bakeout)																
Job: 6401 - PFC/VV Htng/Cooling(bakeout)- KALISH																
6401-000		Bakeout Sys- Requirements Definition	40	06APR09*	01JUN09		93		15,296.80							
6401-001		Bakeout Sys-Preliminary Design	40	02JUN09*	28JUL09		93		43,874.32							
6401-002		Bakeout Sys-PDR	1	29JUL09*	29JUL09		93		1,529.68							
6401-004		Bakeout Sys- EA Analysis	30	30JUL09	10SEP09		93		30,593.60							
6401-005		Bakeout Sys-Final Design	40	11SEP09*	05NOV09		93		44,844.12							
6401-009		Bakeout Sys-FDR	1	06NOV09*	06NOV09		93		1,581.68							
6401-010		Bakeout Sys-Procure Piping & Equipt	65	09NOV09*	19FEB10		93		236,552.08							
6401-013		Assemble & Install	65	22FEB10*	21MAY10		93		169,667.40							
6401-017		Bakeout Sys- ACC Review	10	24MAY10*	07JUN10		93		11,318.80							
6401-020		Bakeout Sys-PTP Testing	10	08JUN10*	21JUN10		93		18,139.60							
Subtotal			302	06APR09	21JUN10		93		573,398.08							



Budget Reconciliation



	Total ETC	Total EAC	ECP 31	delta
6163 - Facility Systems Support FY04	\$0	\$24	24	\$0
6101 - Water Systems	\$46	\$46	95	-\$49
6201 - Cryogenic Systems	\$655	\$655	463	\$192
6301 - Utility Systems	\$105	\$105	109	-\$4
6401 - PFC/VV Htng/Cooling(bakeout)-	\$573	\$573		\$573
SUB TOTAL WBS 6	\$1,379	\$1,403	\$691	\$712