

**TO:** P. Heitzenroeder  
**FROM:** L. Dudek

**SUBJECT:** WBS 6101 & 6301 NCSX Cooling Water and Utility Systems

*Date: August 15, 2008*

**Scope**

This work covered the design, fabrication and installation of the Cooling water system and Utility Systems. The utility system consisted of a basic gaseous nitrogen and instrument air system for general experimental use.

**Status**

This work never proceeded beyond the conceptual design phase.

**Interfaces**

The cooling water system interfaces to the vacuum system to supply the required cooling water and the HVAC chilled water supply system in the CS building which is the ultimate heat sink. The utility systems interface to the facility nitrogen and air systems.

**Specifications**

None

**Schematics and PIDs**

None

**Models**

None

**Drawings**

None

**Analyses**

None

**Testing**

None

**Costs**

None

**Remaining Work**

This work needs to proceed from concept through fabrication and installation.

**Lessons Learned:**

None applicable

**Conclusion:**

Need to work closely with the HVAC facilities engineer to work out detailed location of tie in to system for the cooling water system.

# NCSX Vacuum Water & Utility Gas

L. E. Dudek

# Outline



- Scope / Requirements
- Interfaces
- Design plans
- Material and Labor Estimates
- Schedule
- Risks and uncertainty

# Scope

- **Water Cooling Systems**
  - Provide cooling water for the Vac Pumping System
  - Provide drops for future NB Vac Pumps
- **Utility Gas Systems**
  - Compressed air manifold
  - Vacuum Vent piping

# Water System Requirements

- **Vacuum Pumping System Water**
  - Requirements
    - Load: 5-10 gpm
    - Fluid: Treated Water
    - Pressure: 140 psig
    - Temperature: Ambient
    - Controls: Local, Manual control of pump
  - Provide a small loop <10 gpm
    - Includes design, fabrication and installation
    - Install Heat exchanger & pump

# Water System Interfaces

- Vacuum Pumping System
  - Interfaces via the cooling water connection to the vacuum pumps below the NCSX
- Heat sink
  - Tie in to existing HVAC cooling water system
  - Connection in the NCSX Test Cell Basement
- Power
  - Local power supplied from local MCC (<10 hp)
- Mechanical
  - Interfaces to the machine platform for support of piping

# Water System Design Plan

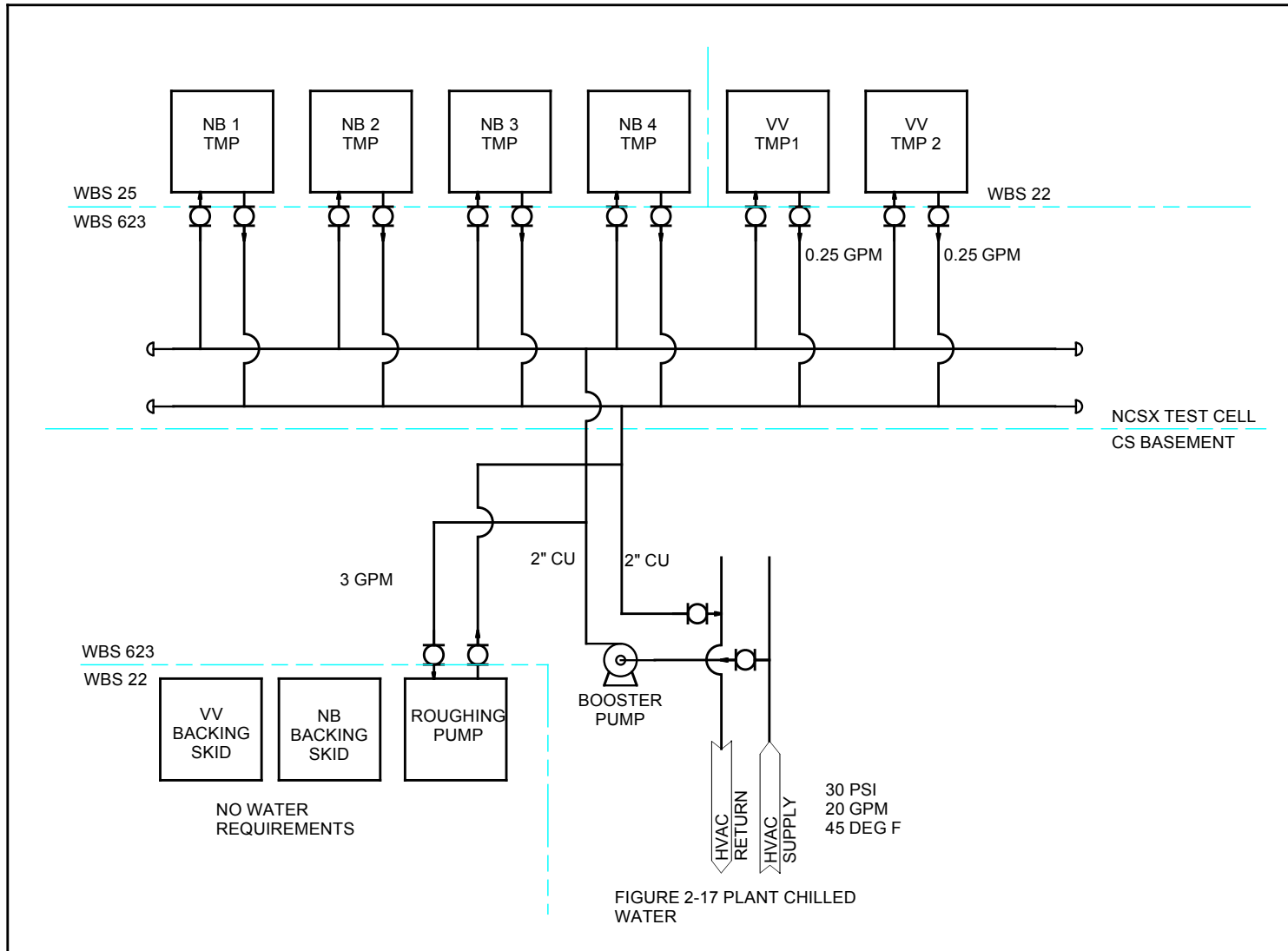


FIGURE 2-17 PLANT CHILLED WATER



# Water System Estimate

Task	41 M&S	EMEM hrs	EMSB hrs	EMTB hrs	EASB hrs
<b>Design</b>					
<b>Conceptual Design</b>		40			20
<b>Layout Drawings</b>		10			20
<b>Final Design</b>		40			160
<b>Fab / Installation</b>				265	
<b>Piping Estimate</b>	\$22,970				
<b>Supervision</b>		50	30		
<b>Test, PTP</b>		8		40	

# Water System Material and Labor Estimate



Component	*Total Labor Manhours	*M&S (\$) (in 2002 \$)
Copper Piping	38	\$3,970
Equipment	133	\$6,948
Adders (see below)	94	5,459.1
<b>ESTIMATE TOTAL</b>	265	16,377.3
<b>CURRENT Year / No. Yrs.</b>	2007	5
<b>ESCALATED TOTAL</b>	265	\$22,970

\*Rates taken from 2002 RS Means Plumbing Estimating guide

# Water System Material and Labor Estimate

## Applicable Adders

15%	Overhead Work (15% Labor) *
10%	Piping Insulation (10% Material) *
40%	Added for Fittings (% Labor and Material) *

\*Rates taken from 2002 RS Means Plumbing Estimating guide

- Work performed by PPPL Techs / Engineers

# Water Systems Schedule

- Design work starts May 2010
- Installation is completed in Feb 2011 in time for Vacuum System Ops
- This work is off the critical path by 100 days

## 61 - Water Systems

### Job: 6101 - Water Systems-DUDEK

#### 613 - Vacuum Pumping System

			Dur		Start	Finish	Float
6101-100		Design Vac Pmp water sys	45		03MAY10*	06JUL10	100
6101-105		Procure Hardware and materials Vac Pmp water	90		07JUL10	10NOV10	100
6101-110		Fabricate and Install Vac Pmp water sys	40		11NOV10*	17JAN11	100
6101-115		Test Vac Pmp water sys	22		18JAN11	16FEB11	100

# Water Systems Risk and Uncertainty

Uncertainty of the Estimate	Evaluation	Comment
Design Maturity	Medium	Design not complicated, but still in a conceptual stage
Design Complexity	Low	Standard piping - off-the-shelf components
Uncertainty Range	-10%/+15%	

No residual risk impacts were identified

# Gas Utilities Requirements

- Requirements
  - Flavors: Compressed Air, Vac. Vent
  - Pressure: 90 psig , 14.7 psia
  - Design: Copper manifold

# Gas Utilities Interfaces

- Interfaces to the atmosphere outside the building (rooftop vent)
- Manifold around machine interfaces to the platform for support
- Vent manifold interfaces to the vacuum vessel pumping system

# Gas Utilities Estimate

	M&S	EMEM hrs	EMTB hrs	EASB hrs
Preliminary Design		60		80
Final design		20		80
Installation		40	322	
Procurements	\$24,398			
Pre Ops Testing		8	40	

- Estimate: Use past experience on NSTX, Cost Estimating Guide
- Work performed by PPPL Techs



# Gas Utilities Schedule



- Design work starts Oct 2010
- Installation is completed in Apr 2011 in time for Vacuum System Ops
- This work is off the critical path by 134 days

## 63 - Utility Systems

Job: 6301 - Utility Systems-DUDEK

			Dur		Start	Finish	Float
6301-001		Vac Vent and Air sys- Prelim Dsn	20		01OCT10*	28OCT10	134
6301-005		Vac Vent and Air sys- PDR	1	R	29OCT10*	29OCT10	134
6301-009		Vac Vent and Air sys- Final dsn	10		01NOV10*	12NOV10	134
6301-010		Vac Vent and Air sys- FDR	1	R	15NOV10*	15NOV10	134
6301-013		Vac Vent and Air sys- Procure hardware and	60		16NOV10	17FEB11	134
6301-017		Vac Vent and Air sys- Fabricate and Install	40		18FEB11*	14APR11	134
6301-020		Vac Vent and Air sys-Test	10		15APR11*	28APR11	134

# Utility Systems Risk and Uncertainty

Uncertainty of the Estimate	Evaluation	Comment
Design Maturity	Medium	Design not complicated, but still in a conceptual stage
Design Complexity	Low	Standard piping - off-the-shelf components
Uncertainty Range	-10%/ +15%	

No residual risk impacts were identified