

## NCSX Work Approval Form (WAF)

**WBS Number: 21**

**WBS Title: Gas Fueling System**

**Job Number: 2101**

**Job Title: Fueling System**

**Job Manager: Bill Blanchard**

**Description:**

The MIE project scope for the Gas Fueling System (WBS 211) is limited to a single gas injector system capable of injecting any one of the species of interest, H<sub>2</sub>, D<sub>2</sub>, or He gas, into the plasma at a time. The proposed fueling system consists of a gas delivery from a single gas cylinder and a gas injection portion consisting of one piezo electric pulse valve, one manual interface valve located at one of the upper P12 port covers. The pulse valve will be operated by a valve driver controlled by the NCSX computer system (greater than 50 T-l/sec fueling rate). In its final configuration, the system will have 2 to 4 injector systems capable of injecting H<sub>2</sub>, D<sub>2</sub>, or He gas into the plasma. The controls will be upgraded with a modern PLC controlling this and other systems.

**Schedule:**

See Attached

**Approvals:**

_____	_____
Job Manager	Date
_____	_____
Responsible Line Manager	Date
_____	_____
Project Manager	Date
_____	_____
Engineering Department Head	Date

**NCSX June 2007 ETC  
TABLE I - DESIGN LABOR**

**WBS Number: 21**  
**WBS Title: Gas Fueling System**  
**Job Number: 2101**  
**Job Title: Fueling System**  
**Job Manager: Bill Blanchard**

**Description:**

*The proposed fueling system consists of a gas delivery from a single gas cylinder and a gas injection portion consisting of one piezo electric pulse valve, one manual interface valve located at one of the upper P12 port covers. The pulse valve will be operated by a valve driver controlled by the NCSX computer system (greater than 50 T-l/sec fueling rate).*

Task ID	K\$		Hours								Basis of Estimate
	M&S		EMEM	EMSM	EMSB	EMTB	EASB	EEEM	EESM	EESB	
<b>Title I and II Design</b>											
Preliminary Design / Management / Admin		32		24					24		
Drafting						8					
Final Design / Management / Admin		48		32					40		
Detail drawings						24					
<b>Subtotal Title I &amp; II Design</b>		<b>80</b>	<b>0</b>	<b>56</b>	<b>32</b>	<b>0</b>	<b>64</b>	<b>0</b>	<b>0</b>	<b>0</b>	
<b>Title III</b>											
Oversight/Management	\$5.0K	16									
Procurement				8				8			
Fabrication				24	48						
Procedure and Installation		8		12	24			40			
Procedure and Testing		16		8				8			
<b>Subtotal Title III</b>	<b>\$5.0K</b>	<b>40</b>	<b>0</b>	<b>52</b>	<b>72</b>	<b>0</b>	<b>0</b>	<b>56</b>	<b>0</b>	<b>0</b>	

This is a relatively simple system that utilizes some existing parts/components already at PPPL. Estimate based on prior experience on similar systems (e.g., NSTX), adjusted for the simplicity of this system. Includes some P&ID drawings, weld drawings, fabrication drawings, two reviews (PDR & FDR) and installation and test procedures. Input from experienced engineers/personnel familiar with specific parts of this scope was used for estimates. Includes overall design and oversight, design activities (dwgs, support and bracket design, overall configuration of the system) and purchasing of components.

This effort includes procurement, fabrication/welding/assembly, installation, oversight, leak checking of the subsystems, procedures, refurbishment of legacy equipment as required and initial operation and testing.

M&S included function generator/valve driver and miscellaneous

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TABLE II - Materials and Subcontracts

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**Materials and Subcontracts (M&S)**

**Basis of Estimate**

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Description:

See Table I

**NCSX June 2007 ETC**  
**TABLE III - Fabrication and Installation**

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**In-house Fabrication and Assembly and Installation**

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Included in Table I

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**TABLE IV - Uncertainty of Estimate and Residual Risk Assessment**

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**Uncertainty of the Estimate**

	High	Medium	Low	Uncertainty	Comments/Other Considerations
				Range (%)	
Design Maturity			X		There have been no design reviews therefore the design is not fixed.
Design Complexity			X	-15%/+25%	Anticipated to only require standard components
Other Comments:					

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		Schedule Impact	
					Low	High	Low	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 responsible 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 Unlikley (P<10%), NC=Non-credible (P<1%