CONSTRUCTION SAFETY

TABLE OF CONTENTS

SECTION 1

CONSTRUCTION SAFETY

1.1 INTRODUCTION

The purpose of this section is to assure that the safety standards during construction operations at Princeton Plasma Physics Laboratory (PPPL) are carried out in a manner to minimize the risk of injury to personnel and damage to property. This section addresses safety requirements for practices most commonly undertaken; however, it does not release workers from the safety requirements of the U.S. Department of Energy (DOE), Occupational Safety and Health Act (OSHA), and PPPL. This document does not specifically address all OSHA requirements and is not inclusive of other applicable parts of OSHA. The ES&H Division maintains a current version of all parts of the applicable Code of Federal Regulations (CFRs), including OSHA.

For construction safety overview, see Appendix A.

1.2 SCOPE

The provisions of this section apply during the construction, alteration, modifications, moving, or demolition of any building or structure at PPPL, and are applicable to both Laboratory personnel and outside subcontractors. The hazards associated with the various construction operations and the equipment used therein are discussed along with the precautions necessary to avoid injury or property loss.

1.3 DEFINITIONS

Construction Activities - Alterations, modifications, moving, demolition, or new installation of a building or structure.

Construction Field Engineer - The PPPL employee who has overall responsibility to ensure that subcontractors are in compliance with OSHA, DOE, and PPPL standards, and reports to the Project Engineer.

Construction Project Engineer - The PPPL employee having responsibility for a specific construction activity.

Construction Safety Engineer - The PPPL employee who verifies compliance by inspecting construction projects while in progress and reports to the Head/Deputy Head of the ES&H Division.

Controlled Area - A regulated area where special safety considerations are necessary and enforced.

DOE - U.S. Department of Energy

Facility - A building, structure, area, room, or something that is built, installed, or established to serve a particular purpose.

Subcontractor - A non-PPPL individual engaged in activities on site within the scope of this section.

FED - Facility Engineering Division. The PPPL functional activity responsible for facility modifications, improvements, or repairs even if such activity is funded and managed by another PPPL element to satisfy its unique purpose. The criteria here is the extent of FED's responsibility for maintaining or servicing the completed facility and the impact of that facility are FED controlled utilities [water, fire, heating, ventilation and air conditioning (HVAC), electrical systems, etc.].

Imminent Danger - A situation which has the immediate potential for death or serious injury to personnel.

OSHA - Williams-Steiger Occupational Safety and Health Act.

1.4 RESPONSIBILITIES

1.4.1 Department Heads/Division Heads are responsible for ensuring the implementation of this section within their administrative areas.

1.4.2 Project Engineers, Construction Field Engineers, and Construction Safety Engineers are responsible for the direct implementation of this section. Specifically, they shall ensure that construction of all facilities is performed in accordance with required standards and shall:

A. Ensure that outside subcontractor personnel and/or PPPL employees are aware of, and perform work within, the requirements of this section.

B. Consult with the cognizant responsible person if work is to be performed in a controlled area, and ensure that recommendations are implemented.

C. Identify ES&H deficiencies and ensure that ES&H non-compliances are corrected.

D. Stop work immediately in areas where "imminent danger" exists.

E. Require that proper personal protective equipment is worn when necessary.

F. Ensure that contract specifications include adequate ES&H requirements.

G. Consult with ES&H Division personnel during design stages in those cases where existing fire protection systems may be impaired.

H. Conduct periodic inspections of construction sites.

I. Ensure that, upon discovery of an unsafe condition or work practice on a project site, the work is halted unless there is responsive action.

1.4.3 The Project Engineer shall arrange, prior to construction, a meeting of appropriate members of ES&H Division, the Facility Engineering Division (FED), or a division responsible for the contract, and subcontract supervisors to discuss methods for carrying out the various construction phases.

1.4.4 The ES&H Construction Safety Engineer shall be responsible for assisting in the implementation of this section. Specifically, the ES&HD Construction Safety Engineer shall:

A. Conduct a minimum of one daily inspection at the construction site to assure adequacy of ES&H compliance during construction phases. Title 29CFR1910 and 1926 shall be used as the criteria for these inspections.

B. Advise project engineers of special hazards in controlled areas and provide a special hazards briefing for subcontract supervisors.

C. Act as a source of information and provide guidance on the subject of construction safety.

D. Keep on file daily construction inspection logs and safety evaluation documentation.

E. Attend pre-bid construction meetings.

F. At project completion, report in writing on the contractor safety performance. This report shall be provided to Procurement, QA, and FED; originals maintained in ES&HD files.

1.4.5 All PPPL employees and Subcontract Personnel shall comply with the requirements (Part 1.5) of this section.

1.5 REQUIREMENTS

1.5.1 Standards - Construction or alteration of facilities shall be carried out within the provisions of OSHA, PPPL standards, DOE orders, state of New Jersey building codes, i.e., Building Officials and Code Administrators (BOCA), and all other applicable codes as specified in the building industry. Where standards are in conflict, the standard providing the greater protection shall be followed.

1.5.2 Special Hazards Briefing - The nature of the PPPL research program occasionally presents special hazards (radiation, cryogenics, etc.) which must be controlled if construction activity will take place in close proximity to the hazard.

1.5.3 Inspections - Regularly scheduled safety inspections shall be conducted by the Project Engineer, Construction Field Engineer, and/or ES&H Construction Safety Engineer. In-depth audits shall be conducted by the ES&H Division if potential hazards associated with the work and the degree of activity so warrants.

1.5.4 Personal Protective Equipment (OSHA 1926.100-1926.107) - Safety equipment which meets OSHA standards including hard hats, safety glasses, hearing protection devices, respirators, lifelines, safety belts, etc., as are appropriate to the hazards encountered, shall be provided and used by job personnel. The ES&H Division is available to advise on appropriate equipment. Hard hats shall be worn whenever there is possible danger of head injury from impact, falling or flying objects, or from electrical shock and burns. Personal protective equipment shall be provided by the subcontractor, or the subcontractor must assure that his staff provides their own equipment.

1.5.5 Access - When work levels are above or below grade, a safe means of access and egress shall be provided.

1.5.6 Subcontractor Training Requirements - All subcontractors at PPPL shall comply with the Subcontractor Training Requirement, Policy No. P-028.

1.5.7 Construction Tools and Equipment - All such items must meet OSHA, ANSI, and other standards, as publicized in the industry.

1.6 PRACTICES/PROCEDURES

1.6.1 Ladders (OSHA 1926.1050) - Ladder feet shall be placed on a substantial base, and the area around the top and bottom of the ladder shall be kept clear. Portable ladders shall be used at such a pitch that the horizontal distance from the top support to the foot of the ladder is one quarter of the working length of the ladder (the length along the ladder between the foot and top support). Ladders shall be tied, blocked, or otherwise secured to prevent displacement when used as access to other levels. Metal ladders shall not be used in areas where they may come into contact with energized electrical conductors.

If a ladder is to provide the only means of access or exit from a working area for 25 or more employees, or simultaneous two-way traffic is expected, a double-cleat ladder shall be installed. Cleats shall be inset into the edges of the side rails a minimum of one-half inch, or filler blocks shall be used on the rails between the cleats. The cleat shall be secured to each rail with three or more 10d common wire nails or other fasteners of equivalent strength. Cleats shall be uniformly spaced, 12 inches center-to-center. Two-inch by four-inch lumber shall be used for side and mid-rails of double cleat ladders up to 12 feet in length; two-inch by six-inch lumber for double cleat ladders from 12 to 24 feet in

length. Double cleat ladders shall not exceed 24 feet in length. Ladders shall be installed so they extend at least 36 inches above the upper level walking or working surface, or provisions shall be made for adequate hand-holds, when used as access to other levels. Defective ladders shall be withdrawn from service immediately.

1.6.2 Scaffolds (OSHA 1926.450 - 1926-452) - Scaffolds shall be erected on sound, rigid footings. Scaffolds and components shall be capable of supporting, without failure, at least four times the maximum intended load. "Standard railing" with intermediate rail and toe-boards shall be installed on all open sides and ends of platforms more than 10 feet above the adjacent floor or ground level. Scaffold working platforms shall be a minimum of 18 inches in width. All planking shall be scaffold grade as recognized by grading rules for the species of wood used. Scaffold planks shall extend over end supports not less than six inches nor more than 12 inches, and secured from movement. All scaffolding and accessories shall have any defective parts immediately replaced or repaired.

1.6.3 Ramps and Runways (OSHA 1926.500(d) - Ramps and runways used by workers shall be not less than 18 inches in width. Ramps and runways used for wheelbarrows shall be not less than 36 inches in width. Ramps and runways with more than a 15 degree incline plane shall be cleated. Ramps and runways more than four feet above the adjacent ground shall have a standard railing. Ramps and runways shall be capable of supporting, without failure, at least four times the maximum load.

1.6.4 Floor Openings, Open Sides, Hatchways, Etc. (OSHA 1926.500 - 1926.502) - All floor openings shall be guarded by a "standard railing." Railing shall be provided on all exposed sides, except entrances to a ramp, stairway, or fixed ladder. Every open-sided floor or platform six feet or more above the adjacent floor or ground level shall be guarded by a standard railing with toe-boards on all open sides except where there is an entrance to a ramp, stairway, or fixed ladder.

1.6.5 Air Tools (OSHA 1926.300 - 1926.305) - Pneumatic power tools shall be connected to the air-supply hose in a positive manner to prevent accidental disconnection. Safety clips or retainers shall be securely installed and maintained on pneumatic impact tools to prevent attachments from being accidentally expelled. The manufacturer's safe operating pressure for all fittings shall not be exceeded.

1.6.6 Electrical - Electrical work shall be in compliance with the National Electrical Code (NEC). Ground Fault Circuit Interrupters shall be utilized where specified in Article 305 of the NEC. The noncurrent-carrying metal parts of plug-connected or portable equipment shall be grounded when double-insulated equipment is not used. Extension cords shall be the three-wire type. Flexible cords shall be used only in continuous lengths without splices. Worn or frayed cords shall not be used. Exposed lamps for temporary lighting shall be guarded by approved lamp guards. Receptacles shall be of approved, dead-front type with a contact for extending ground continuity and shall be so designed and constructed that the plug may be pulled out without leaving any live parts exposed to accidental contact. Where different voltages, frequencies, or types of current (ac or dc) are to be supplied by portable cords, the receptacles shall be marked and designed so that attachment plugs are not interchangeable. Each motor and appliance disconnect and each feeder or branch circuit shall be legibly marked at the point where it originates to indicate its purpose.

1.6.7 Illumination (OSHA 1926.56) - Construction areas, aisles, stairs, ramps, runways, corridors, offices, shops, and storage areas where work is in progress shall be lighted with either natural or artificial illumination. Illumination for work areas shall comply with OSHA 1926.56.

1.6.8 Housekeeping - During the course of construction, alteration, or repairs, form and scrap lumber with protruding nails and all other debris shall be kept cleared from work areas, passageways, and stairs in and around buildings and structures. Combustible scrap and debris shall be removed at regular intervals during the course of construction so as to keep areas neat and orderly. Containers shall be provided for the collection and separation of waste, trash, oily and used rags, and other refuse. An enclosed chute shall be used whenever materials are to be dropped more than 20 feet to any exterior point. When debris is dropped through holes in the floor without the use of chutes, the area where the material is dropped shall be enclosed with barricades not less than 42 inches high and not less than six feet back from the projected opening.

1.6.9 Compressed Gas Cylinders - Valve protection caps shall be in place when compressed gas cylinders are transported, moved, or stored unless secured in welding carts. Cylinder valves shall be closed when work is finished and when cylinders are empty or are moved. Compressed gas cylinders shall be properly secured at all times. Cylinders shall be kept at a safe distance or shielded from welding or cutting operations. Cylinders shall not be placed where they can come in contact with an electrical circuit. All regulators shall be in proper working order before being put to use.

1.6.10 Temporary Heating - Subcontractors using temporary heating units [salamanders, stoves, liquid petroleum gas (LPG) heaters, or portable fuel oil heaters] are responsible for its safe operation. All heating devices shall be Underwriters Laboratory (UL) listed or Factory Mutual (FM) approved. All precautions necessary shall be provided by the subcontractor, including fire watches, adequate fire extinguishers, proper storage of fuel, periodic maintenance, etc. Only electric heating units may be used in the vicinity of electrical apparatus; all other energy sources are strictly prohibited.

1.6.11 Fire Protection - Fire extinguishers of a type and number appropriate to the hazards present shall be provided by the contractor unless work is being performed in areas already adequately protected by existing PPPL fire extinguishers. These extinguishers shall be readily accessible at all times. The number, type, and location of the extinguishers will be determined in accordance with NFPA codes. Where work involves welding, oxyacetylene cutting, or exposure to other open flames, the provisions of Subpart J of Part 1926, OSHA, shall apply. The contractor may not impair fire alarms, water supply, or other fire protection systems without advance approval from the Fire Protection Engineer and Emergency Services Unit (ESU) personnel. Fire hydrants may be used only with the approval of the Fire Protection Engineer and ESU personnel. The introduction of combustibles on the site should be limited to reduce the risk of fire to property or delay to the project. All supplies of flammable liquids that are brought into buildings must be in Underwriters Laboratory (UL) labeled safety cans. Flammable liquids are to be dispensed and used in accordance with paragraph 1910.106 of OSHA. If the construction includes installation of automatic sprinkler protection, the installation shall be completed, tested, and placed in service before occupying the space.

1.6.12 Excavating and Trenching (OSHA 1926.650-1926.652) - Before starting any excavation, approval shall be received from the Project Engineer and/or Construction Field Engineer who will obtain a digging permit from the FED to determine if there are any known underground utilities in the area. National Environmental Policy Act (NEPA) review and certification from the NEPA Compliance Manager will also be required prior to commencing excavation, as per PPPL Procedure ESH-014. Permits shall be located and protected at the excavation site. The walls and faces of all excavations and trenches five feet or more in depth, or in which employees are exposed to danger from unstable earth, shall be guarded by proper shoring, sloping of ground, or some other equivalent means in accordance with Tables P-1 and P-2 of OSHA, Part 1926. Trench shoring, when required, shall be installed from above or from the open end of the trench in a manner that provides protection for the workers during the installation process, and it shall be removed in the reverse manner to provide equal protection. Excavated or other material shall be stored and retained at least two feet from the edge of excavations which employees may be required to enter. Periodic inspections of excavations shall be made by the Project Engineer, Construction Field Engineer, and/or Construction Safety Engineer for evidence of possible cave-ins or slides. When either of these are apparent, all work in the excavation shall cease until the necessary precautions have been taken to safeguard the employees. Trenches more than four-feet deep shall have ladders or steps located no more than 25 feet distant from where personnel are required to work. Adequate signs, barricades, and/or flagpersons shall be placed when necessary to provide protection where work is being performed on or adjacent to streets. The flagpersons shall be provided with and shall wear a red or orange warning garment while flagging. Garments worn at night shall be equipped with reflectorized material.

1.6.13 Excavating Equipment - All equipment and vehicles in use shall be checked by the operator at the beginning of each shift to assure that all parts, equipment, and accessories affecting safe operation are free from defects and in a safe operating condition. No one shall operate equipment in reverse unless one of the following conditions is met:

A) The vehicle has a reverse signal alarm which is audible above the surrounding noise level, and/or

B) A separate observer has been assigned to signal that it is safe to do so.

Bulldozer and scraper blades, endloader buckets, dump bodies, and similar equipment shall be either fully lowered or blocked when repaired or when not in use. When unattended, all excavating equipment shall have motors stopped, brakes set, and keys removed.

1.6.14 Motor Vehicles - All PPPL and subcontractor employee vehicles are subject to the PPPL traffic regulations. Automobile accidents involving PPPL or subcontractor employee vehicles on site shall be reported to PPPL Security (x2536, x2896).

1.6.15 Mobile Cranes - The operator shall comply with the manufacturer's specifications, limitations, and the requirements listed in Procedure ENG-021 (Previously TOP 27.027). Rated load capacities, boom angles, recommended operating speeds, and special hazard warnings or instructions shall be posted on all equipment and be visible from the operator's station. Outriggers shall be deployed on stable footings in accordance with the manufacturer's recommendations when lifts are in progress. Equipment shall be inspected daily by the operator and all safety deficiencies corrected before use. Accessible areas within the swing radius of the revolving super structure shall be barricaded when the crane is operating near construction personnel. Except where electrical distribution and transmission lines have been de-energized and visibly grounded at point of work, or where insulating barriers are provided, no part of a crane or its load shall be operated within 10 feet of a line rated at 50 kV or below. For lines rated over 50 kV, consult the Electrical Safety Engineer of the ES&H Division. Loads shall be properly rigged and balanced before they are set in motion.

1.6.16 Signs and Barriers - Signs requiring the wearing of safety hard hats shall be placed at approaches to construction sites. Warning signs and barricades shall be placed on approaches to all areas where hazardous conditions exist as the result of construction activities.

1.6.17 Explosives - Explosives are banned from the site unless specifically authorized by the ES&H Executive Board, with the exception of Hilti Guns operated by qualified personnel.

1.6.18 Emergency Medical Treatment - For emergencies requiring immediate assistance, dial 3333 on PPPL telephones. On all other telephones dial 243-3333. Stay on the telephone until all required information is given to an appropriate party.

1.6.19 Control for hazardous waste/materials shall be in accordance to Procedure #EWM-001.

1.6.20 All Other requirements of OSHA 1926 and 1910 shall be enforced.

1.7 REFERENCES

29 CFR 1926 and 29 CFR 1910, Safety and Health Regulations for Construction, OSHA

Construction Industry Standards and Interpretations, Volume III OSHA 2079

DOE Order 5480.9, Construction Safety & Health Program
DOE Order 5480.4, Environmental Protection, Safety, and Health Protecion Standards

ES&HD-5008, Section 2, Electrical Safety
ES&HD 5008, Section 8, Chapter 3, Hazardous Waste
ES&HD-5008, Section 5, Fire Protection

APPENDIX A

CONSTRUCTION SAFETY OVERVIEW
FOR THE PLASMA PHYSICS LABORATORY

Some examples of jobs requiring oversight include the Facilities Engineering Division (FED) roofing projects, any building construction, and all TFTR projects where the Subcontractor spends a limited amount of time on the site to do such work as drilling holes in the Test Cell walls, high consequence lifts, installing mezzanines, installing fire detection suppression systems or crane modifications.

Other subcontractor jobs that should have PPPL ES&H overview are projects which may cause serious damage to equipment, buildings, or machinery. Minor jobs such as hooking up computers, painting an office, or delivering materials to the Laboratory do not need to be monitored. However, if it is noticed that some type of hazard or safety violation exists, the cognizant person should stop work and correct the situation and/or notify the ES&H Division .

Prior to start-up of any construction job, by either PPPL, and/or Subcontractor, the ES&H Division should be notified in writing giving the site location, approximate start-date, a brief description of the project, the PPPL employee responsible for the job, and the Subcontractor's name. The cognizant supervisor must also remember that some types of jobs require specific training and permits, e.g., confined space, fire watch, flame permits, etc. Subcontractors are also required to take General Employee Training (GET) if they are on-site for more than eighty hours during any year. Contact the Office of Training and Certification for details.

The monitoring of the job sites will be conducted according to a risk assessment. For example, if the job has been assessed as high risk, the project will be monitored daily (at a minimum). If the job is assessed as low risk, it will be monitored on an as-needed basis.

There may be projects where other ES&H staff will be needed to identify or measure hazards that exist. Some examples are radiography, discharge of water from excavations, the use of chemicals, lead cutting, and transformer repair. The ES&H Division will provide support, consultation or recommendations at whatever level is necessary to assure that all tasks are performed in a manner that meets the ES&H standards of the Laboratory.