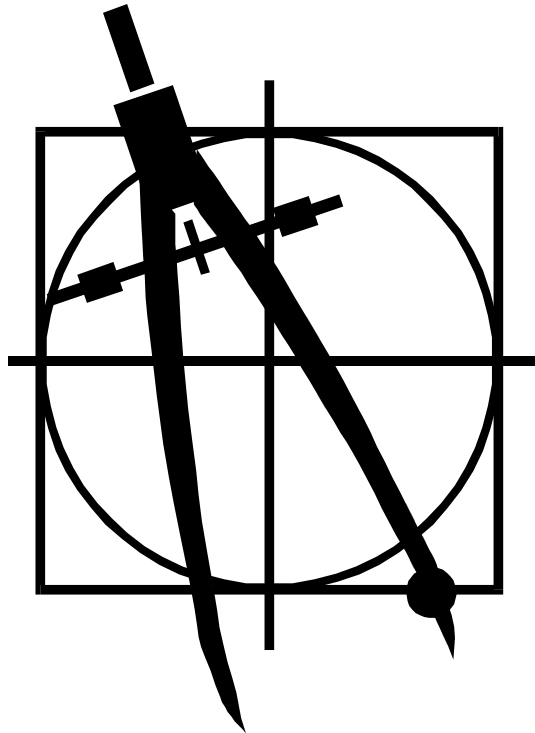


Contractor Safety Advisory



Prepared by
Princeton University
Office of Environmental Health and Safety

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Introduction

This Advisory contains an overview of selected health and safety good practices and regulatory requirements that Contractors may conclude to be applicable to their work at Princeton University. It should be considered as an introduction and not a substitute for a thorough understanding of the subjects. Furthermore, it is for informational purposes only. This Advisory does not relieve the Contractor of its obligations to (1) control the manner and means by which it and its employees, subcontractors and agents perform work or services at Princeton University, and (2) independently ascertain what health and safety practices are appropriate and necessary for the performance of such work or services. Contractors are expected to be familiar with and follow appropriate health and safety practices, including those required by the federal Occupational Health and Safety Act (“OSH Act”), and those set forth in applicable Occupational Safety and Health Administration (OSHA) regulations, as well as any applicable state or local code.

(Additional information about OSHA's requirements can be found at their web site, www.osha.gov).

General Duty Clause

Where OSHA has not promulgated specific standards to address a given situation, it may rely upon a *general duty clause* in the OSH Act for the issuance of citations or fines. OSHA interprets this general duty clause (29 U.S.C. §654(a)) to give it authority to, in appropriate instances, cite a contractor for hazards to which employees of other contractors are exposed. Selected specific OSHA regulations which may be applicable to a Contractor's work on a University project are referenced below. **(Please note that this is a representative, not an exhaustive list. In all instances, it is the Contractor's obligation to identify the OSHA standards or regulations that are applicable, and to be guided accordingly.)**

Personal Protective Equipment

Personal protective equipment (PPE) is used to increase individual safety while performing potentially hazardous tasks, and may include safety glasses, hard hats, gloves, respirators, or any equipment or clothing used to protect against injury or illness. Contractors should ensure that the proper types of PPE are available for and used by their employees. OSHA's requirements are found in **29 CFR 1926 Subpart E - Personal Protective Equipment**.

- Contractors should use safety glasses with side shields to protect against flying particles (e.g., saw dust, nails, metal shavings, etc.) Goggles should be used to protect against molten metal, liquid chemicals, acids and caustic liquids, chemical gases and vapors. Shaded eyewear should be used to protect against potentially injurious light radiation (e.g., cutting and welding, lasers).
- Contractors should wear hard hats working in areas where there is the potential for falling objects or exposed energized electrical conductors that could contact the head.
- Contractors should wear protective footwear (e.g., steel toe boots, leather work boots, etc.) in areas where there is the potential for foot injuries from falling or rolling objects, from objects piercing the sole, or from exposed energized electrical conductors that could contact the feet.
- Contractors should wear hand protection (e.g., leather work gloves, welder's gloves, appropriate chemical protective gloves, etc.) to protect against hazards of skin absorption of harmful substances, severe cuts or lacerations, severe abrasions, punctures, chemical burns, thermal burns, or harmful temperature extremes.
- Contractors may use respiratory protection to protect against inhalation hazards when engineering and administrative controls are not feasible or adequate.

Barricades and Fencing

Barricades act as warning devices, alerting others of the hazards created by construction activities, and should be used to control traffic, both vehicular and pedestrian, safely through or around the work site. Contractors should use barricades as required in **29 CFR 1926 Subpart G – Signs, Signals, and Barricades**, or wherever necessary for the physical protection of people or property. Temporary cyclone fencing, plastic safety fencing and portable manhole barricades are examples of acceptable barricading. Yellow caution tape and/or cones are not considered acceptable barricades, and should be used only until more

suitable barricades can be erected. Signage and illumination should be used where appropriate.

In addition, the following are examples of activities where barricade use is required by code or regulation. Contractors should barricade the following areas:

- Wherever construction debris is dropped without the use of an enclosed chute (**29 CFR 1926 – Demolition**).
- Areas with temporary wiring operating at more than 600 volts (**29 CFR 1926 Subpart K – Electrical**).
- Work areas for electrical equipment with exposed, energized parts (**29 CFR 1926 Subpart K – Electrical**).
- The swing radius of the rotating superstructure of cranes or other equipment (**29 CFR 1926 Subpart N – Cranes, Derricks, Hoists, Elevators, and Conveyors**).
- Wherever equipment is left unattended near a roadway at night (**29 CFR 1926 Subpart O – Motor Vehicles, Mechanized Equipment, and Marine Operations**).
- Excavations (**29 CFR 1926 Subpart P – Excavations**).
- Areas used for the preparation of explosive charges or blasting operations (**29 CFR 1926 Subpart U – Blasting and Use of Explosives**).
- Street openings, such as manholes (**multiple requirements found in 29 CFR 1926**).
- Construction areas in energized electrical substations (**29 CFR 1926 Subpart V – Power Transmission and Distribution**).

Excavations (including Trenches)

Before excavation work begins, the Contractor should be familiar with and follow the regulations found in **29 CFR 1926 Subpart P - Excavations**. The following are general rules and procedures that should be followed during excavation and trenching operations:

- Prior to excavation, New Jersey state law requires that the location of underground installations (e.g., sewer, telephone, electrical, fuel, natural gas, water and other lines, and underground tanks) must be identified and marked out. New Jersey One Call (1-800-272-1000) must be called three (3) full working days before the excavation is planned to begin.
- Excavations more than twenty feet deep should be designed by a registered professional engineer.
- Appropriate safety practices should include a daily inspection of the excavation, adjacent areas, and protective systems by a competent person, i.e., someone who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are hazardous to employees, and who has authorization to take prompt corrective measures to eliminate them.
- Any material or equipment that could fall or roll into an excavation should be placed at least two feet from the edge of the excavation.

- Workers should be protected from cave-ins by an adequate protective system, except when excavations are made entirely in stable rock or when the excavations are less than five feet in depth and examination of the ground by a competent person provides no indication of a potential cave-in.
- When used, sloping should be adequate for the type of soil, as determined by a competent person.
- Trench boxes or shields should be used in accordance with the manufacturer's recommendations, or as designed and approved by a registered professional engineer.
- Ramps, runways, ladders, or stairs used as access should be within 25 feet of a work area if the trench is greater than four feet deep.
- A warning system for pedestrian and vehicular traffic should be in place around all excavations. The warning system should consist of barricades, hand or mechanical signals, or stop logs and flashing lights at night.
- Adequate protection from hazards associated with water accumulation should be in place before working in excavations.
- Workers exposed to public vehicular traffic should be provided with and wear reflectorized warning vests.
- Where workers or equipment are expected to cross over an excavation, walkways with standard guardrails should be provided.

Aerial Lifts

Aerial boom platforms, cherry pickers, and other types of aerial lifts are often used to provide a safe, mobile alternative to scaffolding and ladders. Contractors who use aerial lifting equipment should be familiar with and follow the requirements found in **29 CFR 1926 Subpart L - Scaffolds**. The following are general rules and procedures that should be followed whenever an aerial lift is used.

General Requirements

- Only trained persons should operate lifts.
- Lift controls should be tested daily before first use.
- Occupants should stand firmly on the floor of the basket at all times.

Fall Protection

- A body belt (or harness) and lanyard attached to boom or basket should be worn at all times.
- Occupants should not belt off to adjacent structures.

Use and Operation

- If so equipped, brakes and outriggers should be set before the boom is raised.
- Lift should not be moved while extended, unless designed to do so.
- Manufacturer's load limits should not be exceeded.
- When appropriate, contractors should use warning signs (e.g., "Work Overhead", etc.) or barricades to alert pedestrians.

Overhead Electrical Hazards

- Only insulated aerial devices should be used for work on overhead power lines. In all other cases, at least 10 feet should be maintained between the boom and energized electrical lines.

Scaffolding

In its simplest form, a scaffold is any temporary elevated or suspended work surface used to support workers and/or materials. There are many types of scaffolds, both supported and suspended. Contractors who erect or use scaffolding should be familiar with and follow the requirements of **29 CFR 1926 Subpart L - Scaffolds**. Included here are some general requirements for all scaffolds, as well as specific requirements for a supported scaffold (tubular welded frame) and suspended scaffold (two-point suspension).

General

- The footing of scaffolding should be sound and rigid, capable of supporting the weight. Scaffolding should not be placed on unstable objects, such as bricks or blocks.
- Scaffolds should be erected, dismantled, or moved only by properly trained workers.
- Scaffolds and components should be able to support at least four times the intended load.
- Standard guardrails (e.g., handrail and midrail) and toeboards should be provided for all open sides of the scaffolding that are ten (10) feet or more above the surrounding surfaces.
- To protect against falling objects, screens should be installed between the toeboard and midrail if anyone is required to pass under the scaffolding.
- Any damaged or weakened component of a scaffold should be repaired or replaced immediately.
- All planking or platforms should be overlapped a minimum of twelve (12) inches and secured from movement. Scaffold planks should extend over their end support at least six (6) inches but no more than twelve (12) inches.
- An access ladder or other safe access should be provided.

SCAFFOLDS (TUBULAR WELDED FRAME)

- Cross-braces of the proper length should be used to ensure that the scaffold will remain plumb and rigid.
- To prevent movement, the scaffold should be secured to the building or structure at intervals not to exceed 30 feet horizontally and 26 feet vertically.
- Rolling scaffold should not be used on sloped surfaces.

SWINGING SCAFFOLDS (TWO-POINT SUSPENSION)

- The platform of a two-point suspension scaffold should not be more than 36 inches wide unless designed by a qualified person, and should be surrounded with a standard guardrail and toeboard.

- Ropes capable of supporting at least six (6) times the rated load should be used to suspend two-point suspension scaffolds. All other components should be capable of supporting at least four (4) times the rated load.
- Pursuant to applicable OSHA regulations, no more than two workers may work at one time on suspension scaffold designed for a working load of 500 pounds; no more than three workers may work at one time on suspension scaffolds with a working load of 750 pounds. Each worker should be protected by a personal fall arresting system attached to an independent lifeline. The lifeline should be attached securely to substantial members of the structure (not the scaffold) or to securely rigged lines that will safely suspend the employee in case of a fall.

Fall Protection

When work is performed on elevated surfaces that are six feet or more above the surrounding area protection against falls frequently should be implemented. Fall arresting systems, which include lifelines, body harnesses, and other associated equipment, are often used when fall hazards cannot be controlled by railings, floors, nets, and other means. These systems are designed to stop a free fall of up to six feet while limiting the forces imposed on the wearer. Contractors should be familiar with and follow the requirements of **29 CFR 1926 Subpart M - Fall Protection**.

A variety of systems are available to provide fall protection. Contractors should analyze the work site, the potential hazards and the magnitude of possible injury to workers in assessing which one of the following fall protection systems should be used when work is performed on surfaces elevated six feet or more above the surrounding area.

Guardrails: Standard guardrails consist of a top rail, located 42 inches above the floor, and a mid-rail. Screens and mesh may be used to replace the mid-rail, so long as they extend from the top rail to the floor.

Personal Fall Arresting Systems: Components of a personal fall arresting system include a body harness, lanyard, lifeline, connector, and an anchorage point capable of supporting at least 5000 pounds.

Positioning Device Systems: Positioning device systems consist of a body belt or harness rigged to allow work on a vertical surface, such as a wall, with both hands free.

Safety Monitoring by a Competent Person: This system allows a trained person to monitor others as they work on elevated surfaces and warn them of any fall hazards.

Safety Net Systems: These systems consist of nets installed as close as possible under the work area.

Warning Line Systems: Warning line systems are made up of lines or ropes installed around a work area on a roof. Warning lines act as a barrier to prevent those working on the roof from approaching its edges.

Covers: Covers are fastened over holes in the working surface to prevent falls. Each must be marked with the word "cover".

Hot Work

Cutting and welding operations (referred to as hot work) are commonly associated with construction activities. Hot work equipment, which may produce high voltages or utilize compressed gases, requires special awareness and training on the part of the worker to be used safely. Contractors should control the hazards associated with hot work through the implementation of effective programs required under **29 CFR 1926 Subpart J – Welding and Cutting**.

Hot Work Permits: Though not specifically required by federal, state, or local laws, the use of hot work permits is strongly encouraged. Hot work permits serve as a checklist for operators and those performing fire watch duties. The Contractor responsible for issuing permits should be qualified to examine the work site and ensure that appropriate protective steps, such as those listed in this section, have been taken.

Alarm Systems: Alarm systems should be disabled prior to beginning hot work. Public Safety should be notified at 609-258-1000 when requesting the disabling of an alarm system and at the conclusion of work to reactivate the system.

General Cutting and Welding Controls: Areas where hot work is done should be properly prepared. Combustible and flammable materials within the work area should be protected against fire hazards and the operation should not pose a hazard to others in nearby areas. To help achieve this, the following controls should be used:

- Cutting and welding operations restricted to authorized, properly trained individuals.
- Combustible materials should be moved at least 35 feet from the work site. If this is not possible, protect combustible materials with metal guards or by flameproof curtains or covers (other than ordinary tarpaulins).
- Floor and wall openings within 35 feet of the work site should be covered to prevent hot sparks from entering walls or falling beneath floors or to a lower level.
- Fire resistant curtains and/or tinted shields should be used to prevent fire, burns to workers, and ultra-violet light exposure to others in the area.

Fire Watch: A person other than the operator should perform fire watch duties and remain at the work site for at least 30 minutes after hot work operations have ended. Additionally, the following steps should be taken:

- A fire extinguisher rated at not less than 2-A:10-B:C should be attached to all portable cutting and welding carts.
- If a building or area is equipped with a sprinkler system, then that system should be operational when hot work is performed.
- A fire code permit, which may be obtained from the local fire official, is required for all cutting and welding operations.

Confined Spaces

A confined space is defined as any space that is large enough to enter and perform work, has a limited means of entry or egress (exit), and is not designed for continuous

employee occupancy. Examples of confined spaces include pits, tanks, certain tunnels, and underground vaults.

Contractors should be familiar with relevant portions of **29 CFR 1926 Subpart C – General Safety and Health Provisions**, and use appropriate entry procedures when working in confined spaces, including the following:

- Before entry occurs, test the confined space's atmosphere using a direct reading instrument for oxygen content, combustible gases, and toxic air contaminants.
- If entry is permissible, ensure ventilation is continuous, appropriate and adequate.
- When required, assign a trained attendant to observe those working in the confined space.

When a confined space entry includes hot work (welding or cutting), the following additional procedures from **29 CFR 1926 Subpart J – Welding and Cutting** should be followed:

- Gas cylinders and welding machines should be left outside the space when work is performed in such spaces as tanks, boilers, or pressure vessels. Heavy portable equipment mounted on wheels should be securely blocked to prevent movement.
- Whenever workers must enter the confined space through a manhole or other restricted opening, some means for his or her quick removal should be provided. This could include a body harness and lifeline attached to mechanical retrieval equipment. An attendant with a preplanned rescue procedure should be available to observe the welder and to initiate rescue should it become necessary.
- When operations are suspended for any substantial period of time, such as lunch or overnight, electrodes should be removed from their holders and arc-welding machines should be disconnected from their power source. If gas welding or cutting is in use, fuel gas and oxygen supply should be shut off with the torch valves and at some point outside the confined space. Where possible hoses and torches should be removed from the space.
- After operations are completed, the welder should mark the hot metal or provide for some other means of warning others working in the area.

Lockout/Tagout

Lockout/tagout procedures are designed to prevent accidental startup of machines or equipment, and to prevent the release of stored energy. Through the application of locks and/or tags as direct controls, equipment is isolated from energy sources and injuries to workers are prevented. **When work affects or is done in association with University personnel, Contractors should submit their lockout/tagout procedures to the University's Project Manager.**

Contractors should, at a minimum, adhere to the following procedures found in **29 CFR 1926 Subpart K - Electrical**:

Controls: Controls that are to be deactivated during the course of work on equipment or circuits should be locked or tagged.

Equipment and circuits: Equipment or circuits that are de-energized should be rendered inoperative and should have tags attached at all points where the equipment or circuits could be re-energized.

Tags: Tags should be placed to identify plainly the equipment or circuits being worked on.

Exposure Monitoring

Potential exposures include, but are not limited to, nuisance dust, chemical vapors, hazardous materials (such as lead) and noise. The Contractor should take all necessary precautions to control or contain fugitive emissions from the job site.

- Employee exposures to airborne hazardous substances must be maintained below OSHA permissible exposure limit (PEL), found in **29 CFR 1910.1000 Table Z**, or American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value (TLV) for any chemical.
- Where engineering controls will not adequately control exposures or are not feasible, and the potential exists to create air concentrations in the work area above the PEL or TLV, work area exposure conditions should be monitored. Monitoring should occur, at a minimum, during the start of work and whenever there is a change in procedure, process, or chemical or material used.

Asbestos

Asbestos was incorporated in a number of widely used products, many of which were used in building construction from the late 1800's to the mid 1980's, when most Princeton University buildings were constructed. The most common use of asbestos in Princeton University buildings was in floor tiles, mastic, thermal systems insulation (TSI), plaster, ceiling tiles, structural steel fireproofing and acoustical and decorative plaster. Per the OSHA Asbestos Standard (**29 CFR 1926.1101**) building materials installed prior to 1980 should be presumed to contain asbestos unless historical information or testing indicates otherwise.

- Contractors employed by the University to perform building or facilities-related maintenance, repair or renovation should request from the Project Manager the location of suspect and known asbestos-containing materials (ACM) in the work area(s) to which they are assigned.
- Contractors shall, under no circumstances, damage or disturb known or suspect ACM (unless they are a licensed New Jersey Asbestos Abatement Contractor and have been specifically employed to perform asbestos repair or removal). If in the course of the work, suspected asbestos materials are discovered, the Contractor shall stop work that might disturb the material immediately and notify the Project Manager.
- It is the responsibility of the Contractor to provide its employees with an asbestos awareness program, which should include, but not be limited to, the information contained in this section and appropriate federal and New Jersey regulations.

Lead

Many buildings built or renovated before 1978 have lead-based paint applied to some interior or exterior surfaces. Paint containing 0.5 percent or more lead by weight or 1 mg/cm² or more lead by x-ray fluorescence is considered to be lead-based paint.

- Contractors employed by the university should request from the Project Manager the location of known lead-containing building materials in the work area(s) to which they are assigned.
- Contractors that disturb lead-based paint during the course of work should ensure all work is in compliance with the **OSHA Lead in Construction Standard, 29 CFR 1926.62**, including controlling exposures below the permissible exposure limit and providing biological monitoring for employees, as needed.
- Contractors that disturb lead-based paint during the course of work should take all necessary precautions to protect University employees, students and visitors from exposure to lead dust or contamination. Such measure may include using plastic sheeting to isolate the work area, using wet techniques, washing with trisodium phosphate, and/or using a HEPA vacuum.
- Where the work area is an area normally occupied or frequently visited by children under 6 years old or pregnant women, EHS should be contacted after the work area has been cleaned to perform clearance testing. The Contractor shall continue cleaning efforts until sampling results indicate the lead dust levels are less than or equal to 100 micrograms per square foot on floor surfaces and less than or equal to 500 micrograms per square foot on interior window sills, as appropriate.
- Contractors employed to provide abatement of a lead paint hazard should be licensed by the State of New Jersey to provide such services. All work should be performed in accordance with applicable laws and regulations, including **N.J.A.C. 5:17, Lead Hazard Evaluation and Abatement Code**.
- In many cases, lead paint chips are considered hazardous waste by the U.S. Environmental Protection Agency. Contractors shall ensure that wastes containing lead-based paint, including paint chips, are disposed in accordance with federal and state regulations. All hazardous waste generated from University facilities must be disposed of by contacting Princeton University Environmental Health and Safety (EHS).

Hazard Communication

Chemicals Stored or Used by Princeton University

Chemicals are used extensively at Princeton University, including, but not limited to, laboratories, maintenance activities, and janitorial work. According to the requirements of **29 CFR 1910 Subpart Z**, when the Contractor works in area(s) where chemicals are

stored or used, the Contractor may request from the Project Manager the following information:

- Special precautions and/or safety procedures for the work area.
- Special procedures to follow in the event of an accidental release or exposure to the hazardous chemicals.

Chemicals Stored or Used by the Contractor

- The Contractor must take all necessary precautions to protect University employees, students, and visitors from exposure to the chemicals.
- The Contractor should maintain material safety data sheets (MSDSs) *on-site* for all hazardous chemicals used or stored at the job site. Copies of MSDSs should be provided to the Project Manager and copied to EHS prior to the start of work.
- The Contractor is responsible for cleaning up any spills created or caused by the Contractor. Contractors must alert Public Safety **immediately** at 911 from any campus phone or 609-258-3333 from a cell phone upon discovering a spill.
- The Contractor must dispose of all hazardous chemicals in accordance with federal and state regulations. All hazardous waste generated from University facilities must be disposed of by contacting EHS.

Environmental Issues

Chemical Releases into the Environment

The storage of materials that, if spilled, would cause groundwater contamination, is prohibited in rooms that have floor drains connected to the storm sewer system. Drains not connected to the sanitary sewer system cannot be used to drain away floor cleaning materials or compressor blowdown.

If an accidental release of a chemical to the environment occurs, the contractor must notify Public Safety **immediately** at 911 from any campus phone or 609-258-3333 from a cell phone. Public Safety will contact the Facilities Manager of Environmental Compliance or EHS. A release to the environment may include a spill directly into water (including groundwater) or a spill directly onto land.

Occasionally, roofing and other types of contractors test waterproof membranes or pipe systems with a non-toxic colored dye. Notification of a tracer dye release, including date, time and color to be used, must be reported to either Public Safety at 609-258-1000 or Environmental Health & Safety at 609-258-5294 at least 24 hours in advance. An MSDS for the dye to be released should be faxed to EHS at 258-1804.

Waste Disposal

All contractors must take precautions to ensure hazardous chemicals or materials are disposed of in accordance with federal and state regulations. Materials which may not be disposed in regular trash include, but are not limited to, used solvents or oils, building

materials which may contain asbestos, lead paint chips, sand-blasting grit which may contain lead paint, and unwanted paints and stains.

Contractors are responsible for removing hazardous wastes from the work site and disposing of them properly. **No hazardous materials may be left on campus without the written approval of Environmental Health & Safety.**

Work in Laboratories and Animal Care Facilities

Work performed in laboratories and animal care facilities requires advance planning and special care to address unique safety concerns presented by these areas. Contractors should become familiar with the specific safety and security requirements of these areas prior to performing work, addressing questions and concerns through the University's Project Manager to EHS and appropriate laboratory or animal care personnel.

Tritium Exit Signs

Tritium exit signs are self-illuminating signs containing tritium gas, which is radioactive. These signs produce green light continuously for several years without any external power source and are typically used in areas where providing electrical power is difficult. The signs are labeled with a "CAUTION RADIOACTIVE MATERIAL" warning on the back or side. Unless damaged or broken, a tritium exit sign does not present any hazard.

Tritium exit signs found during renovations or demolition must be disposed of in accordance with federal regulations. EHS must be contacted to make proper disposal arrangements.

Sources of Radiation (e.g., Ionizing and non-ionizing)

When sources of ionizing radiation are brought on to campus for the purposes of non-destructive testing, e.g., nuclear density gauges and x-ray radiography, or for any other purpose, the contractor must meet all state and federal regulatory requirements, including requirements for posting and for establishing exclusion zones

When RF transmitters, e.g., cell base stations, paging installations, etc., are installed at campus locations, it is the responsibility of the contractor to ensure that a radiation survey is performed after the installation to ensure that RF radiation levels comply with NJDEP and FCC requirements.