

# Oak Ridge National Laboratory / Chestnut Ridge Facilities Project Environmental, Safety, and Health Plan

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**ORNL/CRF PROJECT ENVIRONMENTAL,  
SAFETY, AND HEALTH PLAN**

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## **1. SAFETY POLICY**

The safety of all personnel is recognized as a primary concern to all participants at Oak Ridge National Laboratory (ORNL). Unsafe conditions and unsafe behavior can result in injuries and deaths as well as impact schedules, cause financial losses, and damage professional reputations. As such, it is our goal that all project participants plan, manage, and execute their respective operations with the ultimate goal of conducting their operations injury-free on a daily basis.

It is the responsibility of the Seller to adhere to the requirements of this Safety and Health Plan (SHP). Each Seller shall incorporate safety into the planning of each task, assure the safety of their personnel, provide all safety devices necessary for their employees, establish a safe and drug-free work environment, and confirm that their equipment meets the applicable safety standards. Each Seller is responsible for any actions of their personnel that may endanger or otherwise expose other participants to potential hazards on the project site.

The Integrated Safety Management System (ISMS) shall be used to achieve these goals. The ISMS is a practical approach to the prevention of accidents with an emphasis on line management responsibility for safety. A central premise is that work planning starts with a focus on the nature of the job to be performed and assessment of the hazards involved in each step. Through the use of self-assessment and feedback from the line organizations, continuous improvement in each Seller's safety process is expected.

Project participants are required to supervise and direct activities using their best management skills and technical expertise. The Seller will be solely responsible for all work means, methods, techniques, sequences, and procedures. This includes all safety precautions and programs in connection with the work, as well as coordinating all portions of the work. Each lower-tier subcontractor is likewise required to be responsible for all safety precautions and programs in connection with the work under the Seller's contractual agreement.

All project personnel have stop work authority for any task that represents an imminent threat to safety. Only the Company can authorize a restart of the identified task.

## **2. INTRODUCTION**

The Company has developed this SHP for implementing the principles and functions of ISMS. The Company and each Seller's line management shall share the common goal to eliminate injuries to all employees and the downtime associated with accidents. The requirements of the Occupational Safety and Health Administration (OSHA), ORNL, and this SHP establish the requirements and minimum standards that must be met or exceeded.

### **2.1 GENERAL INFORMATION**

The objective of this plan is to emphasize that the protection of people and property is of paramount importance to the success of this project. To accomplish this objective, the project is committed to the principles and functions of ISMS described in U.S. Department of Energy (DOE) Policy 450.4, "Integrated Safety Management System" and discussed in detail further in the SHP.

Accident prevention is a continuing process, not a fixed program. While it is the responsibility of each individual to work safely, it is ultimately each Seller's management responsibility to see that all safety and health policies and practices are followed and enforced. Active participation by Seller personnel in safety and health programs established for the project is mandatory. Each Seller's line management must demonstrate, to their employees, complete support and continuing involvement in all safety and health policies and efforts.

Failure to fully carry out the responsibility to work safely and participate in the safety and health programs can result in removal of individuals from the project at the direction of the Company. Safety is not to be compromised for production. Safety must be considered an integral part of the planning process. The project's goal, along with each Seller's goal, is to eliminate accidents. Seller line management is charged with the responsibility for developing, implementing, and enforcing the safety and health programs and policies established for the project.

## **2.2 WORKER SAFETY AND HEALTH PROGRAM**

Prior to commencement of project activities, the Seller shall:

- a. Accept and agree to work to the Company's DOE-approved Worker Safety and Health Program (WSHP), or
- b. Submit their DOE-approved WSHP to the Company, for review.

The Company's DOE-approved WSHP is available through the Company's Procurement – Public website.

## **2.3 PROJECT SAFETY AND HEALTH PLAN**

Submit 5 calendar days prior to site activities:

- a. For Company approval, a written SHP that complies with the requirements of this SHP, or
- b. A letter stating the Seller will adopt/comply with the Company SHP.

Each Seller will budget to establish and maintain a safety and health program that meets or exceeds the requirements contained in this SHP and the applicable sections of 29 CFR 1910 and 1926.

Each Seller is solely responsible for carrying out their safety and health program. Therefore, the Company requires that each Seller designate a competent on-site employee to carry out this responsibility. Along with the Seller's line managers, this employee is directly responsible for ensuring that the Seller's program and employee actions comply with the minimum safety standards required by this SHP.

## **2.4 SUBCONTRACTOR HAZARD ANALYSIS**

Submit for approval a written hazard analysis (HA) to the Company 5 calendar days prior to site activities. The HA shall:

- a. Identify general work tasks (e.g., excavation, foundations, structural steel, roofing ) anticipated during the project phases;



- b. Identify any potential hazards that could reasonably be expected during these work activities;
- c. List actions or precautions that will be taken to minimize the risk of such hazards that could cause an accident, injury, illness, or environmental insult;
- d. Provide drawings and/or other documentation of protective measures for which applicable OSHA standards require preparation by a professional engineer or other qualified professional;
- e. Identify competent persons required for workplace inspections of the project activity, where required by OSHA standards;

The supervisor shall:

- f. Ensure that the HA is developed and reviewed by the employee before work begins;
- g. Ensure that employees are trained in the process of developing an HA; and
- h. Seek the advice of the safety officer or designee as appropriate.

## **2.5 SUBCONTRACTOR HEALTH AND SAFETY PROCEDURES**

The Seller shall submit all safety and health procedures as required by this SHP to the Company for Company review and approval. Procedures shall be submitted 5 calendar days prior to the start of site activities that require the use of the procedure.

## **3. INTEGRATED SAFETY MANAGEMENT SYSTEM**

The Company has adopted ISMS as the overarching philosophy and approach to systematically integrate safety into work activities. The ISMS is the formal, organized process whereby the project plans, performs, assesses, and improves safe conduct of work. The ISMS for each project is based on the fundamental principles and core functions discussed in DOE Policy P 450.4. Each Seller is committed to these fundamental principles and functions through contractual agreement. The use and implementation of this plan is verified through self-assessment and independent assessment processes.

The Company and Seller are committed to ensuring the safety and health of workers and the public and to protecting the environment. All work will be performed safely and will adhere to all applicable laws and requirements. Integral to this being accomplished is the workers' commitment to work safely and to work to the requirements.

### **3.1 PRINCIPLES OF INTEGRATED SAFETY MANAGEMENT SYSTEM**

The fundamental principles described in DOE P 450.4, discussed below, are incorporated into the ORNL/SNS processes to help ensure that facilities are adequately preserved, that work is conducted safely, and that suitable accident prevention and mitigation measures exist.

#### **3.1.1 Worker and Line Management Responsibility for Safety**

Line management is accountable for empowering workers with the training and authority necessary to establish and maintain safe operating methods commensurate with their assigned duties. Management expectations are clearly communicated to all personnel, personnel are empowered, their feedback is

solicited, the tools necessary to accomplish the work safely are provided, and personnel are held accountable for their actions. Each individual, in turn, is responsible for his or her actions.

Line managers are responsible for training, motivating, and enabling their workers to understand and comply with the project's commitment to safety, and for ensuring that work is accomplished within the authorization basis. Line managers are also responsible, by personal example and by involving their workers, for providing a working environment in which everyone is dedicated to meeting the commitment to safety.

### **3.1.2 Clear Lines of Authority**

The organizational structure focuses on management and worker involvement, and is centered on work planning and execution. Clear and unambiguous roles and lines of responsibility, authority, and accountability at all organizational levels must be established. Safety and health (S&H) responsibility will be integrated into project work activities, and interfaces for processes and organizations will be clearly established to provide for good understanding and communication.

### **3.1.3 Personnel Experience, Knowledge, and Skill**

Each Seller must commit to using a workforce on the project that has the ability to do work safely and efficiently. Each individual associated with the project shall possess the experience, knowledge, skills, and abilities necessary to discharge his or her responsibilities. Line managers must ensure that their workers are competent to safely accomplish the work through the hiring and training processes. Line management must ensure that training and qualification requirements are flowed down to their personnel, and that personnel are held responsible for their performance.

### **3.1.4 Balanced Priorities**

The project ensures a "safety first" culture by effectively allocating, training, and monitoring resources to ensure that work is performed safely. A "safety first" attitude is a must for all personnel. Stop work authority is given to each employee to use when he or she believes an activity is unsafe. Restart approval is given at the appropriate management level. Specific job tasks are planned with appropriate worker involvement, and the work plan is required to be followed to ensure safe operation.

### **3.1.5 Work and Associated Hazards**

Before work is performed, the associated hazards are evaluated and an agreed-upon set of controls is established, which, if properly implemented, provides adequate assurance that the public and the workers are protected from adverse consequences.

### **3.1.6 Administrative and Engineering Controls**

Administrative controls and engineering controls are essential elements of the ISMS. Wherever feasible, engineered controls are designed into the project, and administrative controls are used to supplement engineered controls as appropriate. These controls are established through the work planning process.

### **3.1.7 Authorization Agreement**

The conditions and requirements to be satisfied for operations to be initiated and conducted are clearly established and agreed upon by the Company and Seller.

## **3.2 CORE FUNCTIONS OF INTEGRATED SAFETY MANAGEMENT SYSTEM**

DOE P 450.4 describes the core functions of ISMS. These five functions are not independent and not necessarily sequential. Rather, they are linked and interdependent such that outcomes during the accomplishment of one may affect others. In particular, identifying and implementing opportunities for improvement may arise at any stage of the work process. The five functions are Define the Scope of Work, Identify and Analyze Hazards, Develop and Implement Hazards Controls, Perform Work within Controls, and Provide Feedback and Continuous Improvement.

Seller line management must commit to these core functions of integrated safety management in the manner described below.

### **3.2.1 Define the Scope of the Work**

Defining the scope of work entails identifying and defining all the steps, for each task and sub-task element, needed to complete a particular job safely. Defining the scope of work is a critical element of the safety management system, since it sets the stage for the scope and depth of hazard identification and analysis.

### **3.2.2 Identify and Analyze Hazards Associated with the Work**

Hazard identification includes defining those hazards to workers or property expected to be encountered during the course of performing a particular task and those that are introduced from concurrent work tasks. A Job Hazard Analysis (JHA) shall be performed for each task to address such hazards. There is also a potential that unexpected hazards may be encountered or that the nature of the known hazards might change as work activities progress. Should this occur, the JHA shall be amended to incorporate the new conditions.

### **3.2.3 Develop and Implement Hazard Controls**

The development and implementation of hazard controls includes identifying controls to prevent and mitigate hazards, establishing the safety envelope (what conditions require what response), and performing periodic hazard assessments.

### **3.2.4 Confirm Readiness and Perform Work Within Controls**

Confirmation of readiness is an effort to verify that safety controls have been implemented before starting work. Performing work within controls entails adherence to work controls in a manner such that activities remain within the safety envelope. Readiness assessments are conducted at multiple levels, from each worker assessing his readiness to start a task, to that necessary to demonstrate project readiness to the DOE and regulators.

### **3.2.5 Provide Feedback on Adequacy of Controls**

Feedback and continuous improvement are based on the premise that all work activities can be planned, performed, assessed, and improved. Continuous improvement entails proactive focus on problem prevention and performance improvement to prevent unsafe practices from occurring. The capability to prevent minor problems from becoming major risks or events relies heavily on feedback from workers, observations from those not directly involved with the work, and adequate metrics to assess trends in performance.

### **3.3 ROLES AND RESPONSIBILITIES FOR INTEGRATED SAFETY MANAGEMENT SYSTEM IMPLEMENTATION**

#### **3.3.1 Senior Management**

The Company has the overall responsibility for assuring a safe workplace and for maintaining safe operations. The Company approves all project plans, ensures implementation by conveying to line management their responsibilities for integration of safety performance into all work activities, and confirms management responsibility for integration of safety performance into all work activities. The Company also has responsibility for evaluating the progress and health of the ISMS and adjusting resources as necessary based on feedback of ISMS implementation. This promotes continuous improvement in safety performance, and communicates its importance to project success.

#### **3.3.2 Line Organizations**

Each Seller field manager and supervisor constitute the focus of “line manager responsibility” for the protection of workers and the public within the ISMS framework for all work conducted by their assigned employees and by visitors in their assigned operating facilities. Line managers provide the primary operating interface for employees and visitors. Within the framework of the ISMS, they contribute to work planning, pre-job communication of hazards and controls, work monitoring, and evaluation of results.

Effective integration of support from S&H professionals into line activities is essential to achieving excellence in ISMS. Line management is responsible for defining and providing an adequate level of subject matter expert support, either from its own staff or from external sources, as appropriate for the particular line organization and S&H discipline involved.

#### **3.3.3 S&H Organization**

As noted above, effective integration of S&H into line activities is needed for success of the ISMS. The Safety Coordinator/Safety Designee is responsible for providing overall policy and guidance on S&H issues, and for working with the line organizations to make available necessary and agreed-upon input from S&H professionals and other support. S&H personnel are responsible for ensuring that standards, requirements, and S&H policies are effectively translated into suitable controls for work activities.

#### **3.3.4 Workers**

All Seller personnel are responsible for becoming knowledgeable and maintaining awareness of the hazards associated with their work, for contributing to the formulation of hazard controls, and for conducting their work safely in accordance with those controls. They are encouraged to identify S&H issues in their workplace, to work with their management to provide input for improvements and to resolve concerns, and to exercise stop-work authority in cases of imminent danger to health and safety of workers or the public.

## **4. SUBCONTRACTOR RESPONSIBILITIES**

### **4.1 EXPECTATIONS**

The safety procedures established for the project are based on anticipated work activities. Future work activities may require the development of additional safety procedures or clarification of existing policies and procedures.

It is the responsibility of each employee to work in a safe manner. However, it is ultimately the responsibility of the Seller's line management to see that all safety and health rules and practices are followed.

Safety is never to be sacrificed for production. The safety goal for all projects is to eliminate actions that cause accidents or illnesses.

Each Seller has the explicit responsibility to perform work in accordance with this SHP. Seller line managers are accountable for fulfilling the responsibilities listed in this section, in addition to compliance with their own company requirements, and for attending meetings to discuss or resolve safety issues.

During all execution of field construction activities, the Seller shall designate a person to be responsible for enforcement of safety rules and regulations associated with the ongoing work. This designated individual shall have sufficient knowledge and understanding of the work, the Seller's means and methods, and any applicable regulatory requirements to ensure that the work can be prosecuted safely and compliantly. This person shall also have:

- a. Minimum 30-hour OSHA Construction Safety Course.
- b. Experience and the authority to stop work if the safety and health of a worker or the environment are in danger.
- c. Sufficient time and resources to execute the designated safety and health responsibilities as a first priority of work. The designated individual may have concurrent additional job-site duties only to the extent that those additional duties do not interfere with the ability to perform S&H responsibilities. S&H shall be the first priority, and any other duties shall be immediately suspended if they interfere.
- d. The Seller shall have access to a safety professional that by degree, certification, and/or experience can provide guidance and assistance to the designee in matters of industrial hygiene, industrial safety, or other S&H-related topics.

The Company reserves the option to require a full-time safety representative if the complexity of the scope changes or the Seller does not adequately focus on S&H during the execution of the project.

### **4.2 FIELD MANAGER OR SUPERVISORS**

Each Seller field manager and supervisor has the responsibility for overall training, control, and conduct of personnel on their crew. As first-line supervisors, their role in the safety and health program is crucial because they set standards by which their employees work.

Field supervisor responsibilities include, but are not limited to:

1. Conducting task-specific safety training,
2. Conducting daily safety inspections,
3. Conducting safety sampling,
4. Conducting toolbox safety meetings,
5. Apprising the Company of any safety-related problems that have or may develop,
6. Conducting investigations of all accidents and incidents and submitting reports to the Company, and
7. Compiling OSHA statistical information and reporting this information to the Company.

### **4.3 DEFINITIONS**

**Dedicated Safety Representative:** A full-time dedicated safety representative is an individual (1) scheduled to be on-site during work hours and (2) assigned to exclusively carry out safety-related duties. Specifically, the dedicated safety representative shall not have other responsibilities that may take his or her attention from the expected safety duties. The individual is required to have 2 years or more of safety experience and have completed the OSHA 30-hour Construction Safety and Health course.

**Safety Designee:** A safety designee is an individual who, in addition to other project-related duties, is responsible for performing safety-related duties. As a minimum, this individual is required to have completed the OSHA 30-hour course.

### **4.4 ON-SITE SAFETY REPRESENTATIVE OR DESIGNEE**

Specific responsibilities of the designated safety representative and the safety designee include, but are not limited to, the following:

#### **4.4.1 Employee Safety Orientation and Training**

- Conduct orientation sessions for employees new to the project site, prior to their beginning work;
- Participate in weekly toolbox safety meetings and assist field supervisors, as requested, with meetings;
- Instruct supervisors on safety rules and regulations;
- Instruct employees in the proper use and care of personal protective equipment;
- Instruct employees concerning special procedures (e.g., lockout, excavation, confined space entry, etc.) as required by OSHA and this SHP; and
- Conduct or arrange for appropriate training.

Seller shall confirm that training for their employees and their lower-tier subcontractor employees is adequate for the tasks being performed.

#### **4.4.2 Recordkeeping**

- Complete OSHA, state, federal, company, and project-specific reports;
- Complete accident investigation reports;

- Complete inspection reports; and
- Maintain training documentation.

#### **4.4.3 Safety Standards, Rules, and Regulations**

- Accept authority to stop work;
- Accept authority to take immediate corrective action;
- Implement, maintain, and update, as required, conditions and project-site-specific safety policies and procedures;
- Interpret and implement site-specific safety policies and procedures; and
- Demonstrate, by example, proper safety behavior.

#### **4.5 EMERGENCY SERVICES AND EQUIPMENT**

If a serious or life-threatening injury occurs, ORNL will provide emergency ambulance and firefighting services. Seller employees must use a facility phone to dial 911 or pull a fire alarm box to notify ORNL for emergency response. **If using a privately owned cell phone, Seller must call the Laboratory Shift Superintendent (LSS) at 574-6606.**

In the event of a less-serious injury, Seller employees will be sent to physicians/medical treatment facilities identified by the Seller. In addition to the injury recordkeeping required by OSHA, Seller shall inform the Company of any injury requiring first-aid and of all more serious occupational injuries and illnesses within one hour of the classification of the injury.

#### **4.6 SITE ACCESS**

Only those persons possessing a valid ORNL ID badge may enter the site, and only those workers enrolled in the project may work on the site. Badging procedures will be described to each contractor prior to initiation of work.

#### **4.7 ORIENTATION**

The Seller shall ensure that their employees are briefed on what they can expect and what is expected of them during execution of this project.

Newly employed, promoted, and/or transferred personnel shall be fully instructed in the safety practices required by their assignments. All employees must receive orientation prior to starting work. Visitors must also receive orientation prior to leaving the office areas or be escorted while on-site. The initial indoctrination is to be performed by the Seller's safety designee or dedicated safety representative.

In addition to the Seller's safety and health policies, the orientation must include:

- Employee safety requirements and policies specific to the project;
- Site-specific safety and health requirements;
- Permitting procedures (if applicable), including work permits, hot work permits, etc.;
- Hazard communication on a multi-employer work site;

- Emergency and medical procedures; and
- Other topics as circumstances require.

All employees will complete an Orientation Acknowledgement form at the end of the orientation.

#### **4.8 DISCIPLINARY POLICY**

The purpose of this policy is to state the Company's position on administering equitable and consistent discipline of unsatisfactory conduct on the job-site. This policy ensures fair treatment of all employees in making certain that disciplinary actions are prompt, uniform, and impartial. The primary purpose of any disciplinary plan is to correct the problem, prevent recurrence, and prepare the employee for satisfactory service in the future.

We recognize that employees on the whole normally govern their activities while at work to the same high standards of conduct as they use in their personal affairs. But we recognize that errors in judgment may occur, and when they do, we wish to address them in a fair, impartial, and consistent manner. By using progressive discipline, it is our hope that most employee problems can be corrected in the early stages, thus benefiting both the employee and the project. Open and clear communication between the employee and the supervisor promotes understanding and is the key to preclude the need for any disciplinary action.

Disciplinary action may call for any four of the following steps: verbal warning, written warning, temporary suspension from the project site, and denial of access to the project site for a period of one year or more, depending on the severity of the problem and the number occurrences. All disciplinary actions are based upon incident-free time periods (rolling date). After an active employee has gone for a time period of one year (365 days) without a reoccurrence of any progressive disciplinary action, all prior disciplinary action records will be removed from their personnel file. Records associated with terminations will not be purged from the files.

**All disciplinary actions resulting in suspension or termination will automatically be reviewed by the appropriate Business Agent (if applicable), the Seller's representative, and the Company.**

Employees terminated for safety violations will not be eligible for re-employment for twelve (12) months. Employees terminated for a second time for a safety violation are ineligible for re-employment. Appendix A provides the five categories of offenses that require some form of disciplinary action in order to ensure corrective job performance, with only Class V offenses being characterized as the most serious and for which immediate termination will result.

#### **4.9 EQUIPMENT AND MACHINERY**

Seller personnel shall be trained in the operation, inspection, and maintenance of the equipment, safety features, and procedures to be utilized during operation, inspection, and maintenance of the equipment. This training shall be based on the equipment operating manual and the hazard analysis for the activity.

Before any machinery or mechanized equipment is placed in use, it shall be inspected and tested by a competent person and certified to be in safe operating condition. Inspections and tests shall be in accordance with manufacturer's recommendations and shall be documented. Records of tests and inspections shall be maintained at the site by the Seller, shall be made available upon request, and shall become part of the official project file.



All machinery and equipment shall be inspected daily (when in use) to ensure safe operating conditions. The Seller shall designate competent persons to conduct the daily inspections and tests. Tests shall be performed at the beginning of each shift during which the equipment is to be used to determine that the brakes and operating systems are in proper working condition and that all required safety devices are in place and functional.

Whenever any machinery or equipment is found to be unsafe, or whenever a deficiency that affects the safe operation of equipment is observed, the equipment shall be immediately taken out of service and its use prohibited until unsafe conditions have been corrected. A tag indicating that the equipment shall not be operated, and that the tag shall not be removed, shall be placed in a conspicuous location on the equipment.

Machinery and mechanized equipment shall be operated only by designated qualified personnel. Machinery and equipment shall neither be operated in a manner that will endanger persons or property nor shall the safe operating speeds or loads be exceeded. Equipment will be utilized only for its designed purpose and in accordance with the manufacturer's instructions and recommendations.

Modifications, extensions, replacement parts, or repairs of equipment shall maintain at least the same factor of safety as the original equipment. Modifications shall be authorized in writing by the manufacturer.

#### **4.10 EVACUATION OF THE WORK AREA**

Seller shall observe and participate in notices to evacuate the work area. The evacuation notices may be a drill or actual event. All workers will evacuate to the assembly point identified in the orientation/hazard analysis. Before evacuating the work area, equipment or processes that could become a safety or fire hazard if left unattended should be shut down or made safe.

#### **4.11 ACCIDENT/INCIDENT INVESTIGATIONS AND REPORTING**

All incidents involving illness/injury, property damage, or near-miss must be immediately reported to the Company. This is to include repairable damage to equipment or materials and first-aid cases. Such incidents must be investigated by the Seller safety representative or designee and documented on an Appendix B, "Incident Investigation Report" (or equivalent). The report must be completed and submitted to the Company within 24 hours of the incident. The Company reserves the right to conduct an independent investigation of any incident.

An incident investigation committee will investigate all major incidents. This includes, but is not limited to, any incident resulting in a medical case, lost-time injury, fatality, damage to property or equipment, or a near-miss that could have resulted in such an incident. The committee will review the incident scene, interview all involved or witnessing parties, review all facts pertaining to the accident, and file a report to the Company of the findings and conclusions as well as recommended measures to prevent reoccurrence. The committee will be comprised of, but not limited to:

- Person(s) involved in the incident,
- First-line supervisor of the person(s) involved in the incident,
- Superintendent of the employing Seller,
- Safety representative or designee of the employing Seller,

- Safety representative or designee of the Seller, and
- Project Safety Coordinator or designee.

A DOE F 5484.3 “Individual Accident/Incident Report” must be submitted within two working days of a recordable or lost-time injury or illness (OSHA definition). The Company will provide the report form upon request.

#### **4.12 PERSONAL PROTECTIVE EQUIPMENT**

The Seller is responsible for providing the appropriate personal protective equipment (PPE) in all operations/tasks where there is an exposure to hazardous conditions or where the use of such equipment will reduce the hazards to the employees.

PPE and safety equipment shall be tested, inspected, and maintained in serviceable and sanitary condition as recommended by the manufacturer. Users of PPE and safety equipment shall be trained in the use, limitations, inspection, testing, and maintenance of the equipment.

**Basic Eye Protection**—Employees must wear ANSI Z87-approved safety glasses with sideshields 100% of the time when potentially exposed to hazards from flying particles, molten metal, liquid chemicals, acids, or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.

**Clothing**—Employees are to report to work properly attired; this includes the following:

- Clothing in good repair. Frayed or tattered clothing can be hazardous to employees and will not be permitted.
- No tank tops or sleeveless shirts. Shirts must have at least 2-inch sleeves.
- Long pants only; no short pants, cutoffs, sweat pants, etc.
- If working around moving machinery, no neckties, gauntlet-type gloves, and/or baggy, loose, or ragged clothing.
- No loose, dangling jewelry. Jewelry such as rings, watchbands, necklaces, earrings, and the like can cause or contribute to accidents.
- Shoulder length or longer hair must be tied back and put under the hard hat or worn in a hair net. This will keep it from impeding vision, becoming entangled in machinery, or preventing the use of personal protective equipment.

**Contact Lenses**—Wearers of contact lenses must also wear appropriate eye and face protection devices in a hazardous environment. It should be recognized that dusty and/or chemical environments might represent an additional hazard to contact lens wearers. Hazardous environments include, but are not limited to, those in which a respirator may be required or where welding is being performed.

**Face Shield and Goggles**—When Seller employees are exposed to splashes, mists, etc., either goggles or a face shield must be worn, depending on the situation. With a face shield, basic eye protection must also be worn.

**Foot Protection**—Seller personnel who face possible foot injuries from falling or rolling objects or from crushing or penetrating materials must wear ANSI Z41-approved protective work shoes or boots.

**Head Protection**—All persons must wear head protection if objects might fall from above and strike them on the head, if they might bump their heads against fixed objects, or there is a possibility of accidental head contact with electrical hazards. All construction-designated areas are considered hard hat areas.

**Hearing Protection**—The safety representative or designee will monitor work areas to identify and post high noise areas and provide appropriate hearing protection.

**High Visibility Vests**—All persons exposed to the risk of being struck by motor vehicles and heavy equipment must wear high-visibility apparel in accordance with ANSI/ISEA.

**Welding Shield**—When welding, both basic eye protection and hard hats must be worn with a welding shield. This is to protect employees from popping hot slag when the shield is raised and from overhead work exposures. If welding goggles are worn, basic eye protection is not required while welding.

#### **4.13 ON-SITE SAFETY INSPECTIONS**

Seller supervisors are to conduct and document frequent and regular inspections of the worksite to identify any instances of noncompliances with project S&H requirements.

#### **4.14 WEEKLY TOOLBOX MEETINGS**

Seller supervisors are to conduct weekly toolbox safety meetings. Records of the meetings are retained on-site by the Seller.

#### **4.15 PROTECTION OF WORK AREAS**

Seller must ensure that the work areas and storage areas are conspicuously flagged and barricaded, as needed, prior to initiation of work.

Seller must furnish, post, erect, and install safety devices, equipment, signs, barricades, flagging, and any other item necessary to give adequate warning and caution of hazards, and to provide instructions and directions to workers and the public.

#### **4.16 WORKING AND STORAGE AREAS**

Housekeeping is a general indicator of Seller on-site performance, including safety performance. Each Seller has the responsibility to maintain its area of operations, and those of their lower-tier subcontractors, in an orderly condition free of materials that could create slip/trip or fire hazards. In addition, Seller supervisors shall ensure that a daily walk-down of their work area is conducted, that any deficiencies are immediately corrected, and that the condition of the site is reported to the Seller supervisor.

All materials and equipment in storage, laydown, staging, or work areas must be properly secured so that they are stable and secure against sliding or collapse. All materials storage and loading/unloading areas must be established a safe distance from walkways, aisles, and traffic areas to avoid personnel injury should materials slide or collapse.

## **5. INDUSTRIAL HYGIENE/EXPOSURE MONITORING**

Industrial hygiene is the science of anticipating, recognizing, evaluating, and controlling workplace conditions that may cause worker injury or illness. Seller shall be responsible for all monitoring to ensure compliance with the exposure criteria. Approved and calibrated testing devices shall be provided for the measurement of hazardous substances, agents, or environments. Individuals performing testing and monitoring shall be trained in testing and monitoring procedures and hazards. Testing devices shall be used, inspected, and maintained in accordance with the manufacturer's instructions.

Determination of the concentrations of, and hazards from, hazardous substances, agents, and environments shall be made by a qualified industrial hygienist or other competent person as frequently as necessary to ensure the safety and health of the work environment.

Evaluation criteria are used as guidelines to assess the potential health effects of occupational exposures to substances and conditions found in the work environment. These criteria are generally established at levels that can be tolerated by most healthy workers occupationally exposed day after day for a working lifetime without adverse effects. Because of variation in individual susceptibility, a small percentage of workers may experience health problems or discomfort at exposure levels below these existing criteria. Consequently, it is important to understand that these evaluation criteria are guidelines, not absolute limits between safe and dangerous levels of exposure.

Exposure to any chemical or physical agent via inhalation, ingestion, skin absorption, or physical contact in excess of the acceptable limits specified in 29 CFR 1926, Subpart Z and/or the American Conference of Government Industrial Hygienists (ACGIH) "Threshold Limit Values and Biological Exposure Indices" shall be prohibited. In the event of conflicts between ACGIH and OSHA criteria, the more stringent shall prevail.

## **6. HAZARDOUS WORK REQUIREMENTS**

### **6.1 ASBESTOS**

If work involves asbestos-containing material (ACM), the Company may elect to remove all such material from affected work surfaces before Seller initiates work. At least 14 days' advance notice must be provided to the Company for the area(s) requiring ACM removal.

For Seller ACM removal, the Seller shall:

- Remove identified asbestos material using state-of-the-art work practices and engineering controls as required in 29 CFR 1926.1101, Appendixes A, C, D, E (mandatory), and Appendix F (non-mandatory);
- Conduct works in compliance with 40 CFR Part 61 and 40 CFR Part 763. Handle waste in compliance with 49 CFR Part 171 and 49 CFR Part 172;
- Perform post-abatement visual inspections to confirm that horizontal and vertical surfaces are free of residual dust and debris; and
- Perform clearance sampling prior to removal of critical barriers. Clearance levels shall be 0.01 fibers per cubic centimeter (f/cc) or less, or the background level if this is greater than 0.01f/cc but less than 0.1f/cc. Sample results shall be shared with the Company.

The Company will issue Asbestos Work authorization, Notice of Intent to Demolish or Renovate permits, and Waste Shipping records.

Submit copies of training records, as requested, for Seller Competent Person and Asbestos Workers to the Company prior to the start of work.

Products contains asbestos shall not be used at SNS without the consent and approval of the Company.

## **6.2 COMPRESSED GAS CYLINDERS**

Seller must ensure that these containers are not defective or leaking any product.

Containers not bearing legibly written, stamped, or stenciled identification of the contents shall not be used.

Compressed gas cylinders shall not be used as rollers, supports, or for any purpose other than to contain and use the contents as received.

The container valve shall be kept closed at all times (charged or empty), except when the container is in use.

Compressed gas containers shall not be rolled in the horizontal position or dragged. A suitable hand truck, forklift, or similar material handling device should be used with the container properly secured to the device.

Containers are not to be stored near readily ignitable substances, such as gasoline, oil, or scrap material.

All compressed gas cylinders shall be stored and used valve end up. The cylinders shall be secured to prevent instability.

Valve protection caps should always be in place and hand tight, except when cylinders are in use or connected for use.

## **6.3 CONFINED SPACE**

Seller shall submit the Seller's Confined Space Procedure for Company approval or shall follow the Company's Confined Space Program and training requirements.

A confined space is defined as a space that:

- Is large enough and so configured that an employee can bodily enter and perform assigned work;
- Has limited or restricted means for entry or exit—for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry; and
- Is not designed for continuous employee occupancy.

A permit-required confined space has one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere,
- Contains a material that has the potential of engulfing an entrant,
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section, and
- Contains any other recognized serious acute safety or health hazard.

Operations involving a confined space entry require an evaluation of work by the Seller and the Company's S&H Representative to classify the space as permit-required or non-permit-required.

Permit-required confined spaces require a confined space permit that addresses all elements of 29 CFR 1910.146.

Retrieval equipment shall be provided to facilitate non-entry rescue for all permit-required spaces unless evaluation of the permit-required confined space determines that the use of retrieval equipment creates greater health and safety hazards. In this case, rescue services shall be notified that entry into the confined space will be necessary to perform rescue operations.

#### **6.4 DEMOLITION**

The Seller shall perform an engineering survey of the structure to determine the condition of the framing, floors, and walls, and the possibility of unplanned collapse of any portion of the structure. The Seller shall provide written evidence that such a survey has been performed.

The Company shall ensure that electric, gas, water, steam, and other service lines are shut off, capped, or otherwise controlled outside the building line before demolition work is started.

For demolition projects specific to the Company's Facilities Disposition Program, the Company will perform building deactivation, termination, and/or relocation (if required). Visible air-gapping for utility deactivation and termination will be performed where possible. The Seller will verify that appropriate lockouts, tagouts, or air gaps are in place, and that systems have been de-energized prior to commencing work on those systems.

The Company shall determine if any type of hazardous chemicals, gases, explosives, flammable materials, or similarly dangerous substances have been used in any pipes, tanks, or other equipment on the property. When the presence of any such substances is apparent or suspected, testing and purging shall be performed and the hazard eliminated before demolition is started.

The Seller shall perform demolition in accordance to 29 CFR 1926.850 through 1926.860.

#### **6.5 ELECTRICAL SAFETY**

Electrical installation and maintenance operations shall be conducted in accordance with requirements in 29 CFR 1926 Subpart K, applicable requirements in 29 CFR 1910 Subpart S, and the National Electrical Code.

Seller must ensure that electrical work is performed by qualified persons.

Seller must provide a ground fault circuit interrupter for cord sets, receptacles, and electrical tools, including plug and cord connections to generators and equipment for employee use.

All unfinished circuits are to be tested for energy, capped with wire nuts, and pushed into the box by an electrician. All employees are to be instructed that any wires not capped are assumed to be live and are to be reported to an electrician.

Seller must provide three-wire extension cords of continuous length without splices and designed for hard or extra-hard use.

Seller must protect electrical extension cords from pinch points, sharp edges, pedestrian or vehicle traffic, or other potentially damaging configurations. Extension cords must not be fastened with staples, hung with nails, or suspended on wires.

Extension cords must be arranged in a manner that avoids creating tripping hazards.

Seller shall notify the Company prior to any work being done near overhead lines. Overhead lines shall be de-energized and grounded, or other protective measures (guarding, isolating, insulating, etc.) shall be provided, before work is performed in the vicinity of overhead lines. This will be accomplished by the ORNL Electrical Power Operations Group.

Any vehicle operated in proximity to overhead lines shall maintain the following minimum distance:

- Ten feet (305 cm) for voltage of 50 kV or below;
- Ten feet (305 cm) plus 4 inches (10 cm) per 10 kV for voltage greater than 50 kV; or
- Four feet (122 cm) for vehicles in transit, with its structure lowered for voltages 50 kV or below, with clearance increased 4 inches (10 cm) for every 10 kV over that voltage.

Live parts to which an employee might be exposed shall be put into an electrically safe work condition before an employee works on or near them, unless the deenergizing introduces additional or increased hazards or is infeasible due to equipment design or operational limitations. Energized parts that operate at less than 50 volts to ground and containing less than 10 joules of stored electrical energy are not required to be deenergized if there will be no increased exposure to electrical burns or to explosion due to electric arcs.

Shared neutrals are not permitted for new construction unless otherwise approved by the Company. The approval for shared neutrals shall be obtained prior to installation.

“Working on or near” or “working hot” requires approval by the Company utilizing Appendix C, “Energized Electrical Work Permit.” Seller shall follow the guidelines presented in Appendices D, E, F, G, H, I, J, and K for determining approach boundaries and PPE. These appendices were derived from NFPA 70E, “Standard for Electrical Safety Requirements for Employee Workplaces.” The task-specific hazard analysis is utilized to ensure that workers understand their role in the work to be performed, as well as what others involved in that project or task will be doing.

All electrical equipment utilized by the Seller shall be certified by a Nationally Recognized Testing Laboratory or shall be inspected by an SNS Electrical Inspector.

## **6.6 ELEVATED WORK/FALL PROTECTION**

Seller must provide appropriate fall protection for its employees working 6 feet or more above the work surface. This includes steel erection. The Seller competent person must fully evaluate the work conditions and environmental factors (including seasonal weather changes) before selecting the appropriate fall protection system (active, passive, or a combination of measures, as appropriate). Such evaluation is to be included in the hazard analysis for the task.

Employees shall be trained in the selection and safe use of fall protection systems before the equipment is used. This can be accomplished in a safety meeting or pre-job briefing.

### **Types of Fall Protective Systems**

A personal fall arrest system (PFAS) is a means used to arrest an employee in a fall from a work level. It consists of an anchorage, connectors, and a body harness and will include a lanyard, deceleration device, lifeline, or a combination of these. Anchorage shall be capable of sustaining static loads, applied in the directions permitted by the PFAS, of at least 5,000 pounds per user attached.

A restraint is a full body harness used as a component of a restraint system to prevent the user from reaching a fall hazard. Anchorage must support a minimum of 3,000 pounds per person attached.

A work positioning system of a full body harness is a component to support the user at a work position. Anchorage must support at least 3,000 pounds per person attached.

A warning line system is a barrier erected to warn employees that they are approaching an unprotected edge. It also designates an area in which work may not take place without the use of a guardrail, personal fall arrest system, or a safety net to protect employees. Utilization of a warning line system shall be per applicable OSHA regulations.

A guardrail system is a barrier erected to prevent employees from falling to lower levels.

A controlled access zone is an area in which certain work (e.g., overhead brick-laying) may not take place without the use of guardrail, personal fall arrest, or safety net systems, and access to the zone is controlled.

A safety monitoring system is a system in which a competent person is responsible for recognizing and warning employees of fall hazards.

A safety net system can be used when the workplace is more than 25 feet above the ground, is a water surface or other surface where the use of ladders, scaffolds, catch platforms, temporary floors, safety lines, or a safety harness is impractical.

## **6.7 EXCAVATION/PENETRATION**

The excavation/penetration permit process is utilized to provide for the safety of personnel and protection of existing utilities and facilities during work activities requiring excavations and/or penetrations into structures. Seller is responsible for following the Company's excavation/penetration permit procedure/process.



Prior to excavation/penetration, the estimated location of utility installations (e.g., sewer, telephone, water, fuel, electric lines) underground and in walls, floors, etc. shall be determined by the Company and protected from damage or displacement. Before excavation/ penetration, the Company will provide the Seller with an excavation/penetration permit. The permit shall be posted at the work site.

For penetrating activities (including installation of fasteners less than 2 inches) where the subsurface elements are unknown, the following requirements will be performed:

- Assure GFCI protection on electrically operated equipment/tools,
- Connect non-double-insulated electrically operated equipment/tools with an insulated #8 AWG or larger copper conductor,
- Connect non-electrically operated coring/cutting machines to ground with an insulated #8 AWG or larger copper conductor,
- Require appropriately rated electrically insulated gloves, and
- Investigate/survey for identification of subsurface elements.

Excavation/penetration work activities excluded from the permit process are as follows:

- Maintenance replacements of the same location, depth, and size as the items being replaced (i.e., sign posts, bollards, poles, asphalt milling, etc.),
- Soil borrow areas pre-designated by the Company,
- Earth/rock excavations 12 inches or less in depth with surface area not in excess of 25 square feet, using hand-held tools excluding jackhammers.

## **6.8 FLAMMABLE AND COMBUSTIBLE LIQUIDS**

Only approved containers and portable tanks shall be used for storage and handling of flammable and combustible liquids. Approved safety cans or Department of Transportation approved containers shall be used for the handling and use of flammable liquids in quantities of 5 gallons or less (this does not apply to those liquids that are extremely hard to pour, which may be handled in original containers). For quantities of 1 gallon or less, the original container may be used for storage, use, and handling of flammable liquids.

Containers of flammable and combustible liquids shall be tightly capped when not in actual use.

Flammable liquids may be used only where there are no open flames or other sources of ignition within 50 feet of the operation, unless conditions warrant greater clearance.

All sources of ignition shall be prohibited in areas where flammable and combustible liquids are stored, handled, and processed. Suitable “No Smoking” or “Open Flame” signs shall be posted in all such areas.

Areas where flammable or combustible liquids are transferred at one time, in quantities greater than 5 gallons from one tank or container, shall be separated from other operations by 25 feet distance or by construction having a fire rating of at least 1 hour.

A fire extinguisher, rated not less than 10B, shall be provided within 50 feet of wherever more than 5 gallons of flammable or combustible liquids are being used on the job site. This does not apply to the integral fuel tanks of motor vehicles.

ORNL will provide firefighting services. Seller employees must use a facility phone to dial 911 or pull a fire alarm box to notify ORNL for emergency response. If using a privately owned cell phone, Seller must call the Laboratory Shift Superintendent (LSS) at 574-6606.

## **6.9 HAND AND POWER TOOLS**

Hand and power tools shall be used, inspected, and maintained in accordance with the manufacturer's instructions and shall be used only for the purpose for which designed.

Power tools designed to accommodate guards shall be equipped with such guards when in use. Reciprocating, rotating, and moving parts of equipment shall be guarded if exposed to contact by employees or otherwise create a hazard.

Tools and equipment showing evidence of safety hazards shall not be brought on site. Should hazards become evident after work is initiated, remove the tool from use, clearly indicate the tool is not to be used, and take the tool from the site at the end of the work shift.

## **6.10 HAZARD COMMUNICATION**

Seller must demonstrate compliance with a hazard communication program including employee information and training, provisions for labeling, and availability of material safety data sheets (MSDSs).

Seller shall maintain MSDSs for hazardous chemicals brought on-site and shall supply information regarding hazardous chemicals to the project representative prior to initiation of activities that may potentially expose project personnel to a hazard at the job location.

Upon request, Seller shall provide the Company any applicable MSDS as required by OSHA.

Seller shall remove all unused chemicals or materials brought to the site at the completion of the job.

## **6.11 HEAT AND COLD STRESS**

Personnel exposed to temperature extremes shall be protected in accordance with the American Conference of Governmental Industrial Hygienists (ACGIH) guidelines by implementing appropriate engineering controls, work-rest regimens, and/or personal protective equipment.

## **6.12 HOISTING AND RIGGING**

Hoisting and rigging activities shall be performed in accordance with 29 CFR 1910 Subpart N, 29 CFR 1926 Subparts H and N, DOE Standard 1090, and ANSI B30 and B56 Series.

All operations that require hoisting and rigging shall have a HA and appropriate lift plan prior to beginning work to ensure safety and compliance.

Certification documents showing that Seller hoisting and rigging equipment meets the requirements will be provided to the Company for review. If an inspection certificate expires while the equipment is on site, the equipment will be re-inspected and the inspection certificate updated before continuing work activities.

Equipment operators/riggers, including alternates, shall be qualified to perform their assigned functions. Qualifications shall include physical, knowledge, and skills proficiency based on job function.

The four-leg slings shall be rated as two-leg slings, since it cannot always be determined that all legs will be loaded equally. Other multiple-leg slings should be given due consideration for possible uneven loading.

Each lift shall be classified as ordinary or critical. Lift plan forms are available from the Company Project Manager.

### **6.12.1 Critical Lift**

A lift will be considered critical when any one of the following conditions exists:

- The load item, if damaged or upset, would result in a release into the environment exceeding established permissible environment limits of radioactivity or other hazardous material or other undesirable conditions.
- The load item is unique and, if damaged, would be (1) irreplaceable or (2) not repairable and is vital to a system, facility, or project operation.
- The cost to replace or repair the load item or the delay in operations of having the load item damage would have a negative impact on facility, organizational, or DOE budgets to the extent that it would affect program commitments.
- A lift not meeting the above criteria shall also be designed critical if mishandling or dropping of the load would cause (1) any of the above-noted consequence to nearby installation or facilities or (2) if there was undetectable damage it would jeopardize future operations or the safety of a facility.
- It is necessary to use two or more cranes or forklifts or special hoisting/rigging equipment.
- The lift exceeds 75% capacity of crane (steel erection only).
- The load requires exceptional care in handling because of size, weight, close-tolerance installation, high susceptibility to damage, or other unusual factors.

The critical lift plan must be developed by the Seller in conjunction with the SHP and HA. The critical lift plan must be approved by:

- Subcontractor Lift Supervisor,
- Subcontractor Safety and Health Representative/Designee,
- Operators performing the lift,
- Project Engineer,
- Project Manager,
- Project Safety and Health, and
- Company Level II Manager.

Required attachments to the critical lift plan include:

- Crane operator certification must be issued through a certified competent and must be up-to-date, and all operator certifications must be attached to the plan or be on file;
- Type, size, capacity, engineered designs, and manufacturer of shackles, hooks, jacks, rollers, come-a-longs, spreader bars, and slings;
- Type, size, capacity rating, manufacturer, capacity certificates, and inspection reports for all cranes and other lifting equipment; and
- Lift geometry and free body diagrams to illustrate the individual tensions of each sling involved in the lift, and any shift of weight when the load is lifted.

A complete rigging diagram must be attached to the critical lift plan. The rigging diagram must include the entire rigging process and the following minimum information:

- Type and capacity of lifting equipment;
- Crane boom length, radius, and location of outriggers;
- A plot of the path of travel including all vertical and horizontal clearances from such items as adjacent equipment, power lines, and other encumbrances or hazards;
- Location, size and capabilities of lifting lugs, slings, and other rigging accessories as well as the method of attachment;
- Position of load in relation to the boom to show hook clearance and distance between the boom and the load;
- Description, size, capacity, and location of miscellaneous equipment such as dollies, jacks, hand wrenches, rollers, etc.;
- Location of mats and cribbing used before, during, and after the lift;
- Location and orientation of equipment; and
- Location of underground lines (utility lines, electrical duct banks, cables, etc.), abandoned vessels and tanks, and foundations.

Critical lift plans must be submitted to the Company nominally 5 working days prior to making the lift.

Hoisting and rigging equipment (e.g., slings, shackles, etc.) used for critical-lift service shall have an initial proof load test of 200 percent of the rated capacity.

### **6.12.2 Ordinary Lift**

Any lift that does not meet the definition of a critical lift is considered an ordinary lift. The ordinary production lift plan form can be used or the information can be included in the JHA/lift ticket. The ordinary lift plan/lift ticket must include type, size, and capacity of hoisting and rigging equipment, lift geometry and free body diagram to illustrate the individual tensions on each piece of equipment.

Ordinary production lift plans must be submitted to the Company nominally 5 working days prior to making the lift.

Ordinary production lift plans must be approved by the Seller's supervisor and safety and health representative, and the Company's safety and health representative and Company Project Manager.

### **6.13 LEAD**

Work involving lead shall be performed according to 29 CFR 1926.62, Lead.

The HA shall contain a description of each operation/task in which lead may be emitted and a description of the specific means that will be employed to achieve compliance.

Every task associated with handling/disturbing lead and lead-containing paints shall be evaluated to determine if the employees may be exposed to lead at or above the action level (30 micrograms per cubic meter of air calculated as an 8-hour time-weighted average). Where a determination is made that an employee may possibly be exposed at or above the action level, seller shall conduct an exposure assessment to include personal air monitoring, if feasible, to determine employee exposure.

Seller shall, if possible, remove lead containing paint from affected work surfaces before initiating work (grinding, torch cutting and burning, demolition by sledge hammer or similar tool, manual scraping, manual sanding), which could generate an aerosol. Chemical stripping is the preferred method of paint removal.

The Company may elect to remove all lead paint from affected work surfaces before Seller initiates work. Provide at least 14 days advance notice to the Company for the area(s) requiring lead removal.

### **6.14 LOCKOUT/TAGOUT**

Lockout/tagout (LOTO) procedures must be strictly followed when it is necessary to work on any equipment that may release hazardous energy while the equipment is shut down. Energy means mechanical motion, potential energy due to pressure, gravity, or springs, electrical energy, or thermal energy.

LOTO is required whenever servicing, maintenance, or modification is being performed on equipment in which the unexpected energization or startup of the equipment, or the release of stored energy, could cause injury to people. All sources of hazardous energy must be shut off and secured. LOTO must be performed by each person who works on the equipment.

The Company will perform a LOTO of applicable Company controlled systems and equipment. Seller must provide at least 2 working days advance notice to the Company of systems requiring LOTO.

Following the initial isolation and LOTO by the Company, a representative of the Seller shall review and approve the protection provided. Seller employees shall verify isolation, and overlock isolation points (or a lockbox) with their personal locks. These locks shall be identified with the Seller employee's name and a unique employee identification number (a tag can be used to provide identifying information). A detailed tag must be used in conjunction with the lock if the lockout period extends beyond the work shift. Necessary information will include who locked and tagged out the energy source, brief description of task, and the date tag was applied.

Upon completion of work, Seller employees shall remove all personal locks and notify the Company. The removal of the project lock(s) shall not precede the removal of the Seller lock(s).

Hazardous energy sources introduced by the Seller must be controlled through the use of Seller's hazardous energy control procedure. The Seller shall submit the Seller's hazardous energy control program/procedure for Company's review and approval. The procedure/HA must include/address the following:

- The authorized employee must assess the type, magnitude, and hazards of the energy to be controlled.
- The authorized employee must determine the appropriate methods of controlling the hazardous energy (e.g., disconnect switch or valve). Note: push buttons, selector switches, interlock circuits, and other control type devices are not energy-isolating devices.
- The authorized employee must notify all affected employees of the impending shutdown, the reasons for it, and anticipated duration of shutdown.
- The authorized employee must verify that it is safe to shut down the equipment.
- The authorized employee must turn off or shut down the equipment using established methods for that equipment.
- The authorized employee must operate the energy-isolating device and affix his/her LOTO lock to this device. The lock must be affixed so as to hold the energy-isolating device in an off or safe position that physically prohibits normal operation of the energy-isolating device. Where more than one authorized employee is involved in the job and a Group LOTO procedure is not used, each authorized employee must affix his/her personal lock using a multiple lock hasp.
- The tag is used to provide identifying information. The authorized employee must complete all appropriate information on the tag. If the placement of the tag would compromise safety by obscuring indicator lights or controls, the tag may be located as close as is safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device. Where more than one authorized employee is involved in the job, and a Group LOTO procedure is not used each authorized employee must affix his/her own personal tag on a multiple lock hasp.
- The authorized employee must completely release or otherwise control any stored energy. In the case of stored mechanical energy, vent valves, spring releases, blocking devices, or equipment repositioning (as appropriate) must be utilized. In the case of stored electrical energy, approved grounding wands or discharge devices must be used.
- If there is a possibility of re-accumulation of stored energy to a hazardous level, verification of isolation must be continued until the servicing, maintenance, or modification is completed or until the possibility of such accumulations no longer exists. The equipment must be in a zero-energy state.
- For verification, the authorized employee must physically attempt to operate the energy-isolating device and attempt to restart the equipment using the normal equipment controls (e.g., push buttons, selector switches, and electrical interlocks or otherwise verify that the equipment cannot be restarted).
- If the equipment is electrical, the authorized employee must additionally test potential electrical energy sources using appropriate instruments or testers. The authorized employee shall use test equipment to verify that the circuit elements and equipment parts are de-energized, and shall also determine if any energized condition exists as a result of inadvertently induced voltage or unrelated voltage back-feed even though specific parts of the circuit have been de-energized and presumed to be safe. If the authorized employee is not qualified to test the energy being isolated,

he/she must ensure that a qualified person tests the energy. If the circuit to be tested is over 600 volts, nominal, the test equipment must be checked for proper operation before and immediately after this test. Note: All test equipment must be checked for proper operation regardless of the voltage. Circuits over 600 volts may require special test equipment.

Although electrical LOTO verification/testing is only properly performed on de-energized equipment, there can be occasional surprises (e.g., multiple feeds or sources, or stored electrical energy) and such verification may indeed be on or near unexpectedly energized (live) electrical parts. As such, electrical LOTO verification shall be treated as “working on or near.” The qualified worker must approach the hazard with the assumption that the system is energized until it is verified to be de-energized, and as such must follow the guidelines presented in Appendixes G, H, I, J, K, L, and M for determining approach boundaries and PPE. These Appendixes were derived from NFPA 70E, “Standard for Electrical Safety Requirements for Employee Workplaces.” The “working on or near” or “working hot” permit is not required for LOTO verification/testing.

Before LOTO devices are removed and energy is restored to the equipment, the authorized employee must:

- Verify that it is safe to remove and/or reenergize. The authorized employee must verify that the work for which the LOTO was applied has been completed and that it is safe to reenergize equipment. The authorized employee must check the work area to ensure that all tools and personnel are at a safe distance from the equipment;
- Remove all isolating and grounding devices. The authorized employee must check the equipment to ensure that any removed guards are reinstalled; and
- Remove lock and tag, reset the energy-isolating device, and return the machinery to service. The authorized employee must notify all affected employees that the equipment is back in service.

## **6.15 LOGGING/TREE REMOVAL**

Operations including, but not limited to, felling trees (cutting, as opposed to bulldozing trees), cutting branches off trees and logs, cutting felled trees into logs, chipping branches, and loading and unloading logs in the preparation for construction activities are considered to be a logging operation and shall be accomplished in accordance with the requirements of 29 CFR 1910.266, Logging Operations.

Prior to felling operations, a survey shall be conducted to identify overhead electrical hazards. The findings of this survey and the controls for all potential hazards shall become a part of the hazard analysis.

Prior to felling operations, the work area shall be cleared to permit safe working conditions and an escape route shall be kept clear of the work area. The distance between adjacent occupied work areas shall be at least two tree lengths of the trees being felled.

The ORNL Electrical Power Operations Group shall be notified prior to any work being done near overhead lines.

The Seller shall provide, at no cost to the employee, and assure that each employee who operates a chain saw wears eye, ear, hand, and foot and leg protection constructed with cut-resistant material. The leg protection shall cover the full length of the thigh to the top of the boot on each leg to protect against contact with a moving chain saw.

Each employee performing a logging operation shall work in a position or location that is within visual or audible contact with another employee.

## **6.16 POWER TRANSMISSION AND DISTRIBUTION**

Seller shall perform work in compliance with Subpart V, “Power Transmission and Distribution” (Sections 1926.950–960).

As used in Subpart V, the term “construction” includes the erection of new electric transmission and distribution lines and equipment, and the alteration, conversion, and improvement of existing electric transmission and distribution lines and equipment.

Existing conditions shall be determined before starting work, by an inspection or a test. Such conditions shall include, but not be limited to, energized lines and equipment, conditions of poles, and the location of circuits and equipment, including power and communication lines, CATV, and fire alarm circuits.

Electric equipment and lines shall be considered energized until determined to be de-energized by tests or other appropriate methods or means.

No employee shall be permitted to approach or take any conductive object without an approved insulating handle closer to exposed energized parts than shown in Table 1, unless:

- The employee is insulated or guarded from the energized part (gloves or gloves with sleeves rated for the voltage involved shall be considered insulation of the employee from the energized part); or
- The energized part is insulated or guarded from him and any other conductive object at a different potential; or
- The employee is isolated, insulated, or guarded from any other conductive object(s), as during live-line bare-hand work.

The minimum working distance and minimum clear hot stick distances stated in Table 1 shall not be violated. The minimum clear hot stick distance is that for the use of live-line tools held by linemen when performing live-line work.

Conductor support tools, such as link sticks, strain carriers, and insulator cradles, may be used, provided, that the clear insulation is at least as long as the insulator string or the minimum distance specified in Table 1 for the operating voltage.



**Table 1. Alternating Current – Minimum Distances**

<b>Voltage Range (Phase to Phase) (kilovolt)</b>	<b>Minimum Working and Clear Hot Stick Distance</b>
2.1 to 15	2 ft. 0 in.
15.1 to 35	2 ft. 4 in.
35.1 to 46	2 ft. 6 in.
46.1 to 72.5	3 ft. 0 in.
72.6 to 121	3 ft. 4 in.
138 to 145	3 ft. 6 in.
161 to 169	3 ft. 8 in.
230 to 242	5 ft. 0 in.
345 to 362	7 ft. 0 in. <sup>a</sup>
500 to 552	11 ft. 0 in. <sup>a</sup>
700 to 765	15 ft. 0 in. <sup>a</sup>

<sup>a</sup>For 345–362 kV, 500–552 kV, and 700–765 kV, the minimum clear hot stick distance may be reduced provided that such distances are not less than the shortest distance between the energized part and the grounded surface.

The employer shall provide training or require that his employees are knowledgeable and proficient in procedures involving emergency situations, and first-aid fundamentals, including resuscitation.

When construction work is performed in an energized substation, authorization shall be obtained from the designated, authorized person before work is started.

When work is to be done in an energized substation, the following shall be determined:

- The facilities to be energized, and
- The protective equipment and precautions necessary for personnel safety.

### **6.17 RESPIRATORY PROTECTION**

The Seller will determine which respirator type or class will offer adequate protection based on:

- The respiratory hazard(s) to which the worker may be exposed,
- The workplace and user factors that have the potential to affect respirator performance and reliability,
- His or her informed professional judgment, and
- Scientific literature.

The Seller shall provide respirators in accordance with the following:

- If Seller employees are required to wear negative or positive pressure, tight-fitting respirators, they shall have been medically evaluated;
- Ensure respirator wearers have completed the respirator quantitative fit testing and respirator training;

- Provide respirators and cartridge type specified to protect worker from exposure to identified or suspected hazards as specified in the hazard analysis;
- Provide breathing air, if required. Submit data to Company demonstrating the compressed breathing air quality supplied to the air respiratory protections systems meet the ANSI/CGA G7.1, Commodity Specification for Air, requirements;
- Provide optical corrections for appropriate respirators;
- Ensure that all respirators are NIOSH certified; and
- Seller shall submit its Respiratory Protection Program for the Company's review and approval.

#### **For Company Supplied (e.g., Radiological Areas)**

If Seller personnel performs work in areas that are known to be contaminated or areas that are potentially contaminated with radioactive material, the Company will provide the required respiratory protection for all tasks requiring respirators. Company shall provide respirators in accordance with the following:

- A quantitative fit test and respirator training shall be performed by the Company's Respiratory Protection Program. Company will provide the Respirator Fit Test and Respirator Training, 4 Hours. Seller employee shall submit medical evaluation documentation per 29 CFR 1926.103, before starting the fit test and training. Company requires a minimum of one week prior notification of initiation of work to schedule fit test and training. Company Respiratory Protection Program can be reached at 574-6170 for scheduling.
- Only personnel with current Company General Respirator Training and a quantitative fit test can pick up respiratory protection equipment for project activity use. However, the Seller's S&H person or designated superintendent can pick up respiratory protection equipment for personnel other than themselves provided they have passed the requirements for Company Respirator Issuer Training.
- The number of personnel needing a respirator shall be submitted at least 48 hours before the scheduled need.

Company health physics (HP) personnel shall check, appropriately tag, and segregate for disposal, all respirator equipment before it is removed from the site.

#### **6.18 SANITATION**

An adequate supply of drinking water shall be provided by the Seller. Portable drinking water dispensers shall be designed, constructed, and serviced to ensure sanitary conditions; shall be capable of being closed; and shall have a tap. Containers shall be clearly marked as to their contents and shall not be used for other purposes. Water shall not be dipped from containers. The common drinking cup is prohibited.

When sanitary sewers are not available, chemical toilets and hand-washing facilities shall be provided and maintained by the project.

## 6.19 SCAFFOLDING

The following are general requirements for construction, operation, maintenance, and use of scaffolds used in maintenance of buildings and structures and construction. Consult 29 CFR 1910.28 for additional requirements applicable to specific types of scaffolds used in general industry and 29 CFR 1926 Subpart L for construction.

- Provide fall protection for scaffolds over 10 feet in height in the form of guardrails or personal fall arrest systems.
- Ensure that working levels are fully planked.
- Ensure that scaffolds and associated components are capable of supporting four times the maximum intended load.
- Provide fall protection for employees erecting or dismantling scaffolds where there is exposure to falls from a height of 6 feet or more whenever the installation and use of such protection is feasible and does not create a greater hazard.
- Provide scaffolds with guardrails, toeboards, and midrails, as appropriate, for the type of scaffold used and the work to be performed.
- Erect scaffolds on sound footings or anchorage which is rigid and capable of carrying the maximum intended load without settling or displacement. Unstable objects such as barrels, boxes, loose brick, or concrete blocks shall not be used to support scaffolds or planks.
- Do not load scaffolds in excess of the working load for which they are intended.
- Maintain scaffolds in a safe condition.
- Do not alter scaffolds or move them horizontally while they are in use or occupied.
- Damaged or weakened scaffolds shall be repaired immediately shall not be used until repairs have been completed.
- Provide an access ladder or equivalent safe access to the scaffold.
- Do not work on scaffolds during storms or high winds.
- Do not work on scaffolds which are covered with ice or snow, unless all ice or snow has been removed and the planking sanded to prevent slipping.
- Do not allow tools, materials, and debris to accumulate in quantities to cause a hazard.
- Secure scaffolds to permanent structures, through use of anchor bolts, reveal bolts, or other equivalent means. Do not use window cleaners' anchor bolts to anchor a scaffold to a structure.
- Ensure that protection is provided from falling objects such as hand tools, debris, or other small objects by installing toeboards, screens, debris nets, etc.
- Scaffolds and scaffold components shall be inspected for visible defects by a competent person before each work shift (29 CFR 1926 construction only), and after any occurrence which could affect a scaffold's structural integrity.

## **6.20 STAIRWAYS AND LADDERS**

Ladders shall be used, inspected, and maintained in accordance with 29 CFR 1926 Subpart X, “Stairways and Ladders”; 29 CFR 1910 Subpart D, “Walking-Working Surfaces”; and the manufacturer’s instructions. Ladders shall be used only for the purposes for which designed, and shall be inspected.

Additional requirements for ladders used on or with scaffolds are contained in 29 CFR 1926 Subpart L, “Scaffolds.”

## **6.21 STEEL ERECTION**

Seller shall set forth requirements to protect employees from the hazards associated with steel erection activities involved in the construction, alteration, and/or repair of single and multi-story buildings, bridges, and other structures where steel erection occurs. Requirements shall be compliant with 1926 Subpart R, “Steel Erection.”

Seller shall make certain to give emphasis to the following sections of Subpart R: 1926.750, 1926.752, 1926.754, 1926.755, 1926.757, and 1926.760.

## **6.22 WELDING, CUTTING, AND HOT WORK**

The Seller should have a permit system addressing S&H and fire prevention for the following applications when work is conducted in an undesignated area: welding and allied processes, grinding, heat treating, thawing pipes with a torch or flame, torch-applied roofing, powder driven fasteners, hot riveting, and similar applications producing a spark or flame. Designated areas are permanent locations designed or approved for hot work operations to be performed regularly. Examples of hot work permits are contained in NFPA 51B. If the Seller does not have a permit system, then Seller will be required to perform hot work using the Company’s permit system. In all circumstances the Company reserves the right to issue a Company prepared hot work permit as necessary. Company requires 48 hours’ notice to issue Company hot work permit. The Seller shall submit their permit system for Company’s review and approval. The Seller may choose to follow the Company’s procedure for hot work.

All hot work operations shall be coordinated with the Company Facility Manager/ Project Manager, or designee.

The supervisor of the work to be performed shall inspect the area to ensure that preparations are complete, safe conditions exist, and ensure that all listed precautions on the permit have been considered and checked as met or not applicable.

Welders and burners shall wear protective clothing that meets the requirements of ANSI Z49.1. The selected clothing shall be specified in the Seller’s AHA for hot work activities. Fire watchers who may be exposed to the same hot work hazards as the welders and burners shall also wear the selected protective clothing.

If operations require welding/burning/hot work where anti-contamination clothing is required, Seller personnel shall wear flame-resistant clothing for all layers. Flame resistant clothing shall meet the requirements of NFPA 701. Fire watchers who may be exposed to the same hot work hazards as the welders and burners shall also wear the selected protective clothing.

A fire watch must be designated if any of the following conditions exist:

- A significant amount of combustible material is closer than 35 ft to the point of operations;
- A significant amount of combustible material is more than 35 ft away, but could be easily ignited by sparks;
- Hot work is conducted in areas where the employee must wear multiple layers of clothing and respiratory protection.

The fire watch shall be instructed to:

- Remain present in direct line of sight to the work area and perform no other activities other than fire watch duties;
- Be alert for any condition that could lead to a fire;
- Guard passers-by from welding hazards;
- Interrupt the work when a hazardous condition develops and deal with the situation appropriately;
- Ensure that appropriate fire extinguishing equipment is readily available and know how the equipment is to be used;
- Remain on the scene for at least 30 minutes after completion of hot work to detect and report a fire resulting from stored heat.

## **7. ENVIRONMENTAL PROTECTION AND WASTE MANAGEMENT**

This section provides environmental protection and waste management requirements for on-site activities.

### **7.1 STORM WATER POLLUTION PREVENTION AND CONTROL**

- Prior to mobilization to the site, perform an inspection of equipment containing liquid systems including, but not limited to, bulldozers, backhoes, bobcats, drill rigs, trucks, hoists, and cranes, to ensure no leaks exist. Verify hoses, tubing, and hydraulic lines are in good operating condition. Make all necessary repairs before delivery of equipment or vehicles to the site.
- Perform daily inspections to ensure continued good operating condition of equipment and promptly repair all deficiencies.
- Store all materials indoors or otherwise protected from weather.
- For outdoor painting operations, minimize overspray, and use tarps/vacuums/enclosures to contain sandblasting waste and paint chips from paint removal operations.
- Petroleum products stored in quantities greater than 500 gallons shall be appropriately labeled and have secondary containment capable of preventing any release to a drainage system or the environment.
- Do not allow liquids, including but not limited to, gasoline, diesel fuel, lubricating oil, or antifreeze to enter the storm sewer systems, waterways, drainage ditches, or the ground.
- Use due caution when operating oil-bearing equipment near aquatic resources. Where necessary, implement appropriate control measures, including but not limited to the use of physical barriers

(plastic or tarps, berms, etc.) and or absorbent materials to prevent leaks or spills from entering waterways.

- Maintain a 25-foot minimum buffer zone from streams, be aware of storm drain inlets, and cover or contain debris stored outside.
- Flushing empty concrete trucks or dumping excess concrete is prohibited. Transport excess concrete back to the batch plant. The truck chute may be washed at the work site. Flush the truck chute at designated on site location. The Company/Project Manager will designate the location. Solidified cement waste from truck chute cleaning is solid waste and shall be cleaned-up and transported to the Landfill.
- Conduct all pipeline sanitization, flushing, hydrotesting, etc. in a manner protective of the environment. The Company/Project Manager will designate the approved discharge location(s).
- Water used to disinfect or flush pipelines cannot be released directly to the environment due to possible high concentration of chlorine. The Company/Project Manager will determine the appropriate storage/treatment and will designate the approved discharge location.
- Unless otherwise directed by the Company/Project Manager, all chlorinated or treated water shall be discharged through a treatment/detention basin and monitored for chlorine levels, other contaminants when applicable, and standard water quality indicators. The treatment/detention basin may consist of a field-constructed structure or portable tank.
- Storm water accumulated in excavated areas, chlorinated rinse water, and chlorinated water used to sanitize/flush pipelines shall not be directly discharged, or otherwise allowed to enter the storm systems, waterways, or drainage ditches without written approval from the Company/Project Manager.

## **7.2 EROSION PREVENTION AND SEDIMENT CONTROL**

- Manage excavated soil and spoil material in a manner protective of the environment. Cover stockpiled material to prevent erosion and/or install appropriate sediment controls. Use due caution during excavation or any other soil management in the vicinity of sanitary or storm systems, waterways, or drainage ditches.
- All erosion prevention measures and sediment controls (silt fence, straw bales, catch basins, etc.) shall be in place and approved by the Company/Project Manager prior to beginning excavations, road building, etc. Sediment barriers such as silt fence and straw bales shall be entrenched and of sturdy construction.
- Perform inspection of erosion and sediment controls on a weekly schedule, prior to expected storm events and after each heavy rainfall event. Document each inspection.
- Where appropriate, provide temporary or permanent modifications to surface terrain gradient (soil or crushed stone berms, sediment retention basins, etc.) in order to minimize the flow of storm water into or out of excavated or otherwise disturbed areas.
- All erosion and sediment control measures shall be maintained throughout the course of the project and removed at completion of project and appropriate measures taken to return the area to its previous state. Maintenance shall include, but not be limited to, removal of accumulated sediment, and repairs and/or replacement of storm damaged or otherwise deteriorated structures.

- All disturbed areas shall be stabilized as soon as practicable by appropriate means, including but not limited to the use of mulch or other temporary cover, seeding with vegetative ground cover, etc.

### **7.3 SPILL PREVENTION AND CONTROL**

- Report all spills promptly to the Company/Project Manager/Company Environmental Officer who will determine the proper management and disposal. If the release is of a reportable quantity, the Project Manager will notify the appropriate regulatory agency.
- The responsible Subcontractor will perform proper cleanup of accidental releases of materials. Cleanup is to be done by properly trained personnel. Hazardous waste from the cleanup must be packaged, transported, and disposed of by a licensed entity. The Project Manager must be given a copy of the hauler's manifest.
- Depending on the materials spilled, the Company/Project Manager may require the responsible Subcontractor to hire a certified laboratory to take an appropriate number of soil samples to test at their laboratory. A copy of the results is to be given to the Project Manager.
- For inside work, provide a spill kit, prevent spills to floor drains and do not discharge waste into any ORNL systems without approval.
- For outside work, provide a spill kit, inspect equipment for leaks, and repair leaking equipment in a timely manner.

### **7.4 WASTE MANAGEMENT**

- Subcontractor is responsible for all materials associated with their respective scope of work. As such, the subcontractor will determine whether materials are wastes, and subsequently determine the proper management of those wastes. If subcontractor plans to generate a hazardous waste (as defined by the Resource Conservation and Recovery Act, see 40 CFR 261.3) or generates a hazardous waste as the result of a spill of hazardous material, contact the Project Manager/Company Environmental Officer to determine proper management and disposal.
- Subcontractor will provide containers and/or transport vehicles for excess property for salvage, universal waste, sanitary/industrial waste, and construction/demolition debris.
- Waste Minimization principals shall be incorporated in all activities to ensure the greatest environmental benefits and minimize future liability for the waste that is generated.
- All work will be performed in a manner that maximizes salvage and recycling and minimizes waste disposal to landfills.
- Characterization methods and procedures will be employed by all parties to the contract to ensure that the characteristics of the waste are known and adequately recorded during all stages of the waste management process.
- Subcontractor will be responsible for properly handling and disposing of all wastes generated.

## **8. WORK IN RADIOLOGICALLY CONTAMINATED AREAS**

This section provides requirements for performing work in areas known to be contaminated with radioactive material and/or areas or work operations having a potential of encountering radioactive contamination and/or exposure to ionizing radiation.

### **8.1 SUBMITTALS**

- Seller shall submit a list of the personnel and the applicable training received by each. Provide employee's full name, job title, title of course(s), training date, and training organization. Include a copy of the training certification(s).
- Seller employees, during the check-in process, shall provide information or records regarding prior and concurrent radiation exposure at non-ORNL facilities sufficient to establish the individual's radiation dose status for the current calendar year. Any individual who is monitored by another site or non-ORNL facility concurrent with his/her ORNL assignment (including those monitored by other DOE sites in Oak Ridge) shall notify and authorize ORNL to obtain records of that exposure as often as necessary.

### **8.2 EQUIPMENT, DELIVERY, STORAGE, AND HANDLING**

#### **8.2.1 General**

- The storage and use of equipment and material shall be minimized inside the radiological areas.
- Packaging shall be removed to the maximum extent possible prior to transporting equipment and material into radiological areas.
- Radiologically contaminated waste shall be disposed of in Company furnished metal containers.
- Tools and equipment, including power equipment and temporary scaffolding, shall remain within the "posted area" until surveyed for contamination and tagged for removal by the Company. Contaminated items will be decontaminated by Seller personnel that have had Radiological Worker II training. Provide at least 24 hours advance notice before needing a survey performed.

#### **8.2.2 Company Furnished Equipment**

Equipment shall be requested at least 48 hours in advance and includes:

- Non-disposable coveralls, gloves, shoe covers, and other protective clothing needed to work in radiological areas (disposable items to be provided by the Seller);
- Respirators and cartridges;
- Radiation dosimeters; and
- Equipment necessary to perform required radiological monitoring.



### **8.2.3 Seller Provided Equipment**

- Safety shoes. Shoes that become contaminated cannot leave the radiological area. Upon completion of the project, contaminated shoes shall be decontaminated below release limits or disposed of as contaminated waste.
- Disposable PPE.
- Vacuum cleaners equipped with HEPA filters.
- Portable electric hand tools, equipped with HEPA filters.
- HEPA filters for items 2 and 3 above. Filters shall provide an efficiency of not less than 99.97% when challenged with 0.3 micrometer particle size aerosols.

### **8.2.4 Change Facilities**

- The company will provide change facilities.
- The change facilities shall include clean change areas, showers, lockers, and storage for clean protective clothing.

## **8.3 PREPARATION**

### **8.3.1 Radiation Worker Training**

- Personnel working in radiological areas shall complete a 16-hour Radiation Worker II Training Program and pass a written examination. After completion of the examination, a 2-hour monitoring and a 2-hour dress-out orientation is required. Oral examinations are not permitted. Retraining is required every 2 years. Personnel working in non-posted areas within the Controlled Area shall complete Site Access Training (SAT) or Radiological Training for Visitors.
- Training will be provided by the Company. Submit a written request for training at least 7 days in advance.
- Trained escorts may be used in lieu of Radiological Worker Training to access posted radiological areas; however, work activities while in the area are limited to visual inspections or work observations. Access to the work area shall be done in compliance with SBMS Subject Area Radiation Safety Training and Administrative Access Control.

### **8.3.2 Radiation Monitoring**

- Before starting on-site work, bioassay (urine analysis) and/or in-vitro (body) monitoring is required. Schedule medical monitoring at least 14 days in advance. Monitoring will require 4 hours per employee.
- The Seller personnel on-site for a period of greater than 3 months during the calendar year will be issued radiation dosimeter identification badges before the start of on-site work. Wear dosimeter badges at all times while on-site.

### **8.3.3 Radiation Work Planning**

- The seller will assist the Company in preparation of an ALARA Plan. Submit the ALARA Plan at

least 14 calendar days before work activities.

- The Seller shall request the issuance of an RWP at least 5 calendar days before the scheduled work activity.
- The RWP shall be posted before access is permitted to the radiological area.
- Perform work in accordance to the requirements stated in the RWP.

#### **8.3.4 Equipment Testing**

- Equipment having a HEPA filter shall be tested before used on-site. HEPA filter replacement requires retesting of the equipment. The Company will perform the test in accordance to ASTM D-2986. Notify the Company at least 24 hours in advance of the needed test.

### **8.4 APPLICATION**

#### **8.4.1 Company Provided Services**

- Laundry service for protective clothing and cleaning service for respirators (when disposable PPE is not specified).
- Bioassay and in-vitro monitoring. This service is required of employees before start work, periodically during the project, and on completion of the last day. (Each monitoring activity requires 4 hours.) Copies of personnel exposure records will be provided to the Seller by the Company when radiation monitoring is complete for the project.
- RWP.
- Permits for removal of waste, Seller's tools and equipment.
- Decontamination services of tools, equipment, and personnel.
- Metal storage containers for disposal of contaminated waste.
- Personnel exposure and monitoring records.
- Air monitoring.
- HEPA filter in-place testing.
- ORNL – Qualified Radiological Control Technician.
- Health Physics monitoring.
- Health Physics monitoring instruments.

#### **8.4.2 Radiological Area Requirements (when no dress-out required).**

- Review potential radiological hazards with all personnel working in the radiological area.
- The RWP shall be used to control access to the area. Prior to entry record the entry time, and upon leaving the area record the amount of time spent in the area, and the radiation dose registered by supplemental dosimetry while in the area. This shall be done each time a person accesses the area.

- Transferable contamination is not present. Dress-out is not required.
- No eating, drinking, use of tobacco products or chewing gum.

#### **8.4.3 Radiological Work Area Requirements (when dress-out required)**

- Review potential radiological hazards with all personnel working in the radiological area.
- The RWP shall be used to control access to the area. Prior to entry, record the entry time, and upon leaving the area, the amount of time spent in the area. This shall be done each time a person accesses the area.
- No eating, drinking, use of tobacco products or chewing gum.
- Enter only to perform work required.
- Shoe scuffs are required.
- Personnel monitoring is required before leaving the area.
- Coveralls and gloves are required
- Wear gloves over surgeons gloves (double gloves) when performing hands-on work.
- Requirements when airborne radioactivity is possible are the following:
  - Additional coveralls (two layers) and a hood.
  - Appropriate respiratory protection. Respiratory is required for activities that disturb or damage existing surfaces such as drilling, cutting, or demolition.
  - Double gloves

#### **8.4.4 Containment of Dust and Debris**

The following are requirements for all contaminated work areas.

- Equip portable hand tools used to drill, cut, or otherwise disturb contaminated materials with a HEPA-filtered exhaust ventilation system.
- Always implement dust-suppression techniques. Dry sweeping, using compressed air for cleaning, or other dust-creating activities are prohibited.
- HEPA filters and respiratory cartridges shall be discarded as contaminated waste.
- When possible use engineering controls (e.g., tents, gloveboxes, glovebags) to avoid releases of radioactive material.

#### **8.4.5 Personnel Monitoring (when applicable)**

- Each worker exiting the radiological area into a less restrictive area shall self-monitor. Monitoring instructions will be provided during the Radiation Worker Training. Follow posted instructions and utilize the equipment provided.
  - A whole body frisk is required (estimated time is 4 minutes)
  - A hand frisk is required (estimated time is 2 minutes)
- Contamination is not expected to be found during monitoring. If contamination is found, remain at the monitoring station and notify Company Project Manager/Health Physics.

- Seller shall provide the Company with needed information to issue reports for a radiological event or occurrence.

## **8.5 RADIOGRAPHY WORK**

- Radiographers' licenses are not valid for work on the ORNL site, and so the work will be performed under the ORNL RPP.
- Non-ORNL radiographers are exempt from Radiological Worker I or II training requirement provided they meet applicable Nuclear Regulatory Commission or Agreement state requirements.
- Company will provide an orientation lecture.
- Radiographers will need to sign in on an RWP in order to perform their work.
- Any training equivalences shall be request from the RGD Program Lead and the NRPD Director.
- Radiographers will wear ORNL TLDS and secondary dosimeters and their dose during this work will be assigned to ORNL.
- Radiological posting materials will be provided by RCTs to the radiographers, and the radiographers will post their work area in accordance with ORNL requirements
- The radiation source to be used for this work will be registered for site access approval with Source Control.

**APPENDIX A: DISCIPLINARY ACTIONS BY OFFENSE CLASS AND OCCURRENCE**

<b>OFFENSE</b>	<b>FIRST</b>	<b>SECOND</b>	<b>THIRD</b>
<p><b>Class I</b></p> <ul style="list-style-type: none"> <li>• Creating or contributing to unsanitary conditions due to poor housekeeping</li> <li>• Posting or removing notices on bulletin boards without permission</li> <li>• Eating in unauthorized areas</li> <li>• Failure to report the use of prescription drugs</li> <li>• Unauthorized soliciting of contributions on ORNL/SNS/CNMS Project</li> <li>• Smoking in unauthorized areas (Note: This may be upgraded to a Class V offense if in a hazardous area)</li> </ul> <p>For Fourth Offense, next step in Progressive Disciplinary Policy is 30-day suspension, followed by Access Denial for the Fifth Offense within a 365-day time period.</p>	Verbal reprimand	Written reprimand	3-day suspension
<p><b>Class II</b></p> <ul style="list-style-type: none"> <li>• Unauthorized use of equipment, tools, or machinery</li> <li>• Failure to observe traffic and parking rules</li> <li>• Horseplay</li> </ul> <p>For Fourth Offense within a 365-day time period, next step is Access Denial.</p>	Written reprimand	3-day suspension	30-day suspension
<p><b>Class III</b></p> <ul style="list-style-type: none"> <li>• Gambling on site</li> <li>• Disregard for safety rules (other than those mentioned elsewhere)</li> <li>• Failure to report an injury or accident</li> </ul>	3-day suspension	30-day suspension	Access denied to site
<p><b>Class IV</b></p> <ul style="list-style-type: none"> <li>• Threatening or intimidating other employees or supervisors</li> <li>• Intentionally punching another employee's timecard, dropping brass, or using another ID badge</li> </ul>	30-day suspension	Access denied to site	
<p><b>Class V</b></p> <ul style="list-style-type: none"> <li>• Any violation of safety procedures that contribute to the potential for loss of life or limb (see Note 1 for examples)</li> <li>• Possession of weapons or firearms on company property, including site parking areas</li> <li>• Possession of drugs, alcohol, and related paraphernalia on company property, including site parking areas</li> <li>• Any other violations of the Drug Free Work Place policy</li> <li>• Theft of property from company, client or other employees</li> <li>• Assault on a supervisor or other employee</li> </ul>	Access denied to site		
<p>Note 1: Examples of Safety Violations</p> <ul style="list-style-type: none"> <li>• Failure to comply with Company 100% fall protection policy</li> <li>• Violation of confined space entry procedures</li> <li>• Violation of First Break procedure</li> </ul>			

NOTE: This policy is designed to set minimum standards and is not meant to supersede a subcontractor's policy or policies which may be more stringent.

**Progressive Discipline Policy**

**Acknowledgement:**

I have read and understand the Project policy on discipline. I further understand that not following the company or client's rules and regulations will result in disciplinary action up to and including denial of Project site access.

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Witness

\_\_\_\_\_  
Date

## APPENDIX B: INCIDENT INVESTIGATION REPORT (EXAMPLE)

Page 1 of 2

### PART 1

Date of Incident:	Time of Incident:	Date of Investigation:
Company:Contract Number:		
Location of Incident:		
Describe what the employee was doing at the time of the incident:		
Did injury result? Yes / No ____. If No proceed to Part 3	If yes <input type="checkbox"/> Employee Name(s) SSN(s) <input type="checkbox"/> Proceed to Part 2 <input type="checkbox"/>	

### PART 2

Body part(s) affected:		
Disposition: Employee Sent to	<input type="checkbox"/> Doctor <input type="checkbox"/> Emergency Room <input type="checkbox"/> Personal Physician <input type="checkbox"/> On-Site Medical Station <input type="checkbox"/> Other	<input type="checkbox"/> Employee refused treatment Result impression <input type="checkbox"/> 1 <sup>st</sup> Aid Only <input type="checkbox"/> Medical Recordable <input type="checkbox"/> Lost Time or Restricted Duty
Type of Injury:		
Employee Supervisor:		
Witnesses:		
Circle the Number Identifying Contributing Factors:		
1. Absent/Improper Guarding 2. Defective Equipment 3. Weather/Temperature 4. Inappropriate PPE 5. Inadequate Housekeeping 6. Slippery/Uneven Walking Surface 7. Improper Layout of Work Area 8. Inadequate Ventilation 9. Inadequate Lighting or Noise Control 10. Improper Storage or Placement of Materials 11. Insect/Animals in Work Area 12. No At Risk Condition Identified 13. Other	14. Operating Without Authority 15. Improper Use of Equipment 16. Inadequate Procedures 17. Use of Defective Equipment/Tools 18. PPE Not Used 19. Inadequate Training 20. Improper Position or Posture 21. Horseplay 22. Altercation 23. No At Risk Act Identified 24. Other _____ _____	

### PART 3

How Did The Incident Occur?		
What Object or Substance was Involved?		
Any Previous or Similar Incidents?	Project Specific:	Company Wide:
What Factors Contributed to the Incident		

Was a HA developed for the task being performed? Yes/No \_\_\_\_ If yes, attach a copy.

What **corrective actions** are being taken to prevent recurrence? Also list the person responsible for implementing and the target completion date for each item.

\_\_\_\_\_

\_\_\_\_\_

Supervisor/Investigation Team Members: \_\_\_\_\_

Name(s) Signature(s)/Date

Reviewed by: \_\_\_\_\_

Contractor Safety Representative/Date Program Safety Manager/Date



## APPENDIX C: ELECTRICAL JOB BRIEFING AND PLANNING CHECKLIST (EXAMPLE)

(This Appendix is derived from NFPA 70E.)

Appendix illustrates considerations for an Electrical Job Briefing Checklist.

### Identify

- The hazards
- The voltage levels involved
- Any “foreign” (secondary source) voltage source
- Any unusual work conditions
- Number of people needed to do the job
- The shock protection boundaries
- The available incident energy
- Potential for arc flash (Conduct a flash-hazard analysis)
- Flash protection boundary

### Ask

- Can the equipment be energized?
- Are back feeds of the circuits to be worked on possible?
- Is a “standby person” required?

### Check

- Job plans
- Single-line diagrams and vendor prints
- Status board
- Information on plant and vendor resources up to date
- Safety procedures
- Vendor information
- Individuals are familiar with the facility

### Know

- What the job is
- Who else needs to know – Communicate!
- Who’s in charge

### Think

- About the unexpected event...What if?
- Lock – Tag – Test – Try
- Test for voltage – FIRST
- Use the right tools and equipment, including PPE
- Install and remove grounds
- Install barriers and barricades
- What else?

### Prepare for an emergency

- Is the standby person CPR trained?
- Is the required emergency equipment available? Where is it?
- Where is the nearest telephone?
- Is confined space rescue available?
- Are radio communications available?
- What is the exact work location?
- How is the equipment shut off in an emergency?
- Are the emergency telephone numbers known?
- Where is the fire alarm?
- Where is the fire extinguisher?





**PART III: APPROVAL(S) TO PERFORM THE WORK WHILE ELECTRICALLY ENERGIZED:**

\_\_\_\_\_  
Subcontractor Supervisor

\_\_\_\_\_  
Electrical Safety Officer

\_\_\_\_\_  
Project Manager

\_\_\_\_\_  
Level II Manager

**APPENDIX E: APPROACH BOUNDARIES TO LIVE PARTS FOR SHOCK PROTECTION**

<b>Nominal System Voltage Range, Phase to Phase</b>	<b>Limited Approach Boundary<sup>1</sup></b>		<b>Restricted Approach Boundary<sup>2</sup> Includes Inadvertent Movement Adder</b>	<b>Prohibited Approach Boundary<sup>3</sup></b>
	<b>Exposed Movable Conductor</b>	<b>Exposed Fixed Circuit Part</b>		
0 to 50 V	Not Specified	Not specified	Not Specified	Not Specified
51 to 300 V	10 ft 0 in	3 ft 6 in	Avoid Contact	Avoid Contact
301 to 750 V	10 ft 0 in	3 ft 6 in	1 ft 0 in	0 ft 1 in
751 V to 15 kV	10 ft 0 in	5 ft 0 in	2 ft 2 in	0 ft 7 in
15.1 to 36 kV	10 ft 0 in	6 ft 0 in	2 ft 7 in	0 ft 10 in
36.1 to 46 kV	10 ft 0 in	8 ft 0 in	2 ft 9 in	1 ft 5 in
46.1 to 72.5 kV	10 ft 0 in	8 ft 0 in	3 ft 3 in	2 ft 1 in
72.6 to 121 kV	10 ft 8 in	8 ft 0 in	3 ft 2 in	2 ft 8 in
138 to 145 kV	11 ft 0 in	10 ft 0 in	3 ft 7 in	3 ft 1 in
161 to 169 kV	11 ft 8 in	11 ft 8 in	4 ft 0 in	3 ft 6 in
230 to 242 kV	13 ft 0 in	13 ft 0 in	5 ft 3 in	4 ft 9 in
345 to 362 kV	15 ft 4 in	15 ft 4 in	8 ft 6 in	8 ft 0 in
500 to 550 kV	19 ft 0 in	19 ft 0 in	11 ft 3 in	10 ft 9 in
765 to 800 kV	23 ft 9 in	23 ft 9 in	14 ft 11 in	14 ft 5 in

<sup>1</sup>Limited Approach Boundary - A shock protection boundary to be crossed by only qualified persons (at a distance from a live part) which is not to be crossed by unqualified persons unless escorted by a qualified person.

<sup>2</sup>Restricted Approach Boundary - A shock protection boundary to be crossed by only qualified persons (at a distance from a live part) which, due to its proximity to a shock hazard, requires the use of shock protection techniques and equipment when crossed.

<sup>3</sup>Prohibited Approach Boundary - A shock protection boundary to be crossed by only qualified persons (at a distance from a live part) which, when crossed by a body part or object, requires the same protection as if direct contact is made with a live part.

**APPENDIX F: PROTECTIVE CLOTHING AND PERSONAL PROTECTIVE EQUIPMENT  
MATRIX**

Protective Clothing & Equipment	Protective Systems for Hazard/Risk Category						
	Hazard/Risk Category No.	-1 (note 3)	0	1	2	3	4
<b>Untreated Natural Fiber</b>							
a. T-shirt (short sleeve)	X				X	X	X
b. Shirt (long sleeve)			X				
c. Pants (long)	X	X	X (note 4)		X (note 6)	X	X
<b>FR Clothing (Note 1)</b>							
a. Long-sleeve shirt			X	X		X (note 9)	X
b. Pants			X (note 4)	X (note 6)		X (note 9)	X
c. Coverall			(note 5)	(note 7)		X (note 9)	(note 5)
d. Jacket, parka, or rainwear			AN	AN		AN	AN
<b>FR Protective Equipment</b>							
a. Flash suit jacket (2-layer)							X
b. Flash suit pants (2-layer)							X
c. Head Protection							
1. Hard hat			X	X		X	X
2. FR hard hat lines						AR	AR
d. Eye protection							
1. Safety glasses	X	X	X	AL		AL	AL
2. Safety goggles				AL		AL	AL
e. Face & head protection							
1. Arc-rated face shield or flash shield hood					X (note 8)		
2. Flash suit hood						X	X
3. Hearing protection (ear canal inserts)					AR (note 8)	X	X
f. Hand protection, leather gloves (note 2)			AN	X		X	X
g. Foot protection, leather work shoes			AN	X		X	X

**Legend:**

AN = As needed  
AL = Select one in group  
AR = As required  
X = Minimum required

**Notes:**

1. See Table 4 Arc rating for a garment is expressed in cal/cm<sup>2</sup>.

2. If voltage-rated gloves are required, the leather protectors worn external to the rubber gloves satisfy this requirement.
3. Hazard/Risk Category Number “-1” is only defined if determined by Notes 3 or 6 of Table 5.
4. Regular weight (minimum 12 oz/yd<sup>2</sup> fabric weight), untreated, denim cotton blue jeans are acceptable in lieu of FR pants. The FR pants used for Hazard/Risk Category 1 shall have a minimum arc rating of 4.
5. Alternate is to use FR coveralls (minimum arc rating of 4) instead of FR shirt and FR pants.
6. If the FR pants have a minimum arc rating of 8, long pants of non-melting or untreated natural fiber are not required beneath the FR pants.
7. Alternate is to use FR coveralls (minimum arc rating of 4) over non-melting or untreated natural fiber pants and T-shirt.
8. A faceshield with a minimum arc rating of 8, with wrap-around guarding to protect not only the face, but also the forehead, ears, and neck (or, alternatively, a flash suit hood), is required.
9. Alternate is to use two sets of FR coveralls (the inner with a minimum arc rating of 4 and outer coverall with a minimum arc rating of 5) over non-melting or untreated natural fiber clothing, instead of FR coveralls over FR shirt and FR pants over non-melting or untreated natural fiber clothing

## APPENDIX G: SIMPLIFIED, TWO CATEGORY, FLAME-RESISTANT (FR) CLOTHING SYSTEM

**Use of Simplified Approach.** The use of Table 4 is suggested as a simplified approach to assure adequate PPE for electrical workers within facilities with large and diverse electrical systems. The clothing listed in Table 4 fulfills the minimum FR clothing requirements of Table 3 and Table 6. The clothing systems listed in this table should be used with other PPE appropriate for the Hazard/Risk Category. See Table 6.

**Table 4: Simplified, Two Category, Flame Resistant Clothing System**

Clothing*	Applicable Tasks
<p><b>Everyday Work Clothing</b></p> <p>FR long-sleeve (minimum arc rating of 4) worn over an untreated cotton T-shirt with FR pants (minimum arc rating of 8)</p> <p><i>or</i></p> <p>FR coveralls (minimum arc rating of 4) worn over an untreated cotton T-shirt (or an untreated natural fiber long-sleeve shirt) with untreated natural fiber pants.</p> <p><b>Electrical “Switching” Clothing</b></p> <p>Multilayer FR flash jacket and FR bib overalls worn over either FR overalls (minimum arc rating of 4) or FR long-sleeve shirt and FR pants (minimum arc rating of 4), worn over untreated natural fiber long-sleeve shirt and pants, worn over an untreated cotton T-shirt</p> <p><i>or</i></p> <p>Insulated FR overalls (with a minimum arc rating of 25, independent of other layers) worn over untreated natural fiber long-sleeve shirt with untreated denim cotton blue jeans (“regular writhe”, minimum 12 oz/yd<sup>2</sup> fabric weight), worn over an untreated cotton T-shirt.</p>	<p>All Hazard/Risk Category 1 and 2 listed in Table 6</p> <p>On systems operating at less than 1,000 volts, these tasks include work on all equipment <i>except</i></p> <ul style="list-style-type: none"> <li>• Insertion or removal of low-voltage motor starter “buckets,”</li> <li>• Insertion or removal of power circuit breakers from switchgear cubicle or</li> <li>• Removal of bolted covers from switchgear.</li> </ul> <p>On systems 1,000 volts or greater, tasks also include the operation of switching devices <i>with equipment enclosure doors closed.</i></p> <p>All Hazard/Risk Category 3 and 4 tasks listed in Table 6.</p> <p>On systems operating at 1,000 volts or greater, these tasks include work on exposed live parts of all equipment.</p> <p>On systems of less than 1,000 volts, tasks include insertion or removal of low-voltage motor starter MCC “buckets”, insertion or removal of plug-in devices into or from busaway, insertion or removal of power circuit breakers and removal of bolted covers from switchgear.</p>

\* Note other PPE required for the specific tasks listed in Tables 5 and 6, which include arc-rated face shields or flash suit hoods, FR hardhat liners, safety glasses or safety goggles, hard hat, bearing protection, leather gloves, voltage-rated gloves, and voltage-rated tools.

**APPENDIX H: WORK TASKS AND RELATED HAZARD CATEGORY**

**(Derived from NFPA 70E)**

<b>Task (Assumes Equipment is Energized, and Work Is Done Within the Flash Protection Boundary)</b>	<b>Hazard/Risk Category</b>	<b>V-rated Gloves</b>	<b>V-rated Tools</b>
<b>NEMA E2 (fused contactor) Motor Starters, 2.3 kV through 7.2 kV</b>	-	-	-
Contactor operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N
Contactor operation with enclosure doors open	2*	N	N
Work on energized parts, including voltage testing	3	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized parts >120V, exposed	3	Y	Y
Insertion or removal (racking) of starters from cubicles, doors open	3	N	N
Insertion or removal (racking) of starters from cubicles, doors closed	2	N	N
Application of safety grounds after voltage test	3	Y	N
Removal of bolted covers (to expose bare, energized parts)	4	N	N
Opening hinged covers (to expose bare, energized parts)	3	N	N
<b>Metal Clad Switchgear, 1 kV and above</b>	-	-	-
CB or fused switch operation with enclosure doors closed	2	N	N
Reading a panel meter while operating a meter switch	0	N	N
CB or fused switch operation with enclosure doors open	4	N	N
Work on energized parts, including voltage testing	4	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	2	Y	Y
Work on control circuits with energized parts >120 V, or exposed	4	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open	4	N	N
Insertion or removal (racking) of CBs from cubicles, doors closed	2	N	N
Application of safety grounds, after voltage test	4	Y	N
Removal of bolted covers (to expose bare, energized parts)	4	N	N

## APPENDIX H: WORK TASKS AND RELATED HAZARD CATEGORY

(Derived from NFPA 70E)

Task (Assumes Equipment is Energized, and Work Is Done Within the Flash Protection Boundary)	Hazard/Risk Category	V-rated Gloves	V-rated Tools
Opening hinged covers (to expose bare, energized parts)	3	N	N
Opening voltage transformer or control power transformer compartments	4	N	N
<b>Other Equipment 1 kV and above</b>	-	-	-
Metal clad load interrupter switches, fused or unfused	-	-	-
Switch operation, doors closed	2	N	N
Work on energized parts, including voltage testing	4	Y	Y
Removal of bolted covers (to expose bare, energized parts)	4	N	N
Opening hinged covers (to expose bare, energized parts)	3	N	N
Outdoor disconnect switch operation (hookstick operated)	3	Y	Y
Outdoor disconnect switch operation (gang-operated, from grade)	2	N	N
Insulated cable examination, in manhole or other confined space	4	Y	N
Insulated cable examination, in open area	2	Y	N

**Legend:**

**V-rated Gloves** are gloves rated and tested for the maximum line-to-line voltage upon which work will be done.

**V-rated Tools** are tools rated and tested for the maximum line-to-line voltage upon which work will be done.

2\* means that a double-layer switching hood and hearing protection are required for this task in addition to the other Hazard/Risk Category 2 requirements of Table 4.

Y = yes (required)

N = no (not required)

**Notes:**

1. Maximum of 25 kA short circuit current available, 0.03 second (2 cycle) fault clearing time.
2. Maximum of 65 kA short circuit available, 0.03 second (2 cycle) fault clearing time.
3. For < 10 kA short circuit current available, the Hazard/Risk Category required may be reduced by one number.
4. 42 kA short circuit current available, 0.33 second (20 cycle) fault clearing time.
5. 35 kA short circuit current available, up to 0.5 second (30 cycle) fault clearing time.
6. For < 25 kA short circuit current available, the Hazard/Risk Category required may be reduced by one number.



## APPENDIX I: GLOVE VOLTAGE REQUIREMENTS

Class Designation of Glove or Sleeve	Maximum AC Use Voltage rms, V	AC Retest Voltage rms, V	Maximum DC Use Voltage avg, V	DC Retest Voltage avg, V
00	500	2 500	750	10 000
0	1 000	5 000	1 500	20 000
1	7 500	10 000	11 250	40 000
2	17 000	20 000	25 500	50 000
3	25 500	30 000	39 750	60 000
4	36 000	40 000	54 000	70 000

## APPENDIX J: PROTECTIVE CLOTHING CHARACTERISTICS

(Table derived from NFPA 70E)

Typical Protective Clothing Systems		
Hazard Risk Category	Clothing Description (Typical number of clothing layers is given in parentheses)	Required Minimum Arc Rating of PPE [(cal/cm <sup>2</sup> ) J/cm <sup>2</sup> ]
0	Non-melting, flammable materials (i.e., untreated cotton, wool, rayon, or silk, or blends of these materials, with a fabric weight at least 4.5 oz/yd <sup>2</sup> (1))	
1	FR shirt and FR pants or FR overall (1)	4 (16.74)
2	Cotton underwear – conventional short sleeve and brief/shorts, plus FR shirt and FR pants (1 or 2)	8 (33.47)
3	Cotton underwear plus FR shirt and FR pants plus FR coverall, or cotton underwear plus two FR coveralls (2 or 3)	25 (104.6)
4	Cotton underwear plus FR shirt and FR pants plus multi-layer flash suit (3 or more)	40 (169.36)

NOTE: Arc rating is defined in Article 100 and can be either ATPV or E<sub>BT</sub>. ATPV is defined in ASTM F 1959-99 as the incident energy on a fabric or material that results in sufficient heat transfer through the fabric or material to cause the onset of a second-degree burn based on the Stoll curve. E<sub>BT</sub> is defined in ASTM F 1959-99 as the average of the five highest incident energy exposure values below the Stoll curve where the specimens do not exhibit break open. E<sub>BT</sub> is reported when ATPV cannot be measured due to FR fabric breakopen.

## APPENDIX K: VOLTAGE REQUIREMENTS FOR BLANKETS

Class Designation of Blankets	AC Use Voltage, rms, max <sup>A</sup>	A-C Retest Voltage max	DC Retest Voltage, max
0	1 000	5 000	20 000
1	7 500	10 000	40 000
2	17 000	20 000	50 000
3	26 500	30 000	60 000
4	36 000	40 000	70 000

<sup>a</sup>The maximum use voltage is based on the following equations:

Maximum a-c use voltage = 0.95 a-c maximum retest voltage – 2 000<sub>v</sub>  
Classes 1, 2, 3, and 4.

Maximum a-c use voltage = 0.95 d-c maximum retest voltage – 30 5000<sub>v</sub>  
Classes 1, 2, 3, and 4.

Maximum a-c use voltage = 0.95 d-c maximum retest voltage – 18 000<sub>v</sub>  
Class 0.