**Department of Energy**
**Princeton Site Office**
P.O. Box 102
Princeton, New Jersey 08542-0102

JAN 26 2011

Professor Stewart Prager, Director
Princeton Plasma Physics Laboratory
P.O. Box 451
Princeton, NJ 08543

SUBJECT: DAVIS BACON WAGE DETERMINATION FOR THE NATIONAL SPHERICAL TORUS EXPERIMENT (NSTX) UPGRADE PROJECT

Dear Professor Prager:

Enclosed for your information and records is a copy of the Davis-Bacon Determination for the NSTX Upgrade Project. Please note that portions of this work are "covered" under the Davis-Bacon Act. The enclosed Davis-Bacon wage determination delineates which work has been determined to be "covered" as well as a delineation of work that was determined to be "excluded" and the exclusions that were applied to this work.

If there are any questions regarding this determination do not hesitate to contact the Federal Project Director for this project, Jeffrey Makiel, at 243-3721 or jmakiel@pppl.gov.

Sincerely,

Joseph Arango, Acting Manager
Princeton Site Office

Enclosure:
As Stated

Electronic cc: M. Williams, PPPL, w/encl
R. Strykowski, PPPL, w/encl
R. Templon, PPPL, w/encl
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# REQUEST FOR DAVIS-BACON DETERMINATION

Princeton Plasma Physics Laboratory
Contract No. DE-AC02-09CH11466

DEPARTMENT OF ENERGY
CHICAGO OPERATIONS OFFICE
PRINCETON SITE OFFICE
Request for Davis-Bacon Determination

(1) TO: Contracting Officer
Princeton Site Office
P.O. Box 102
Princeton, NJ 08540

(2) Project Title: **NSTX Upgrade**

Project No.:

Date: **1/20/11**

(3) Proposed Method of Performance: (Describe the location of work, Scope of Proposed Work, and Proposed methods to accomplish the work.)

***LOCATION:*** C and D Site, Princeton Plasma Physics Laboratory (PPPL).

***WORKSCOPE:*** The following workscope will be completed as part of this project:

WBS 1 - The new centerstack will provide a toroidal magnetic field at the major radius of 1 Tesla compared to 0.55 Tesla in the original NSTX device, and will enable operation at plasma current up to 2 Mega-Amp compared to the 1 Mega-Amp rating of the original device. It has been determined that the Centerstack should be fabricated at PPPL due to the fact that PPPL has the experience, having built the present Centerstack, and any issues with the fabrication process for this unique design could be handled most effectively in a setting where the engineers and designers who developed the design are available for immediate consultation if problems arise.

Replacement of Center Stack Assembly

a. The entire Center Stack Assembly (CSA) shall be removed from the existing NSTX device and replaced, including the following parts:

- Toroidal Field (TF) inner leg bundle including flags, hubs, and flexible connectors
- Ohmic Heating (OH) coil
- Poloidal Field (PF) coils PF1A Upper, PF1A Lower, and PF1B
- Center Stack Sensors
  - Rogowski Coils
  - Mirnov Coils
  - Flux Loops
  - Langmuir Probes
  - Thermocouples
- Microtherm thermal insulation
- Inboard Gas Injection piping and nozzle
- Center Stack Casing (CSC)
- Plasma Facing Components (PFC) associated with CSC including the Inboard Divertor (IBD)
- Pedestal which supports Center Stack Assembly from floor

b. Various components which interface directly with the CSA shall be modified as necessary fit the new CSA including (but not limited to) the following parts:

- TF, OH, PF1A Upper (PF1AU), PF1A Lower (PF1AL), and PF1B Lower (PF1BL) coil electrical leads
- Coaxial Helicity Injection (CHI) electrical leads
- Water cooling lines to TF, OH, PF1AU, PF1AL, and PF1BL leads
- Cables and connectors associated with CSA sensors
- Supply piping for heating and cooling of CSC and IBD
- Supply piping for inboard gas injection

Modification of NSTX Device for Extended Performance

a. Various parts of the NSTX device shall be evaluated and modified as necessary in order to

operate at higher field, higher current, and longer pulse length including (but not limited to):
- TF outer leg supports
- PF coil supports
- Vacuum vessel (VV)
- Internal hardware including Passive Plate (PP) supports and Outboard Divertor (OBD)

b. Various parts of the NSTX device shall be modified as necessary in order to provide geometric fit with new or modified parts associated with the upgrade.
c. Parts not listed in a. and b. above shall be retained and/or unmodified if possible.

Modification of Supporting Subsystems and Equipment
All supporting subsystems and equipment shall be evaluated and modified as necessary in order to operate at higher field, higher current, and longer pulse length including (but not limited to):
- Internal hardware including Passive Plate supports and Inboard Divertor
- Auxiliary Systems
  - Vacuum pumping systems
  - Cooling water systems
  - Gas Injection systems
  - Bakeout systems
- Diagnostic systems
- Electrical power systems
- I&C systems,

WBS 2 - A second TFTR neutral beamline will be decontaminated, reconditioned to the same status as the existing beamline on NSTX, and installed at Bay K of NSTX in such a way that its three beams are tangent to the radii: 130cm, 120 cm, and 109.4 cm. Beamline #1 and beamline #2 shall be configured so they can operate together or separately to support experiments. The decontamination of the neutral beam is being pursued to determine which components can be returned to a condition that is acceptable for use on NSTX, thereby saving the cost of fabricating new components.

WBS 3 - Auxiliary Systems
The Vacuum pumping system, water cooling system, bakeout system and Gas delivery system will undergo necessary modifications to support WBS 1 and 2

WBS 4 - Plasma Diagnostics Systems
The CS will require new magnetic diagnostics to be fabricated and installed.

WBS 5 - Power Systems
The power systems will be upgrade to provide additional power and control to the device. This will include reconfiguration and upgrade to;
- AC/DC converters
- DC Systems
- Control and protection systems
- Digital coil protection system

WBS 6 - Central Instrumentation and Control I&C Systems
This upgrade will be capable of producing plasmas on the order of 6.5 seconds; to-date they are less than two seconds. For dozens of CAMAC and PC-based data acquisition systems this will require an upgrade, and, in some cases, replacement. The real-time plasma control system will require an

upgrade to accommodate additional input/output signals, control loops, and a longer control period. The networks and analysis pool computers will need to be upgraded to achieve reasonable performance for time-sensitive functions. Some test cell racks will be relocated; there will be a modest effort required to route the control, timing, and communication cabling and qualify the systems.

WBS 7 - Project Management and Integration
Provide for the technical and program management of the upgrade scope, cost and schedule.

WBS 8 - Installation
Torus Assembly and construction includes the assembly and installation of the NSTX torus, coils systems and all associated supports including construction management. This WBS element includes removal of equipment for clearance and accessibility, moving existing coils, modifying existing supports mounted on the vacuum vessel and installing a new external coil support structure.
Also included in this WBS element is the removal of the existing Center Stack and installation of the NSTX Upgraded Center Stack, followed by closing up the vacuum vessel, pumping down, leak checking, bakeout and machine area scrubs to be ready for Integrated System Testing.

***METHODS:*** This is a hardware upgrade to an existing, operating fusion research device located at PPPL. The deliverable of this project is to design, build and install a new Centerstack for NSTX and install a second Neutral Beamline on NSTX. The purpose of the NSTX Centerstack Upgrade is to expand the NSTX operational space and thereby the physics basis for the next-step ST facilities. Due to the nature of the work involved, most of the effort will be performed with in-house labor (design, engineering, project management, fabrication and installation). Some standard utility support effort will be sub contracted under Basic Ordering Agreement (BOA) procurement vehicles on a fixed price basis.

| (4) Estimated Cost Breakdown | | | (5) Davis-Bacon Committee Recommendation | | |
|---|---|---|---|---|---|
| **NSTX Upgrade** | | | | | |
| **Estimated Cost Breakdown** | | | | | |
| | **Amount (esc K$)** | **Covered** | **Description** | **Non- Covered** | **Description** |
| **1.1 - 1.1 Torus Systems** | | | | | |
| a. Engineering | $7,677 | | | X | |
| b. Construction | $0 | | | n/a | |
| c. Fabrication / Assembly | $2,605 | X | Setup of CS fabrication facility area electircal and services in CS high bay | X | Fabrication, assembly and testing of CS, TF,and PF coils and pre assy of structural hardware. |
| d. Installation | $0 | | | X | |
| e. Procurement | $7,061 | | | X | |
| f. Contingency | $4,677 | | | X | |
| **1.1 - 1.1 Torus Systems Total** | **$22,020** | | | | |
| **1.2 - 1.2 Plasma Heating** | | | | | |
| a. Engineering | $3,660 | | | X | |
| b. Construction | $0 | | | n/a | |
| c. Fabrication / Assembly | $7,227 | | | X | |
| d. Installation | $8,668 | | | X | |
| e. Procurement | $4,255 | | | X | |
| f. Contingency | $3,624 | | | X | |
| **1.2 - 1.2 Plasma Heating Total** | **$27,434** | | | | |
| **1.3 - 1.3 Auxiliary System** | | | | | |
| a. Engineering | $187 | | | X | |
| b. Construction | $0 | | | n/a | |
| c. Fabrication / Assembly | $9 | | | X | |
| d. Installation | $192 | X | Water and gas services in basement areas | X | Water/gas services in TFTR and NSTX test cell |
| e. Procurement | $50 | | | X | |
| f. Contingency | $65 | | | X | |
| **1.3 - 1.3 Auxiliary System Total** | **$503** | | | | |
| **1.4 - 1.4 Plasma Diagnostics** | | | | | |
| a. Engineering | $714 | | | X | |
| b. Construction | $0 | | | n/a | |
| c. Fabrication / Assembly | $524 | | | X | |
| d. Installation | $226 | | | X | |
| e. Procurement | $374 | | | X | |
| f. Contingency | $505 | | | X | |
| **1.4 - 1.4 Plasma Diagnostics Total** | **$2,343** | | | | |
| **1.5 - 1.5 Power Systems** | | | | | |
| a. Engineering | $2,888 | | | X | |
| b. Construction | $0 | | | n/a | |
| c. Fabrication / Assembly | $1,188 | | | X | |
| d. Installation | $2,324 | X | Cable & tray installation in basement areas | X | Cable & tray installation in TFTR and NSTX test cell |
| e. Procurement | $1,750 | | | X | |
| f. Contingency | $1,464 | | | X | |
| **1.5 - 1.5 Power Systems Total** | **$9,614** | | | | |
| **1.6 - 1.6 Central I&C** | | | | | |
| a. Engineering | $185 | | | X | |
| b. Construction | $0 | | | n/a | |
| c. Fabrication / Assembly | $201 | | | X | |
| d. Installation | $200 | | | X | |
| e. Procurement | $335 | | | X | |
| f. Contingency | $181 | | | X | |
| **1.6 - 1.6 Central I&C Total** | **$1,102** | | | | |
| **1.7 - 1.7 Project Support & Integration** | | | | | |
| a. Engineering | $8,741 | | | X | |
| b. Construction | $0 | | | n/a | |
| c. Fabrication / Assembly | $5,769 | | | X | |
| d. Installation | $0 | | | X | |
| e. Procurement | $0 | | | X | |
| f. Contingency | $3,834 | | | X | |
| **1.7 - 1.7 Project Support & Integration Total** | **$18,344** | | | | |
| **1.8 - 1.8 Assembly** | | | | | |
| a. Engineering | $20 | | | X | |
| b. Construction | $0 | | | n/a | |
| c. Fabrication / Assembly | $0 | | | X | |
| d. Installation | $6,818 | | | X | |
| e. Procurement | $0 | | | X | |
| f. Contingency | $2,303 | | | X | |
| **1.8 - 1.8 Assembly Total** | **$9,141** | | | | |
| **Grand Total** | **$90,499** | | | | |

Project Title: **NSTX Upgrade**
Project No.:

A. DAVIS-BACON ACT IS APPLICABLE:

1. ☒ Construction, alteration, repair including painting over $2,000
2. ☐ Installation involving substantial construction
3. ☐ Demolition when indispensable and preliminary to scheduled new construction
4. ☐ Other: .....

B. DAVIS-BACON ACT IS NOT APPLICABLE (48 CFR 970.2204-1-1):

Particular work items falling within one or more of the following criteria normally will be classified as non-covered by the Davis-Bacon Act, hereinafter referred to in the section as the "Act".

☐ Individual work items estimated to cost $2,000 or less. The total dollar amount of the management and operating contract is not a factor to be considered and bears no relation to individual work items classified as construction, alteration and/or repair, including painting and decorating. However, no item of work, the cost of which is estimated to be in excess of $2,000, shall be artificially divided into portions less than $2,000 for the purpose of avoiding the application of the Act.

☐ Work and services that are a part of operational and maintenance activities or which, being very closely and directly involved therewith, are more in the nature of operational activities than construction, alteration, and/or repair work. This includes work and services which would involve a material risk to continuity of operations, to life or property, or to DOE operating requirements, if performed by persons other than the contractor's regular production and maintenance forces. However, any decision that contracts or work items are non-covered for these reasons must be made by the **Head of the Contracting Activity** without power of delegation.

☒ Assembly, modification, setup, installation, replacement, removal, rearrangement, connection, testing, adjustment, and calibration or machinery and equipment. However, it is noted that these activities are covered if they are part of, or would be a logical part of, the construction of a facility, or if construction-type work which is not "incidental" to the overall effort is involved.

☒ Experimental development of equipment, processes, or devices, including assembly, fitting, installation, testing, reworking, and disassembly. This refers to equipment, processes, and devices which are assembled for the purpose of conducting a test or experiment. The design may be only conceptual in character, and professional personnel who are responsible for the experiment participate in the assembly. Specifically excluded from the category of experimental development are buildings and building utility services, as distinguished from temporary connections thereto. Also specifically excluded from this category is equipment to be used for continuous testing (e.g., a machine to be continuously used for testing the tensile strength of structural members).

☐ Experimental work in connection with peaceful uses of nuclear energy. This refers to equipment, processes and devices, which are assembled and/or set in place and interconnected for the purpose of conducting a test or experiment. The nature of the test or experiment is such that professional personnel who are responsible for the test or experiment and/or data to be derived therefrom must, by necessity, participate in the assembly and interconnections. Specifically excluded from experimental work are buildings, building utility services, structural changes, drilling, tunneling, excavation, and back-filling work which can be performed according to customary drawings and specifications, and utility services of modifications to utility services, as distinguished from temporary connections thereto. Work in this category may be performed in mines or in other locations specifically constructed for tests or experiments.

☐ Emergency work to combat the effects of fire, flood, earthquake, equipment failure, accident, or other casualties, and to restart the operational activity following the casualty. Work which is not directly related to restarting the activity or which involves rebuilding or replacement of a structure, structural components, or equipment is excluded from this category.

☐ Decontamination, including washing, scrubbing, and scraping to remove contamination; removal of contaminated soil or other material; and painting or other resurfacing, provided that such painting or resurfacing is an integral part of the decontamination activity and performed by the employees of the contractors performing the decontamination.

☐ Burial of contaminated soil waste or contained liquid; however, initial preparatory work readying the burial ground for use (e.g., any grading or excavating that is a part of initial site preparation, fencing, drilling wells for continued monitoring of contamination, construction of guard of other office space) is covered. Work performed subsequent to burial which involves the placement of concrete or other like activity is also covered.

*Experimental installations*. Within DOE programs, a variety of experiments are conducted involving materials, fuels, coolants, and processing equipment. Certain types of situations where tests and experiments have presented coverage questions are described as follows:

Set-ups of device and/or processes. The proving out of investigative findings and theories of a scientific and technical nature may require the set-up of various devices and/or processes at an early, pre-prototype stage of development. These may range from laboratory bench size to much larger set-ups. As a rule, these set-ups are made within established facilities (normally laboratories), required utility connections are made to services provided as a part of the basic facilities, and the activity as a whole falls within the functional purpose of the facility. Such set-ups are generally not covered. However, the erection of structures, which are public works is covered if construction type work, other than incidental work, is involved. Preparatory work for the set-up requiring structural changes or modifications of basic utility services, as distinguished from connections thereto, is covered. The following are illustrations of non-covered set-ups of devices and/or processes:

☐ Assembly of piping and equipment within existing “hot cell” facilities for proving out a conceptual design of a chemical processing unit;

☐ Assembly of equipment, including adaptation and modification thereof, in existing “hot cell” facilities to prove out a conceptual design for remotely controlled machining equipment;

☐ Assembly of the first graphite pile in a stadium at Stagg Field in Chicago;

☐ Assembly of materials and equipment for particular aspects of the direct current thermonuclear experiments to explore feasibility and to study other ramifications of the concept of high energy injection and to collect data thereon.

Loops. Many experiments are carried on in equipment assemblies, called loops, in which liquids or gases are circulated under monitored and controlled conditions. For purposes of determining coverage under the Act, loops may be classed as loop facilities or as loop set-ups. Both of these classes of loops can include in-reactor loops and out-of-reactor loops. In differentiating between clearly identified loop set-ups and loop facilities, an area exists in which there have been some questions of coverage, such as certain loops at the Material Test Reactor and at Engineering Test Reactor and the Idaho National Engineering and Environmental Laboratory site. Upon clarification of this area, further illustrations will be added. In the meantime, the differentiation between loop set-ups and loop facilities must be made on a case-by-case basis, taking into account the total criteria set forth in this subpart:

☐ Loop set-ups. The assembly, erection, modification, and disassembly of a loop set-up is non-covered. A non-controversial example of a loop set-up is one which is assembled in a laboratory, e.g., Oak Ridge National Laboratory, Argonne National Laboratory, or Lawrence Livermore National Laboratory, for a particular test and thereafter disassembled. However, preparatory work for a loop set-up requiring structural changes or modifications of basic utility services as distinguished from connections thereto is covered, as are material and equipment that are installed for a loop set-up which is a permanent part of the facility or which is used for a succession of experimental programs.

☐ Loop facilities. A loop facility differs from a loop set-up in that it is of a more permanent character. It is usually, but not always, a greater size. It normally involves the building or modification of a structure. Sometimes it is installed as a part of construction of the facility. It may be designed for use in a succession of experimental programs over a longer period of time. Examples of loop facilities are the in-reactor “K” loops at Hanford and the large Aircraft Nuclear Propulsion loop at the Idaho National Engineering and Environmental Laboratory site. The on-site assembly and erection of such loop facilities are covered. However, once a loop facility is completed and becomes operational, the criteria set forth in this paragraph for operational and maintenance activities apply.

☐ Reactor component experiments. Other experiments are carried on by insertion of experimental components within reactor systems without the use of a loop assembly. An example of reactor facilities erected for such experimental purposes are the special power excursion test reactors (SPETRs) at the National Reactor Test Site which are designed for studying reactor behavior and performance characteristics of certain reactor components. Such a facility may consist of a reactor vessel, pressurizing tank, coolant loops, pumps, heat exchangers, and other auxiliary equipment as needed. The facility also may include sufficient shielding to permit work on the reactor to proceed following a short period of power interruption, and buildings as needed to house the reactor and its auxiliary equipment. The erection and on-site assembly of such a reactor facility is covered, but the components whose characteristics are under study are excluded from coverage. To illustrate, one of the SPETRs planned for studies of nuclear reactor safety is designed to accommodate various internal fuel and control assemblies. The internal structure of the pressure is designed so that cores of different shapes and sizes may be placed in the vessel for investigation, or the entire internal structure may be easily removed and replaced by a structure which will accept a different core design. Similarly, the control rod assembly is arranged to provide for flexibility in the removal of instrument leads and experimental assemblies from within the core.

☐ Tests of experiments in peaceful uses of nuclear energy. These tests or experiments are varied in nature and some are only in a planning stage. They consist of one or more nuclear or non-nuclear detonations for the purposes of acquiring data. The data can include seismic effects, radiation effects, amount of heat generated, amount of material moved and so forth. Some of these tests are conducted in existing mines, while others are conducted in facilities specifically constructed for the tests or experiments. In general, all work which can be performed in accordance with customary drawings and specifications, as well as other work in connection with preparation of facilities is treated as covered work. Such work includes tunneling, drilling, excavation and back-filling, erection of buildings or other structures, and installation of utilities. The installation of the non-nuclear material or nuclear device to be detonated, and the instrumentation and connection between such material or device and the instrumentation are treated as non-covered work.

☐ Tests or experiments in military uses of nuclear energy. As in 970.2204-1-1 (c)(4), these tests or experiments can be varied in nature. However, under this category it is intended to include only detonation of non-nuclear material or nuclear devices. The material or devices can be detonated either underground, at ground level, or above the ground. These tests or experiments have been conducted in, on, or in connection with facilities specifically constructed for such tests or experiments. As in tests or experiments in peaceful uses of nuclear energy, all work which can be performed in accord with customary drawings and specifications, as well as other work in connection with preparation of facilities are treated as covered work. Such work includes building towers or similar structures, tunneling, drilling, excavation and backfilling, erection of buildings or other structures, and installation of utilities. The installation of the non-nuclear material or nuclear devices and instrumentation are treated as non-covered work.

☐ Construction site contiguous to an established manufacturing facility. As DOE-owned property sometimes encompasses several thousand acres if real estate, a number of separate facilities may be located in areas contiguous to each other on the same property. These facilities may be built over a period of years, and established manufacturing activities may be regularly carried on at one site at the same time that construction of another facility is underway at another site. On occasion, the regular manufacturing activities of the operating contractor at the first site may include the manufacture, assembly, and reconditioning of components and equipment which in other industries would normally be done in established commercial plants. While the manufacture of components and equipment in the manufacturing plant is non-covered, the installation of any such manufactured items on a construction job is covered.

☐ The **Head of the Contracting Activity** has prescribed this class of work as exempted.

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|---|---|---|---|
| (Member) | 1/21/11 (Date) | (Member) | (Date) |
| (Member) | 1/24/11 (Date) | (Member) | (Date) |

APPROVAL: Raymond M Kimble (Contracting Officer) 1/24/11 (Date)