NCSX June 2007 ETC
TABLE I - DESIGN LABOR

WBS Number: 22
WBS Title: Vacuum Pumping System
Job Number: 2201
Job Title: Vacuum Pumping System
Job Manager: Bill Blanchard

Description:
The proposed design consists of a high vacuum system which is manually operated and includes an isolation valve, a vertical pumpduct on a lower P12 port cover and one 1500 l/s TMP. The TMP will be backed by an existing booster mechanical pump system. The system will also contain one unshielded RGA and one ion gauge with and a valved access port for initially roughing down the vacuum vessel.

Task ID	KS	Hours										
	M&S	EMEM	EMSM	EMSB	EMTB	EAEM	EASB	EEEM	EESM	EESB	EETB	
Title I and II Design												This is a relatively simple vacuum pumping system that will utilize major components (TMP, isolation valves, booster and mechnical pump) already at PPPL. Estimate based on prior experience on similar systems (e.g., NSTX), adjusted for the simplicity of this system. Input from experienced engineers/personnel familar with specific parts of this scope was used for estimates. Includes design activities, some P&ID drawings, weld drawings, fab drawings, calculations, two reviews (PDR & FDR), oversight and purchasing of components. The system should have an approximate pumping speed of 700 l/s for attaining 4e-7 Torr or less after the vacuum vessel has been baked out and the surfaces well conditioned.
Preliminary Design												
AC Power / Instrumentation												
Backing System							16	16				
Instrumentation Rack							20	16				
Rack to Instrumentation							16		16			
VPS (Mechanical)												
Design / Management / Admin		64		24								
Drafting							24					
Final Design												
AC Power / Instrumentation												
Backing System							32					
Instrumentation Rack							36					
Rack to Instrumentation							24		32			
VPS (Mechanical)												
Design / Management / Admin		88		32								
Drafting							40					
Subtotal Title I & II Design		***152***	***0***	***56***	***0***	***0***	***208***	***32***	***48***	***0***	***0***	
Title III												This effort includes procurement, fabrication/welding/assembly, installation, oversight, leak checking of the subsystems, installation procedures, refurbishment of legacy equipment as required and initial operation and testing.
AC Power / Instrumentation												
Backing System / Procurement	$3.0K						8					
Instrumentation Rack / Procurement	$3.0K						8					Includes standard cabling, raceways, conduits and miscellaneous items
Rack to Instrumentation / Procurement	$1.5K						8		8			
Backing System / Procedure / Installation							16				96	
Instrumentation Rack / Procedure / Installation							16				128	
Rack to Instrumentation / Procedure / Installation							16		40		96	
VPS (Mechanical)												
Oversight / Admin		16										
Procurement	$10.0K	4		8								Includes piping and other miscellaneous items. Major components available from legacy equipment.
Fabrication					144							
Procedure and Installation		16		40	80							
Procedure and Testing		12		8								
Subtotal Title III	***$17.5K***	***48***	***0***	***56***	***224***	***0***	***72***	***0***	***48***	***0***	***320***	