Service and Maintenance Subcontractor Environment, Safety, and Health Manual, Volume 2

National Laboratory of the Rockies, U.S. Department of Energy Office of Critical Minerals and Energy Innovation

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List of Acronyms and Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
ACM	asbestos-containing material
AHJ	authority having jurisdiction
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
CFR	Code of Federal Regulations
CMS	central monitoring station
CRS	Colorado Revised Statute
dB	decibel
dBA	decibel, A-weighted scale
DOE	U.S. Department of Energy
EEWP	energized electrical work permit
ESHQ	Environment, Safety, Health, and Quality
EPA	U.S. Environmental Protection Agency
FHA	fall hazard analysis
FM	facility manager
FPE	fire protection engineer
GFCI	ground fault circuit interrupter
H&R	hoisting and rigging
IH	industrial hygiene
ISM	Integrated Safety Management
LEED	Leadership in Energy and Environmental Design
LO/TO	lockout/tagout
MEC	munitions and explosives of concern
MOP	method of procedure

MUTCD	Manual on Uniform Traffic Control Devices
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NIST	National Institute of Science and Technology
NLR	National Laboratory of the Rockies
OSHA	Occupational Safety and Health Act, or Occupational Safety and Health Administration
PFAS	personal fall arrest system
POC	point of contact
PPE	personal protective equipment
PM	project manager
SAIA	Scaffold & Access Industry Association
SDS	safety data sheet
STEP	South Table Mountain Energy Park
STM	South Table Mountain
SWP	safe work permit
TM	technical monitor
TTCM	Temporary Traffic Control Manual
TTCP	Temporary Traffic Control Plan
TLV	threshold limit value
TWA	time-weighted average
UL	Underwriters Laboratories
USC	United States Code

1 Introduction

The Service and Maintenance Subcontractor Environment, Safety and Health Manual (hereafter referred to as "this manual") has been developed to identify the minimum requirements for service subcontractors and their lower-tier subcontractors (hereafter referred to as "subcontractors") that require personnel to perform construction activities at the U.S. Department of Energy (DOE's) National Laboratory of the Rockies (NLR) projects.

1.1 Background

It is DOE policy that all subcontractors shall provide a safe and healthful workplace for their personnel. In part, these conditions will be ensured by implementing the worker safety and health program established in 10 Code of Federal Regulations (CFR) Part 851, Worker Safety and Health Program. Each subcontractor is responsible for ensuring compliance with all applicable requirements that govern their work at NLR facilities, including any consensus standards incorporated by reference.

1.2 Definitions

Combustible material: Any material that will ignite and sustain combustion, including wood, paper, cardboard, plastic, rubber, vegetation, flammable/combustible liquids, flammable gases, etc. This includes some fire-retardant materials, which are less flammable and harder to ignite but may still sustain combustion under the right conditions.

Competent person: Someone who can identify existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt, corrective measures to eliminate them. A competent person is one who has extensive training knowledge/experience in a particular activity or job function. A competent person at NLR shall be capable of demonstrating the "knowledge and skill sets" that match their "competent person" designation.

Designated hot-work area: A specific location, such as a maintenance shop or a detached outside location, that is of noncombustible or fire-resistive construction, essentially free of combustible and flammable contents, and suitably segregated from adjacent areas, that is designed and approved for hot-work operations (i.e., activities with open flames, welding, brazing, cutting, grinding, and other flame-/spark-producing tasks, and the use of powder actuated tools).

Graded approach: Applying a level of rigor commensurate with the importance or significance of the activity, in relation to the associated hazards and consequences, to ensure available resources are used most efficiently and effectively.

Hold point: A point of defined circumstances (i.e., excavation permit, hot-work permit) beyond which a construction activity shall not proceed without the approval of a designated authority.

Imminent danger: A condition or practice that could reasonably be expected to cause death or serious injury, severe property damage, or environmental impairment unless immediate actions are taken to mitigate the effects of the hazard created.

Noncombustible material: A material, in the form in which it is used and under the conditions anticipated, that

will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat.

Non-NLR site: Land, buildings, or structures, including installed equipment and utilities, that are used by NLR workers conducting NLR work but are neither leased nor government-owned specifically for NLR operations. Examples are sites owned by research partners or other government agencies and used by NLR workers conducting NLR business.

NLR site: A geographic area owned or leased by or for the account of the federal government for the performance of DOE program activities. This includes extant buildings, infrastructure, and other improvements. Some of the areas included in the NLR site that are more commonly referred to include the South Table Mountain (STM) Campus, Flatirons Campus, South Table Mountain Energy Park (STEP), Denver West buildings, Alaska Campus, and the Golden Warehouse.

Qualified person: One who, by possession of a recognized degree, certificate, or professional standing, or with extensive knowledge, training, and experience, has successfully demonstrated their ability to solve or resolve problems relating to the subject matter, the work, or the construction project.

Service/maintenance activity: Servicing, installing, adjusting, modifying, repairing, inspecting and maintaining of new or existing property and assets, including the site, structures, buildings, laboratories, offices, and equipment.

Subcontractor: A person, corporation, or other entity—other than the prime contractor (NLR)—who furnishes labor, supplies, materials, equipment, or services in furtherance of the DOE's mission under a construction or similar contract with NLR, including a task order agreement. A subcontractor's site tenure may vary depending on the nature of the project, and its employees are not considered a permanent force.

Subcontract administrator: An NLR employee who is authorized to award and administer a subcontract on behalf of NLR.

Technical monitor: The NLR project manager or project controller who converts the end-user needs into purchase order specification and/or a subcontract scope of work. Responsibilities include managing technical aspects, defining performance requirements, monitoring subcontractor performance/deliverables, and reviewing/approving invoices and subcontract modifications.

Vendor, maintenance, and service subcontractor safety orientation checklist: An NLR form used to document the project-relevant environment, safety, health, and quality (ESHQ) information conveyed to the subcontractor prior to starting work. The subcontractor then has the responsibility to ensure the content covered in the checklist/orientation is effectively flowed down to all their employees and their subcontractors prior to the start of any work.

Welding blanket: A heat-resistant fabric that is listed and approved by Factory Mutual (FM Global) and designed to be placed in the vicinity of a hot-work operation; intended for use in horizontal applications with light to moderate exposures—such as that resulting from chipping, grinding, heat-treating, sandblasting, and light horizontal welding—and designed to protect machinery and prevent ignition of combustibles, such as wood, that are located adjacent to the underside of the blanket.

Welding curtain: A heat-resistant fabric that is listed and approved by FM Global and designed to be placed in

the vicinity of a hot-work operation; intended for use in vertical applications with light to moderate exposures—such as that resulting from chipping, grinding, heat-treating, sandblasting, and light horizontal welding—and designed to prevent sparks from escaping an area.

Welding pad: A heat-resistant fabric that is listed and approved by FM Global and designed to be placed directly under a hot-work operation, such as welding or cutting. It is intended for use in horizontal applications with severe exposures, such as those resulting from molten substances or heavy horizontal welding, and designed to prevent the ignition of combustibles that are located adjacent to the underside of the pad.

Worker: A leased worker, subcontractor, independent contractor/consultant, volunteer, or other individual providing construction services to NLR or working on NLR sites.

1.3 Layout and Use of This Manual—Imperative Information

1.3.1 Scope

This manual contains excerpts from, and references to, numerous regulations, codes, and standards that are not presented in their entirety. Similarly, not all ESHQ subject matter is covered in this manual. Each subcontractor is responsible for ensuring compliance with "all applicable requirements" that govern their work at NLR facilities, including any consensus standards incorporated in 10 CFR Part 851 by reference. If the manual does not contain information relative to a particular ESHQ topic, the subcontractor shall ensure the governing regulatory provisions or national consensus standards, as applicable, are implemented. If there is a conflict between requirements, the subcontractor is to apply the most stringent, unless otherwise directed by the NLR ESHQ point of contact (POC). Subcontractors are always encouraged to apply best management practices in all endeavors.

1.3.2 Layout of This Manual

The chapters in this manual are arranged according to topic area and, in general, are laid out in the same format. The chapter will identify who the requirements apply to, the broad regulatory drivers, and the subcontractor's responsibilities.

Each chapter will also identify any requirements specific to the NLR site and/or DOE. Also presented in each chapter are issues of special emphasis that NLR has identified or for which additional risk control mechanisms are required (e.g., safety plans to be submitted for review and acceptance by the ESHQ POC, or permits required prior to performing work, etc.).

1.3.3 Use of This Manual

It is the responsibility of the subcontractor to know, understand, and plan for the NLR-specific requirements/special emphasis programs. Further, it is the responsibility of the subcontractor to ensure lower-tier subcontractors know, understand, and comply with the requirements identified in this manual.

2 Program Policy

2.1 Applicability

The requirements of this section apply to all construction subcontractors and lower-tier subcontractors (hereafter referred to as "subcontractors") performing construction activities on NLR sites.

This section provides requirements for identifying key aspects of the subcontractor environmental, safety, and health policies to provide all employees with a safe and healthy workplace while also protecting the environment in compliance with DOE and the Occupational Safety and Health Administration (OSHA).

The subcontractor is responsible for flowing down the worker safety and health requirements applicable to the subcontractors at any tier, to the extent necessary, to ensure compliance with the requirements. The subcontractor determines which program requirements should flow down into contracts with their lower-tier subcontractors and incorporate appropriate requirements.

Utility providers who furnish electricity, natural or manufactured gas, water, sewage, thermal energy, chilled water, steam, hot water, or high-temperature hot water that may have power lines installed on-site to serve the facility are covered under 48 CFR (Federal Acquisition Regulation [FAR]) Part 41, are not considered service contractors, and are therefore not covered under 10 CFR Part 851. Utility providers operate under supply contracts rather than contracts for services. The fact that utility employees sometimes come on-site to service power lines does not convert the contract into a service contract.

2.2 Regulatory Requirements

NLR facilities are government-owned or leased facilities and subject to 10 CFR Part 851, Worker Safety and Health Program requirements. While the enforcement provisions of the OSHA Act of 1970 do not apply (as NLR facilities are government-owned), DOE has exercised its statutory authority to prescribe that all subcontractors comply with the OSHA Safety and Health Standards for General Industry (29 CFR Part 1910) and Construction (29 CFR Part 1926); DOE will enforce compliance with these standards. The provisions of 10 CFR Part 851.23 require subcontractors to comply with specific safety and health standards, including:

- 10 CFR Part 851, Worker Safety and Health Program
- 29 CFR, Parts 1904, Recording and Reporting Occupational Injuries and Illnesses
- 29 CFR, Part 1910, Occupational Safety and Health Standards, excluding 29 CFR 1910.1096, Ionizing Radiation
- 29 CFR, Part 1926, Safety and Health Regulations for Construction
- American Conference of Governmental Industrial Hygienists (ACGIH) *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*, latest edition
- American National Standards Institute (ANSI) Z88.2, *American National Standard for Respiratory Protection,* latest edition
- ANSI Z136.1, *American National Standard for Safe Use of Lasers*, latest edition

- ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, Sections 4.3 and E4.3, latest edition
- National Fire Protection Association (NFPA) 70, *National Electrical Code*, latest edition
- NFPA 70E, *Standard for Electrical Safety in the Workplace*, latest edition
- NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*
- 10 CFR Part 850, Chronic Beryllium Disease Prevention Program
- 10 CFR Part 707, Workplace Substance Abuse Programs at DOE Sites
- Controlled Substances Act (21 U.S. Code [USC] 812)
- 21 CFR Part 1308, Schedules of Controlled Substances
- DOE-STD-1090-2007, Hoisting and Rigging.

Other regulations are listed at 10 CFR Part 851.23 but may not be applicable depending on the construction activities. It shall be understood that 10 CFR Part 851 provides the basic foundation for a worker safety and health program and that subcontractors may need to go beyond requirements in establishing programs to protect workers from hazards associated with their activities.

Furthermore, it shall be noted that additional regulatory and NLR requirements are mentioned in the remainder of this manual.

Note: The current version of a regulation or standard applies if the current version is not otherwise shown.

2.3 NLR-Specific Requirements

2.3.1 Safe Work Permit

A safe work permit (SWP) shall be issued by NLR. Subcontractors shall not start work until a safe work permit is issued.

2.3.2 Training and Documentation

For work activities in which specific training is required by safety regulations (e.g., OSHA), the subcontractor shall maintain records readily available on-site, showing proof of current training records for any authorized workers. Designated competent persons are expected to have a higher level of experience, training, and qualifications. Subcontractors shall have in place a mechanism to verify the competent person's knowledge and skill sets match the competent person designation (i.e., written test, training certifications, etc.). NLR has the authority to assess the competent person and revoke the designation if competency is not demonstrated.

Photocopies of training certificates, certification cards, wallet IDs, licenses, etc., identifying the individual, the specific training, who conducted the training, and the date completed (and/or expiration date) are accepted in lieu of originals.

In addition, NLR may require some projects to have specific qualifications for their designated on-site safety representative (e.g., qualified superintendent, safety professional, Board of Certified Safety

Professionals certification), depending on the complexity of the project and hazards involved. NLR will identify this requirement in the request for proposals.

2.3.3 Subcontractor Incident Response and Notification

The subcontractor shall report all incidents involving injury, property damage and near misses, and spills (no matter how minor) to the NLR ESHQ POC and the NLR technical monitor (TM) as soon as the scene is stabilized, but in all cases, a notification shall be made without delay. This reporting time frame is necessary to meet DOE notification time requirements to begin any necessary event investigation, scene security, cleanup, and traffic rerouting, etc.

For all emergencies at the NLR sites (excluding the Flatirons Campus), the subcontractor shall contact Laboratory Protection by:

- Using any building red phone
- Dialing extension 1234 from any building landline
- Calling 303-384-6811 from any outside line (cell phone).

Note: At the STM Campus, DO NOT call 911, as this will cause confusion and delays. The Central Monitoring Station (CMS) will coordinate and direct the emergency response services to your location.

For work at Flatirons Campus the subcontractor shall:

- Call 9-911 and ask for Boulder County Dispatch.
- Identify their location as the NLR Flatirons Campus and the nature of the emergency; stay on until directed to hang up.
- Then call NLR Laboratory Protection at 303-384-6811 to provide information on the emergency. All other incident response requirements apply to work at the Flatirons Campus.

2.3.4 NLR Response to Emergencies

Upon notification of an emergency, NLR will provide notification to external and internal responders such as ESHQ and safety and emergency preparedness personnel.

2.3.5 Subcontractor Event Investigation

After the response has occurred, do not disturb the scene, but stabilize and secure it. The subcontractor shall initiate an event investigation and/or participate in the ESHQ event investigation, as determined by NLR. There is an expectation and responsibility to fully understand what occurred, what caused the event, and identify corrective actions. The subcontractor shall submit an initial report to NLR within 24 hours of the event and follow up with a complete investigation within five business days of the event.

The subcontractor is further responsible for the prompt implementation of corrective actions for deficiencies identified through an ESHQ event investigation, or as reported by DOE, the NLR TM, ESHQ, or other authorities having jurisdiction (AHJs).

2.3.6 Subcontractor Initial Screening Process

All NLR subcontractors and all their lower-tier subcontractors are required to meet pre-established ESHQ risk criteria prior to being awarded a subcontract to perform construction work at NLR sites. This includes the Environment, Safety and Health Offeror or Lower-Tier Risk Evaluation Worksheet submittal as part of construction solicitations. NLR Acquisition Services will forward the worksheet to the ESHQ POC for review and acceptance. The ESHQ POC shall evaluate and assess subcontractors' or lower-tier subcontractors' past safety performance, looking at the following information:

- Experience modification rate
- OSHA citations
- Fatalities, multiple hospitalizations, and amputations
- Environmental citations.

NLR reserves the right to consider additional requested information to determine whether the subcontractor or lower-tier subcontractor is accepted or rejected.

The subcontractor is responsible for ensuring all its lower-tier subcontractors' ESHQ Subcontract Risk Evaluation Worksheets are provided to the NLR ESHQ POC for review and acceptance prior to performing work on an NLR site. Subcontractors and all lower-tier subcontractors must provide and maintain workers' compensation insurance during the entire performance period of this subcontract.

Additional information regarding the subcontractor screening process can be found on the NLR Subcontractor website.

2.4 NLR Special Emphasis

2.4.1 Integrated Safety Management System

The subcontractor shall incorporate the elements of the DOE Integrated Safety Management (ISM) System Guide to conform with NLR's ISM requirements. An effective ISM plan establishes a single system that integrates requirements into the work planning and execution process to protect the workers, public, and the environment. NLR implements five core ISM functions for work activities that could potentially affect workers, the public, or the environment and applies them as a continuous cycle with the degree of rigor appropriate to address the type of work activity and the hazards involved:

1. **Define the scope of work.** Translate missions into work, set expectations, identify, andprioritize tasks, and allocate resources.
2. **Analyze the hazards.** Identify, analyze, and categorize hazards and potential environmental impacts associated with the work.
3. **Develop and implement hazard controls.** Identify and agree upon standards and requirements, identify controls to prevent/mitigate hazards, establish the ESHQ parameters, and implement controls.
4. **Perform work within controls.** Confirm readiness and perform work safely and in the prescribed manner to protect workers, the public, and the environment.
5. **Provide feedback and continuous improvement.** Gather feedback on the adequacy of controls

from workers and appropriate stakeholders. Identify and implement opportunities for improvement and conduct line management and independent oversight.

Subcontractor program flexibility is understood and encouraged if the subcontractor's program tenets adequately address the spirit and intent of the ISM provisions.

2.4.2 Stop Work Authority

All workers at NLR sites have the authority to stop work and the work of others upon the discovery of immediately dangerous conditions or other serious hazards to workers, the public, or the environment and will not be subject to reprisal or retaliation. Workers have the authority to stop the work immediately and notify their supervisor and ESHQ POC. Work may not proceed until the circumstances are reviewed and deficiencies corrected.

2.5 Subcontractor Responsibilities

As required in 10 CFR Part 851, the subcontractor shall establish a Subcontractor Worker Safety and Health Program. Worker protection measures should be based on the use of a graded approach to ensure that available resources are used most efficiently and effectively. A process by which the level of analysis, documentation, and actions necessary to comply with a requirement are commensurate with (1) the relative importance to safety, safeguards, and security and (2) the magnitude of any hazard involved. Subcontractor Worker Safety and Health Programs shall be integrated into other related site-specific worker protection activities and within the ISM system. There shall be an open and continuous line of communication between the subcontractor and NLR to address any unsafe acts or conditions that may arise during the project. Workers shall be instructed to report to the construction contractor's designated representative hazards not previously identified or evaluated. If immediate corrective action is not possible or the hazard falls outside of project scope, the subcontractor shall notify affected workers, post appropriate warning signs, implement needed interim control measures, and notify the subcontractor project manager (PM) and the NLR PM of the action taken. The subcontractor designated representative shall stop work in the affected area until appropriate protective measures are established.

The subcontractor has overall accountability for the safety of their project and shall allocate the resources necessary for implementing all required safety-related requirements and contract/subcontract requirements. The subcontractor shall:

- Follow all NLR site-specific environmental, safety and health requirements and associated permits as defined by this manual.
- Establish ESHQ flow-down requirement in all subcontracts. The subcontractor shall validate that these requirements are accurately and completely flowed down to all subcontractors through training, orientation, direct observation, and other performance assurance methods.
- Designate a subcontractor safety manager/designated on-site safety representative to oversee all activities.
- Provide training to employees in safe-work practices.
- Document all required training and have available for review.
- Provide personal protective equipment (PPE) as required, training employees in how to use the

equipment and enforcing its use in the field.

- Monitor the workplace for unsafe conditions and take immediate action to correct unsafe conditions, acts, and other deficiencies identified during inspections.
- Perform necessary personal exposure monitoring.

- Coordinate and conduct prejob planning with subcontractors, field supervisors, affected lab managers, and others, as required.
- Conduct a daily walk around safety inspection and document this inspection.
- Instruct all employees, initially and periodically, on matters pertaining to employee safety and health rights, protections, obligations, and responsibilities.

2.6 References

- 10 CFR Part 851, Worker Safety and Health Program
- 29 CFR Part 1910, Occupational Safety and Health Standards for General Industry

3 Drug and Alcohol Policy

3.1 Applicability

The requirements of this section apply to all subcontractors and lower-tier subcontractors (hereafter referred to as "subcontractors") performing construction activities on NLR sites.

The purpose of this chapter is to establish expectations for maintaining a work environment at NLR sites that are drug-free and safe. The subcontractor shall develop and implement a drug and alcohol policy consistent with federal and state laws and regulations.

3.2 Subcontractor Responsibilities

The subcontractor is responsible for compliance with 10 CFR Part 851 Appendix A–Worker Safety and Health Program, and shall ensure a work environment that is free from unauthorized or illegal use, possession, or distribution of alcohol or controlled substances. Workers who are involved with illegal drugs or other controlled substances, or who abuse alcohol, pose unacceptable risks to safe and efficient operations.

- Unlawful manufacture, distribution, dispensing, possession, use, transfer, or sale of drugs is prohibited.
- Although medical and recreational marijuana use is permitted in some states, such use remains illegal under federal law. Therefore, its use or possession in any form is prohibited in all NLR facilities and on all DOE property, including leased properties.

3.3 Regulatory Requirements

Subcontractor work activities shall be conducted in accordance with the following statutory requirements:

- 10 CFR Part 707, Workplace Substance Abuse Programs at DOE Sites
- Controlled Substances Act (21 USC 812)
- 21 CFR Part 1308, Schedules of Controlled Substances.

4 Disciplinary Policy

4.1 Applicability

The requirements of this section apply to all subcontractors and lower-tier subcontractors (hereafter referred to as "subcontractors") performing activities on NLR sites.

This section provides requirements for identifying key aspects of the subcontractor disciplinary policy to provide all employees with a safe workplace.

The subcontractor disciplinary policy shall provide rules and guidelines for administering disciplinary action to employees who violate safety rules and procedures or who, by their record or actions, indicate a disregard for safety.

The policy shall detail actions which result in verbal warnings, written warnings, and termination.

The policy should include safety awareness for all employees and motivate them to perform their work safely, in accordance with established safety rules, procedures, and instructions. It shall identify written warnings, disciplinary leave, termination, and disciplinary actions.

Subcontractors shall have a system with provisions for recognition of employees for following safe work practices, training, and retraining programs to ensure employee compliance with safe and healthy work practices.

4.2 Subcontractor Responsibilities

Supervisors shall receive training on the company's disciplinary policy guidelines and procedures established for day-to-day operations.

Supervisors shall understand their responsibilities and company policies and procedures for disciplining employees (i.e., progressive disciplinary action).

They shall be involved in addressing safety performance issues and taking disciplinary action when safety policy is not followed.

Employees shall be provided with a copy of the disciplinary policy and shall read and understand the requirements in the policy.

NLR shall be notified in writing when an employee is disciplined and the action is taken.

4.3 References

- 10 CFR Part 851 Appendix A, Worker Safety and Health Functional Areas
- 10 CFR Part 851, Worker Safety and Health Program

5 Occupational Medicine

5.1 Applicability

The requirements of this section apply to all subcontractors and lower-tier subcontractors (hereafter referred to as "subcontractors") performing construction activities on NLR sites if either of the following criteria apply:

- The subcontractor's workers are on-site for more than 30 days in a 12-month period.
- The subcontractor's workers on-site are enrolled for any length of time in a medical or exposure monitoring program required by any rule or other obligation (e.g., OSHA, hearing conservation, respiratory protection, and silica exposure).

5.2 Regulatory Requirements

The subcontractor shall establish and provide comprehensive occupational medicine services to workers on the site as required by:

- 10 CFR Part 851, Appendix A, Worker Safety and Health Functional Areas
- 10 CFR Part 851, Worker Safety and Health Program
- Executive Order 13335, Incentives for the Use of Health Information Technology
- 10 CFR 712.38(b)(2), Maintenance of Medical Records
- USC Sec. 552a, Records Maintained on Individuals
- 10 CFR Part 1008, Records Maintained on Individuals
- 29 CFR Part 1910.1020, Access to Employee Exposure and Medical Records
- 42 USC Sec. 7384, Energy Employees Occupational Illness Compensation Program Act.

5.3 NLR-Specific Requirements

Where applicable, NLR requires subcontractors to submit health and safety plans that document compliance with the occupational medicine provisions contained in Appendix A.8. to 10 CFR Part 851, Worker Safety and Health Program.

5.4 NLR Special Emphasis

The occupational medicine requirements in 10 CFR Part 851 are unfamiliar to many subcontractors, and "flowing down," or transferring the responsibility for compliance with these requirements to lower-tier subcontractors, is irregular and tends to lack proper oversight to ensure high-quality compliance. Further, subcontractors may fail to inform occupational medicine services providers of their responsibilities specified in 10 CFR Part 851, which is a regulation unique to DOE sites and applicable at NLR.

5.5 Subcontractor Responsibilities

The subcontractor is responsible for complying with Appendix A.8. of 10 CFR Part 851, Worker Safety and Health Program, including the accurate and timely flow of these requirements to all lower-tier subcontractors, and for ensuring all lower-tier subcontractors comply with these requirements.

- The subcontractor is responsible for providing their occupational medicine services providers access to

worksite hazard information.

- The subcontractor is responsible for coordinating with the NLR ESHQ POC and providing their occupational medicine services provider with access to the following:
  - Current information about actual or potential work-related site hazards (chemical, radiological, physical, biological, or ergonomic)
  - Employee job-task and hazard analysis information, including essential job functions
  - Actual or potential worksite exposures of each employee
  - Personnel actions resulting in a change of job functions, hazards, or exposures.
- The subcontractor shall notify their occupational medicine services providers when an employee has been absent because of an injury or illness for more than five consecutive workdays (or an equivalent time for those individuals on an alternative work schedule).

The subcontractor and their occupational medicine services provider are responsible for developing and maintaining a record containing any medical, health history, exposure history, and demographic data collected for the occupational medicine purposes for each employee for whom medical services are provided. All occupational medical records shall be maintained in accordance with Executive Order 13335, Incentives for the Use of Health Information Technology.

The subcontractor is responsible for notifying their occupational medicine services provider of the requirements contained in Appendix A.8. of 10 CFR Part 851, Worker Safety and Health Program. The occupational medicine services provider and subcontractor are responsible for implementing and ensuring compliance with the following requirements:

- The subcontractor's occupational medicine services provider determines the content of the worker health evaluations.
  - Workers shall be informed of the purpose and nature of the medical evaluations and tests offered by the occupational medicine services provider.
  - The occupational medical provider shall determine the necessary health evaluations.
  - Diagnostic examinations will evaluate employee's injuries and illnesses to determine work-relatedness, the applicability of medical restrictions, and referral for definitive care, as appropriate. After a work-related injury or illness or an absence due to any injury or illness lasting five or more consecutive workdays (or an equivalent time for those individuals on an alternative work schedule), a return-to-work evaluation will determine the individual's physical and psychological capacity to perform work and return to duty. At the time of separation from employment, individuals shall be offered a general health evaluation to establish a record of physical condition.
- The occupational medicine services provider shall monitor ill and injured workers to facilitate their rehabilitation and safe return to work and to minimize lost time and its associated costs.

  The occupational medicine services provider shall include measures to identify and manage the principal preventable causes of premature morbidity and mortality affecting

worker health and productivity. The subcontractor shall include programs to prevent and manage these causes of morbidity when evaluations demonstrate their cost effectiveness.

- The occupational medicine services provider shall review and approve the medical and behavioral aspects of employee counseling and health promotional programs, including the following types:
  - Subcontractor-sponsored or subcontractor-supported employee assistance programs
  - Subcontractor-sponsored or subcontractor-supported alcohol and other substance abuse rehabilitation programs
  - Subcontractor-sponsored or subcontractor-supported wellness programs.

5.6 References

- 10 CFR Part 851 Appendix A, Worker Safety and Health Functional Areas
- 10 CFR Part 851, Worker Safety and Health Program
- Executive Order 13335, Incentives for the Use of Health Information Technology
- 10 CFR Part 712.38(b)(2), Maintenance of Medical Records
- USC Sec. 552a, Records Maintained on Individuals
- 10 CFR Part 1008, Records Maintained on Individuals
- 29 CFR Part 1910.1020, Access to Employee Exposure and Medical Records
- 42 USC Sec. 7384, Energy Employees Occupational Illness Compensation Program Act

6 Hazard Identification and Control Process

6.1 Applicability

The requirements of this section apply to all subcontractors and lower-tier subcontractors (hereafter referred to as "subcontractors") performing activities on NLR sites unless otherwise specifically exempted by NLR. This section provides the requirements for establishing a method for identifying, controlling, and documenting hazards associated with subcontractor work activities and communicating this information to all affected workers.

6.2 Regulatory Requirements

Subcontractor methods for identifying, controlling, and documenting hazards associated with subcontractor work activities shall be conducted in accordance with the following statutory requirements:

- 29 CFR Part 1926, Construction Safety and Health Regulations for Construction
- 29 CFR Part 1910, Occupational Safety and Health Standards for General Industry
- 10 CFR Part 851, Worker Safety and Health Program.

6.3 NLR-Specific Requirements

In addition to Section 6.2, all subcontractor work activities shall meet the following NLR-specific requirements for hazard identification and control.

6.3.1 General Requirements

The subcontractor is responsible for understanding the scope of work in sufficient detail to ensure the work is effectively planned for each definable work activity, the hazards associated with the work are identified, and the planned protective measures are implemented.

6.3.2 Worker Training

The subcontractor shall ensure affected workers are made aware of foreseeable hazards and protective measures prior to beginning work on that activity.

6.3.3 Record of Training

The subcontractor shall ensure workers acknowledge that they were informed of the hazards and protective measures associated with assigned work activities and understand those requirements.

6.3.4 Method of Procedure

A method of procedure (MOP) may be required by this manual or the subcontractor documents. MOPs are required for, but not limited to, the following activities:

- Complex lockout/tagout (LO/TO)
- Energized electrical work

- Testing and start-up of equipment
- Flushing
- Pressure testing.

6.4 Subcontractor Responsibilities

The provisions of this procedure apply to the development and implementation of the subcontractor's hazard identification and control program. The subcontractor shall be responsible for implementing an effective hazard identification and control program that:

- Identifies, evaluates, and controls potential and existing hazards/agents in the workplace through the prejob safety planning process
- Determines engineering devices, administrative controls, and PPE are available, appropriate, tested, and used by employees
- Determines employees are trained as required
- Has provisions to manage and notify NLR when there are changes related to the work scope, materials, and/or processes that may introduce new or different hazards to the project.

6.5 References

- 10 CFR Part 851, Worker Safety and Health Program
- 29 CFR Part 1910, Occupational Safety and Health Standards for General Industry
- 29 CFR Part 1926, Construction Safety and Health Regulations for Construction

7 Control of Hazardous Energy, LO/TO

7.1 Applicability

The requirements of this section apply to all subcontractors' and lower-tier subcontractors' (hereafter referred to as "subcontractors") activities (e.g., constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining/servicing equipment) where the unexpected release of hazardous energy (e.g., electrical, hydraulic, pneumatic, chemical, thermal, compressed gases, mechanical, and gravity) or start-up of the machines, equipment, and systems could cause injury on NLR sites.

7.2 Regulatory Requirements

The subcontractor's control of hazardous energy program and associated work activities—as defined in Section 7.1 where the unexpected release of hazardous energy or start-up of the machines, equipment, and systems could cause injury—shall be conducted in accordance with the following statutory requirements:

- 29 CFR Part 1910.147, The Control of Hazardous Energy (Lockout/Tagout)
- 29 CFR Part 1910.333, Selection and Use of Work Practices
- NFPA 70E, *Standard for Electrical Safety in the Workplace*, latest edition.

Exception: Construction subcontractors are not required to adhere to requirements for "periodic inspections" contained in 29 CFR Part 1910.147(c)(6).

7.3 NLR-Specific Requirements

In addition to Section 7.2, all work activities requiring the use of LO/TO shall meet the following NLR requirements as applicable in Sections 7.3.1–7.4.1 of this manual.

7.3.1 NLR Building Equipment and Systems LO/TO

Prior to conducting any work that requires LO/TO within an existing NLR building or that interfaces with an existing NLR utility system, the subcontractor shall notify the NLR TM, ESHQ POC, and facility manager (FM) for coordination. This includes LO/TO that occurs on building construction temporary and/or permanent electrical power tie-ins at the point of NLR-supplied power distribution. The NLR FM shall control and coordinate LO/TO work being conducted on equipment/systems and shall ensure that the subcontractors are aware of and comply with the requirements of the NLR LO/TO program. The subcontractor shall ensure the ESHQ POC is provided with the provisions of the subcontractor's LO/TO program/procedures. When NLR equipment-/system-specific procedures are available, they shall be provided to the subcontractor and used as part of the LO/TO.

When the subcontractor performs work that is downstream of the NLR power distribution point for temporary or permanent power tie-in, is downstream of an existing NLR LO/TO, or is completely independent of existing NLR building equipment/systems, the LO/TO shall be performed in accordance with the subcontractor's accepted LO/TO program.

A service subcontractor, vendor, or partner company that does not have an LO/TO program but is required to perform service and maintenance on an NLR system under LO/TO may be provisionally authorized. The NLR

Primary Authorized Worker must determine the appropriate use of the provisionally authorized worker designation, perform the associated briefing, and collect and retain the required documentation. A written LO/TO procedure is required when using provisionally authorized workers, and the Lockout/Tagout Provisional Worker Authorization must be completed.

7.3.1.1 *Tagout-Only Requirements*

When equipment/system cannot physically be locked out and a tagout is applied to equipment/system in place of lockout, the subcontractor shall attempt feasible measures to renovate or modify the equipment to accept a lockout device at the energy-isolating device(s). When this cannot be accomplished, the subcontractor shall:

- Implement additional measures to provide the equivalent level of safety (i.e., post an attendant, remove isolating circuit element, fuse, or valve handle) and document it in the SWP.
- Apply a properly completed tag at the energy-isolating device and controls. Individual tags shall include the name and cell phone number for each worker.
- Verify energy sources are eliminated.
- Check the tag periodically when working under a tagout to verify it is still in place.

7.3.2 Equipment-Specific LO/TO Procedures

Written equipment-specific procedures are required for complex applications or when multiple crews or employers are engaged in a common LO/TO application. When written LO/TO procedures are required, the subcontractor may elect to use their own procedure format, the NLR MOP template, or the NLR LO/TO equipment-specific procedure format. If the subcontractor elects to use their own procedure format, they shall meet the minimum content requirements of 29 CFR Part 1910.147 and NFPA 70E for electrical applications.

7.3.3 Subcontractor LO/TO Inspection Procedures

The subcontractor shall ensure that weekly documented inspections are made for all active LO/TO applications. These inspections shall be kept at the jobsite and made available for review by NLR.

The subcontractor shall also perform daily informal (undocumented) inspections to verify LO/TOs remain in place.

7.3.3.1 Simple vs. Complex LO/TO

Lockout applications of different systems pose a variety of hazards to employees based on the characteristics of the system. LO/TO may be as simple as a single lockout device on a subpanel breaker or may involve several points that need to be isolated in a specific order. NLR has developed criteria for simple and complex LO/TO applications with different levels of planning for each.

Simple LO/TO

Equipment meeting the following criteria may be classified as a simple LO/TO application and will only require coordination with the site FM, knowledge of the affected systems, and verifiable training to be performed:

- The equipment does not have the potential for stored residual hazardous energy or accumulation of stored hazardous energy after shutdown that could endanger workers.

- The equipment has a single hazardous energy source that can be readily identified and isolated at a single location.
- The isolation and locking out of the hazardous energy source will fully de-energize hazardous energy from the system and deactivate the equipment.
- The equipment is isolated from the hazardous energy source and locked out during service and maintenance.
- A single lockout device will achieve a locked-out condition.
- The lockout device is under the exclusive control of the single authorized employer performing the service and maintenance.
- The service and maintenance activities do not create hazards for other workers.
- There have not been accidents involving the unexpected activation or re-energization of the equipment during service and maintenance.

Complex LO/TO

A complex LO/TO is defined as a lockout condition that does not meet all the above criteria for a simple LO/TO. When it is discovered that a future lockout condition will meet the criteria for a complex application, an MOP shall be developed by the construction contractor prior to energy isolation. MOPs for complex LO/TO applications shall include the following information:

- Description of the systems to be locked out and any other affected systems
- A detailed, step-by-step sequential procedure for notifications, energy isolation, and verification
- A drawing of the affected systems highlighted to identify isolation points and other controls
- Identification of involved employees, roles of identified workers, and what equipment will be involved
- Hold point identified to hold a pre-job briefing if LO/TO being performed is for electrical systems.

Construction contractors are free to use their own form for complex LO/TO applications or may request a compliant form from NLR. MOPs for complex applications will require review and acceptance by NLR prior to energy isolation.

7.3.4 Subcontractor Training Requirements

Subcontractors that are trained in accordance with the requirements identified in 29 CFR Part 1910.147, Control of Hazardous Energy (Lockout/Tagout) will be considered as meeting the necessary training requirements for working at NLR. Electrical contractors will additionally have to be trained in the latest edition of NFPA 70E.

7.4 NLR Special Emphasis

7.4.1 Applying LO/TO

Every exposed subcontractor shall apply their own uniquely keyed lock and a properly completed tag (including name and cell number) to secure the energy source(s) prior to beginning work activities. When more than one individual is working on the same piece of equipment, excavation, or project, a group lock box, multilock hasps (gang hasp), or other acceptable means shall be used, and each worker shall apply his or her lock. Combination

locks are not acceptable. Workers shall not rely on another person's lockout for protection. **Supervisory controlled LO/TOs are prohibited at NLR.**

7.5 References

- 29 CFR Part 1910.147, The Control of Hazardous Energy (Lockout/Tagout)
- 29 CFR Part 1910.333, Selection and Use of Work Practices
- NFPA 70E, *Standard for Electrical Safety in the Workplace*, latest edition.

8 Electrical Safety

8.1 Applicability

The prime contractor is responsible for the development and implementation of an electrical safety program to be followed throughout all phases of the construction project. This program applies to all lower-tiered subcontractor activities performed on NLR sites unless specifically exempted by the NLR electrical AHJ.

8.2 Regulatory Requirements

The subcontractor electrical safety program shall be conducted in accordance with the following statutory requirements:

- 29 CFR Part 1910.269, Electric Power Generation, Transmission, and Distribution
- 29 CFR Part 1910.333, Selection and Use of Work Practices
- 29 CFR Part 1910.147, The Control of Hazardous Energy (LO/TO)
- NFPA 70E, *Standard for Electrical Safety in the Workplace*, latest edition.

Note: Whenever there is a conflict between any requirements contained or referenced in this chapter, the most stringent requirement shall apply unless specifically exempted by the NLR electrical AHJ.

8.3 NLR-Specific Requirements/Permits

In addition to Section 8.2, the subcontractor electrical safety program shall meet the following NLR requirements, as applicable.

8.3.1 Energized Electrical Work

Work on energized systems at NLR shall be strenuously avoided unless it has been approved by the NLR electrical AHJ and there is no reasonable alternative course of action. If energized electrical work shall be performed on hazardous electrical circuit parts, the subcontractor shall obtain an NLR authorized energized electrical work permit (EEWP) from the PM prior to performing any energized electrical work. If energized work shall be performed on any other type of energy system (excluding electrical), it shall be authorized by the NLR TM with concurrence from the NLR electrical AHJ.

Exception with approval from NLR electrical AHJ: Taking voltage or current measurements for diagnostic purposes and/or verification of the absence of energy by using standard test equipment such as voltmeters and current probes is permitted on energized electrical systems without issuance of an EEWP. All other hazard identification, control, and PPE requirements, including shock protection and arc-flash protection, continue to apply and shall be documented in the SWP or MOP. An MOP is an option for documenting the electrical risk assessment and electrical job safety plan. NLR can provide a template upon request.

8.3.2 General Electrical Work Safety Requirements

Subcontractors shall identify the electrical hazards associated within each definable feature of work and establish the necessary controls to maintain an acceptable level of risk. To assist in the evaluation of electrical hazards, subcontractors shall employ an electrical risk assessment consistent with requirements of NFPA 70E, *Standard for Electrical Safety in the Workplace* (current revision as adopted by NLR) for shock and arc-flash

hazards. The identified hazards and control measures shall be documented in the associated electrical job safety plan, SWP, MOP, or other work control document that provides an acceptable level of hazard identification and control for the associated task or work sequence.

The safe electrical work practices that are employed shall prevent electric shock, burns, arc flash, or other injuries that could result from either direct or indirect electrical contact. This may include specialized training, observing required approach distances, and the use of PPE consistent with the requirements of NFPA 70E.

The subcontractor shall conduct electrical job briefings prior to starting work each day. The briefing shall cover the elements in the electrical job safety plan to include such subjects as hazards associated with the job, work procedures involved, special precautions, energy source controls, PPE requirements, and the information on the energized electrical work permit, if required. Additional job briefings shall be held if changes that might affect the safety of employees occur during work.

8.3.2.1 PPE

Subcontractors are responsible for identifying, providing, and maintaining their own PPE. Maintenance of PPE includes the required testing and certification. Records of such testing shall be made available for review.

PPE appropriate to the hazard present shall be used. Electrical PPE may include:

- Rubber insulating gloves with protectors
- Eye, face, head, and hearing protection
- Nonconductive headgear (Class E-rated hard hat)
- Arc-flash protective clothing, as required by NFPA 70E
- Hot-sticks and similar tools.

8.3.2.2 Qualified Electrical Worker

The subcontractor shall provide proof of NFPA 70E training as requested by the ESHQ POC. NLR only accepts instructor-led (virtual or in-person) NFPA 70E training from approved providers. Online, self-paced courses will not be accepted. For a current list of NLR-accepted providers, contact the ESHQ POC. A training program is not considered acceptable until verified by the electrical AHJ or designee.

In addition to having NFPA 70E training, qualified workers shall maintain the necessary skills and knowledge related to the construction, operations of electrical equipment, and the associated hazards to be permitted to work on electrical systems at NLR. A qualified electrical worker can lose their status at NLR if they demonstrate that they do not have the skills, knowledge, and training necessary to safely perform work based on an incident or observation. A qualified electrical worker is a person who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify the hazards and reduce the associated risk. Such a person is familiar with the proper use of precautionary techniques, PPE, insulating and shielding materials, insulated tools, and test equipment in addition to NLR-specific procedural requirements. Verification of training shall be in accordance with Section 2.3.2.

Apprentice electricians shall work under the supervision of a journeymen electrician and have received the appropriate electrical safety training prior to work assignments that involve electrical hazards.

Electrical apprentices can only work on systems that are in an electrically safe work condition as defined by NFPA 70E.

The subcontractor is responsible for documenting the qualifications of the qualified electrical workers used on the project.

8.3.3 Ground Fault Circuit Interrupter Protection

Subcontractors shall ensure use ground fault circuit interrupter (GFCI) protections where an employee is operating or using cord sets (extension cords) or cord- and plug-connected tools related to maintenance and construction activity supplied by 125-volt, 15-, 20-, or 30-ampere circuits. Where employees operate or use equipment supplied by greater than 125-volt, 15-, 20-, or 30-ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented.

The users of a portable GFCI shall use the test button provided before each use. If the GFCI breaker fails the test, tag out of service with a “DANGER - DO NOT USE” tag and (if portable) remove from service.

8.3.4 Tripped Facility Circuit Breakers

Tripped facility circuit breakers may not be re-energized until it has been determined that the equipment and circuit can be safely re-energized. Do not reset or operate facility circuit breakers. Contact the FM or your NLR PM if this occurs.

8.3.5 Flexible Cords and Cables

Use flexible cords listed by Underwriters Laboratories and suitable for conditions and location of use. Flexible cord sets used with grounding-type equipment shall contain an equipment grounding conductor. Protect flexible cords and cables from damage. When possible, hang the extension cord sets appropriately overhead to avoid tripping hazards and damage caused by foot traffic and equipment. Avoid sharp edges, pinching, or improper storage. Cords sets that are damaged shall be removed and discarded or repaired by a qualified person.

8.3.6 LO/TO

Subcontractors shall ensure electrical systems and equipment are effectively isolated, locked, and tagged out in accordance with the requirements of Chapter 8 prior to performing any work on or near the energized systems.

Subcontractors shall make all feasible efforts to place electrical systems and equipment into an electrically safe work condition to eliminate performing hazardous energized electrical work as defined in Section 8.3.7.

Note: Per the requirements of NFPA 70E, workers are to conduct zero-energy verification when performing LO/TO (per Article 120, Establishing an Electrically Safe Work Condition.6 for details). This includes using an adequately rated portable test instrument—which is a meter with leads, not a proximity tester—and workers must verify correct meter operation on a known source before and after verifying zero-energy.

Note: The intent of zero-energy verification recognizes the possibility that conductors may still be energized through equipment failure, human error, or other unexpected circumstances. Until zero-energy is verified, workers must be fully protected from shock and arc-flash hazards that may exist.

8.3.7 Hazardous Energized Electrical Work

Hazardous energized electrical work at NLR is defined as "work performed within the restricted approach boundary or interactions with the equipment when conductors or circuit parts are not exposed, but an increased likelihood of injury from an exposure to an arc-flash hazard exists, creating the potential for injury, explosion, or injuries due to electric arcs."

When it has been determined by the subcontractor in conjunction with the appropriate NLR authorities (NLR PM, electrical AHJ, and ESHQ POC) that there is no other reasonable alternative course of action, the subcontractor shall obtain an NLR EEWP in accordance with Section 8.3.1 prior to performing any hazardous energized electrical work.

Exception: An EEWP shall not be required if a qualified person is provided with and uses appropriate safe work practices and PPE for the following conditions:

- Testing, troubleshooting, and voltage measuring
- Thermography and visual inspections if the restricted approach boundary is not crossed
- Access to and egress from an area with energized electrical equipment if no electrical work is performed and the restricted approach boundary is not crossed
- General housekeeping and miscellaneous nonelectrical tasks if the restricted approach boundary is not crossed.

8.3.7.1 Energized Electrical Work Permit

The subcontractor shall ensure a permit has been completed with the NLR-required concurrences and approvals before work may be initiated on hazardous energized systems. The permit being submitted shall be task-specific. Blanket, general, or open-ended permits are prohibited and will not be processed. After a permit has been approved, changes in the scope of work or associated hazards require cessation of work and a timely reassessment of the permit. If necessary, additional controls will be established and a new permit issued.

An NLR-approved EEWP serves as the authorization basis to conduct energized electrical work on energized circuits.

8.3.8 Two-Worker Rule

When working with voltages greater than 150 V, NLR requires a second qualified electrical worker to be present when work is performed within the shock-restricted approach boundary or the arc-flash boundary of an exposed energized electrical conductor or circuit part. The two-worker rule also applies to zero energy verification and voltage measurement. The second worker functions as a safety observer and does not participate in the actual work. The second worker also cannot serve as an attendant. The second worker shall be trained in cardiopulmonary resuscitation and be prepared to initiate other emergency response procedures. Subcontractors shall ensure a second worker is present, as required above.

8.3.9 Safe Penetration of Building Surfaces

Subcontractors are required to obtain an NLR Surface Penetration Permit prior to performing any surface penetration inside existing NLR buildings and/or facilities. A surface penetration is defined as an opening made by drilling, cutting, hammering, or otherwise piercing a wall, floor, ceiling, roof, or concrete pad.

The permit outlines the steps necessary for safe penetration of building surfaces with respect to preventing contact with hidden hazards such as live electrical conductors. The NLR FM will issue the permit to the subcontractor. The subcontractor will be responsible for providing all the required materials, personnel, and protective equipment to conduct surface penetration. These materials may include but are not limited to drill stops, GFCIs, dielectric gloves, and mats.

Note: This permit is also necessary to identify other significant hazards, such as natural gas, water lines, compressed air, and drains.

Subcontractors performing surface penetrations in or on new building construction shall be required to use an equivalent permit method when the potential exists to contact hidden hazards associated with live electrical conductors, natural gas, water lines, compressed air, etc.

8.3.10 Excavations

All excavations, including hand digging, trenching, grading, and drilling activities (including staking), shall first be permitted by the appropriate NLR FM. Hydro excavation is required within 5 ft of de-energized underground utilities to prevent damage. The subcontractor shall adhere to all the applicable electrical safety requirements as provided in Chapter 8 of this manual.

8.4 References

- 29 CFR Part 1910, Subpart S, Electrical
- 29 CFR Part 1910, Subpart R, Special Industries
- 29 CFR Part 1910.333, Selection and Use of Work Practices
- 29 CFR Part 1910.147 General Industry, The Control of Hazardous Energy (lockout/tagout)
- NFPA 70E, *Standard for Electrical Safety in the Workplace*, latest edition

9 Excavations

9.1 Applicability

The requirements of this section apply to all subcontractors and lower-tier subcontractors (hereafter referred to as "subcontractors") performing excavation operations and activities on NLR sites unless otherwise specifically exempted by NLR.

9.2 Regulatory Requirements

All subcontractor excavation activities shall be conducted in accordance with the statutory requirements of 29 CFR Part 1926, Subpart P, Excavations.

9.3 NLR-Specific Requirements/Permit

9.3.1 NLR Excavation Permit

In addition to Section 9.2, subcontractors shall obtain an approved NLR Excavation Permit from the appropriate NLR FM for all excavations including trenching, grading, directional boring, drilling, or ground penetrations.

The FM shall determine what sections of the Excavation Permit need to be satisfactorily completed to authorize excavation. At a minimum, the FM and/or the NLR PM, the subcontractor superintendent or designee, and the equipment operator shall physically walk the proposed excavation site with a site drawing (minimum ANSI C size sheet) and compare to the site utility locate drawing and physical markings. Any deviations identified during this walk shall be resolved prior to issuing the permit.

9.3.1.1 Subcontractor Excavation Plan

If required, the subcontractor is responsible for submitting to the NLR FM, PM and ESHQ POC an Excavation Plan to NLR for review and concurrence before excavation activity begins. This plan shall show the proposed boundaries on a site map, including depth of the affected areas and the safety precautions, which shall comply with OSHA Standard 1926, Subpart P, Excavations. Where soil tests are required, manual soil tests shall include the use of a pocket penetrometer, hand-operated shear vane, or other OSHA-authorized manual test accepted by NLR. The results of both visual and manual tests shall be documented and maintained in a written log by the competent person and shall identify the date, time, and location of tests.

The FM/PM will verify the Excavation Plan (if required) with the appropriate engineering and construction as-built utility drawings to identify any potential conflicts with existing underground facilities and/or utility lines.

9.3.1.2 Utility Locating Services

The NLR FM will dictate the necessary underground utility location and identification services as part of the subcontractor's work. These services shall be performed prior to NLR authorizing the excavation permit. The FM will verify the lines have been identified with appropriate color-coded markers.

When the subcontractor is responsible for the underground utility location and identification, public utility locating services can be coordinated through the Utility Notification Center of Colorado, 800-922-1987 (811). The Notification Center will contact the various utility companies (e.g., Xcel, Pleasant View Sanitation District) to come to the NLR construction site for the purpose of locating and identifying all underground utilities with the appropriate color-coded markers. Some utility location and identification may require a private utility

location company, (e.g., SiteWise, Consolidated Mutual Water) to complete. The NLR Architecture and Engineering Services group can provide drawings with approximate locations of existing utilities and structures to aid in marking the utilities.

If there is any uncertainty as to the degree of safety protection anticipated on underground electrical power lines, the electrical service shall be de-energized first with a planned outage arranged and coordinated through the affected FM and PM.

Excavation activities that require personnel to work at, or potentially be exposed to, unprotected heights of 6 ft or more shall require the use of fall protection.

9.3.1.3 Pothole Verification

The NLR PM or assigned representative shall work directly with the subcontractor, who will hand dig or otherwise safely "pothole" (daylight) to verify location and depth of the various utilities and NLR-owned underground facilities and/or lines which may conflict with the excavation activity. NLR contracts with SiteWise to provide potholing (hydro excavation) services.

When the subcontractor excavating activities are within 5 ft of underground utilities, the NLR PM or NLR-designated representative may choose to be physically present. The preferred method is to hydro excavate. Hydro excavation shall be performed within 5 ft of underground de-energized electrical to prevent damage.

Note: At the FM's discretion, the subcontractor may be required to perform pothole activities prior to the approval of the Excavation Permit. However, no other excavation may take place without the approved NLR excavation permit.

9.3.1.4 Confined Spaces

The configuration of an excavation such that the excavation is deemed to be a confined space is out of scope for the manual.

9.3.2 NLR Excavation LO/TO

All underground electrical (50 V and above) and other systems covered by the LO/TO program shall be de-energized and locked out during excavations within 5 ft of those systems, unless otherwise approved in advance by the appropriate FM and ESHQ POC.

The LO/TO shall be in accordance with an NLR-accepted subcontractor LO/TO program. During excavation/construction activities, no locks or tags shall be installed or removed on facility systems by subcontractors without the written approval of the applicable FM or designated representative.

9.3.3 Subcontractor Training Requirements

Subcontractor excavation-competent persons who are trained and knowledgeable about soils analysis, the use of protective systems, identification of existing and predicable excavation hazards, and the requirements of 29 CFR Part 1926, Subpart P, Excavations will typically be considered as meeting the necessary excavation-competent-person training for working at NLR. The subcontractor shall provide proof of such training to the prime contractor. The subcontractor is required to provide a competent person at the jobsite when excavations work is ongoing. The subcontractor shall ensure the competent person(s) can demonstrate their knowledge and skill sets match the excavation and protective systems that are in place. In addition, all subcontractors working

in or around excavations shall receive general excavation hazards awareness training.

9.4 NLR Special Emphasis

9.4.1 Munitions and Explosives of Concern and/or Cultural Resources

The laboratory facilities at the STM Campus and STEP Campus are located on a portion of the former Camp George West National Guard base. The former base had a long and varied history as a military installation from 1902 through 1953. Portions of the NLR campus are subject to the discovery of military munitions and explosives of concern (MECs) and/or other cultural resources.

All MECs or suspect foreign objects encountered on the STM Campus shall be treated as extremely dangerous. These items can be unexploded ordnance, discarded military munitions, or munitions constituents.

All subcontractors performing work in an "STM identified area of concern" shall brief their workers and lower-tier subcontractors on the potential for discovery of MECs and the required response actions. NLR ESHQ POCs will assist in providing the necessary information to affected subcontractors on the types of MECs that may be found on the site and required response actions upon discovery.

In the event an employee discovers an MEC or suspect foreign object while performing work on NLR facilities, the employee shall be trained to follow the "three Rs":

- **Recognize:** Do not touch, disturb, or move the item. Munitions come in all shapes, sizes, and colors, but exposure to weather and time can alter or remove these markings.
- **Retreat:** Mark the general location of the MEC with hazard tape, colored cloth or ribbon, hat, etc. at a point no closer than you first recognized it. Do not transmit any radio frequency when in the proximity of an MEC. Evacuate the area to a safe distance of at least 100 yd. Do not allow any coworkers to re-enter the area until it has been cleared by the Jeffco Bomb Squad or NLR Security.
- **Report:** Immediately upon reaching a safe distance from the MEC, contact NLR Security at 303-384-6811. Security will notify the Jefferson County Sheriff's Office bomb squad.

If potential cultural resources, such as historical or archeological items, are unearthed or discovered during construction, work in the area shall stop. NLR will determine within 24 to 48 hours whether work in the construction site can continue. Potential cultural items may not be moved or stockpiled upon discovery.

9.5 Subcontractor Responsibilities

The subcontractor shall be responsible for the following:

- Obtaining an approved NLR Excavation Permit from the FM
- Monitoring/daily inspections of excavation, trenching, and shoring operations
- Designating a competent person who has had the training to act in this position and providing the competent person the authority to effectively discharge their duties
- Ensuring the requirements of this section are effectively communicated and flowed down to lower-tier subcontractors
- Investigating and reporting to the NLR TM and ESHQ POC all incidents involving excavations, trenching, and shoring.

9.6 References

- 29 CFR Part 1926, Subpart P, Excavations.

10 Fire Protection and Prevention

10.1 Applicability

The subcontractor shall be responsible for the development and implementation of a fire protection program to be followed throughout all phases of the project. This program shall apply to all subcontractors' and lower-tier subcontractors' (hereafter referred to as "subcontractors") activities performed on NLR sites unless otherwise specifically exempted by NLR.

10.2 Regulatory Requirements

The subcontractor fire protection and prevention program shall be conducted in accordance with the following statutory requirements:

- 29 CFR Part 19210.39, Fire Prevention Plans
- 29 CFR Part 1910, Subpart E, Exit Routes and Emergency Planning
- 29 CFR Part 1910, Subpart H, Hazardous Materials
- 29 CFR Part 1910, Subpart Q, Welding, Cutting and Brazing
- ANSI Z49.1 – 2012, *Safety in Welding, Cutting and Allied Processes*, Sections 4.3 and E4.3. or latest edition
- NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*, latest edition
- International Fire Code (edition based on NLR Contract and local adoptions)
- NFPA 51B, Standard for Fire Prevention During Welding, Cutting, and Other Hot Work (latest edition)

10.3 NLR Specific Requirements/Permit

In addition to Section 11.2 of this manual, the subcontractor fire protection and prevention program shall meet the following NLR requirements as applicable.

10.3.1 Performance of Hot Work

The following requirements apply to subcontractors conducting activities with open flames, welding, brazing, cutting, grinding, and other flame-/spark-producing tasks, and the use of powder actuated tools.

Subcontractors conducting hot work shall perform such work under the NLR hot-work permit system. The hot-work permit shall be obtained from the NLR FM. Subcontractors may be authorized to use their own hot-work permit system on a case-by-case basis if formally approved by the NLR fire protection AHJ, which may include review of the written hot-work permit system and an observation of the system in action to determine whether the subcontractor system is equivalent in risk reduction to the NLR hot-work permit system. However, all hot work performed inside existing NLR buildings shall be performed under the NLR hot-work permit system. The NLR FM will issue the permit. The subcontractor will be responsible for providing all the required materials, personnel, and protective equipment to conduct all hot work. The subcontractor shall ensure that all lower-tier subcontractors understand and comply with the requirements of the permit system.

The subcontractor shall perform a walk-down of the work to facilitate thorough hazard identification and control. The subcontractor is ultimately responsible for compliance with the requirements of the permit, including completion of the daily checklist. The hot-work permit is valid for the specified task noted on the permit and may not exceed 14 days in duration. Variance from the scope of work identified on the permit is prohibited.

10.3.1.1 Hot-Work Location Selection Hierarchy

The location of hot work shall be determined by using the following priority list:

- Alternatives to performing hot work should be used where practical. Examples of alternate methods include providing portable oil-filled radiator-type heaters to thaw frozen pipe; using mechanical hydraulic shears or reciprocating saws instead of hot-work cutting; using mechanical bolting or air-actuated fasteners instead of welding; or using screwed, flanged, or clamped piping connections instead of welding connections together.
- If alternative methods are unavailable, hot work should be performed in off-site subcontractor shops or designated hot-work areas (e.g., preapproved weld booths or shop areas) where practical.
- If off-site designated hot-work areas are unavailable, hot work should be performed in on-site designated hot-work areas.
- If hot work shall be conducted on-site outside of designated hot-work areas, the subcontractor shall ensure that hot work is not conducted during facility fire-sprinkler system outages (or other fire suppression systems).
- If hot work shall be conducted on-site outside of designated hot-work areas, the subcontractor shall ensure that hot work is not conducted when the potential exists for an explosive environment, such as locations where flammable vapors or combustible dusts are present.
- If hot work shall be conducted on-site outside of designated hot-work areas, the subcontractor shall ensure that hot work is not conducted where there is exposure to unprotected accumulations of combustible materials.
- If hot work shall be conducted on-site outside of designated hot-work areas, the subcontractor shall ensure that hot work is not conducted outdoors when a Red Flag Warning is in effect. Prior to the start of any hot-work activity, the subcontractor shall review the National Weather Service at weather.gov for a Red Flag Warning alert. If a red flag is posted, the subcontractor shall adhere to fire bans or restrictions posted at www.jeffco.us.
- If hot work shall be conducted on-site outside of designated hot-work areas, the subcontractor shall ensure that hot work is not conducted in other locations the FM determines unsuitable for hot work.

10.3.1.2 Hot-Work Permit Exempt Activities

Hot-work permits are not required for the following activities:

- Electric soldering irons and electric resistance spot welding
- Heat guns
- Grinding on nonmetallic materials
- Orbital welding

- Plastic pipe fusion.

10.3.1.3 Prohibited Hot-Work Activities

The following activities are prohibited on NLR premises unless specific written approval is obtained from the NLR fire protection AHJ:

- Hot work performed on containers or equipment that contain or have contained flammable liquids, gases, or solids
- Roofing operations that involve heat sources and hot processes, such as torch-applied roofing or the use of tar kettles
- Pyrotechnics or special effects
- Candles, incense, or similar combustion-based items
- Charcoal cooking devices
- Design and installation of gas cutting and welding equipment covered in NFPA 51, *Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes*
- Use of acetylene generators.

10.3.1.4 Control of Combustible Materials

The following requirements apply to the control of combustible materials as it applies to hot-work operations.

General:

- Combustibles shall be relocated at least 35 ft in all directions from the hot-work area (see Section 1.2 for definition of combustible material). The FM is permitted by the hot-work permit to extend the separation distance in instances where the scope of work and the tools used to conduct hot work result in possible travel of slag, sparks, spatter, or similar mobile sources of ignition farther than 35 ft. The separation distance may only be reduced to less than 35 ft if approval is obtained from an NLR fire protection engineer (FPE). FPE approval is indicated by signing the corresponding checkbox on the hot-work permit.
- If relocation is impractical, combustibles shall be shielded by a barrier constructed of noncombustible materials (such as metal or as defined in Section 1.2) or otherwise protected by a listed welding curtain, welding blanket, welding pad, or equivalent.
- Ducts and conveyor systems that might carry sparks to distant combustibles shall be shielded, shut down, or both.

Floors:

- Where combustible materials, such as paper clippings, wood shavings, or textile fibers, are on the floor, the floor shall be swept clean for a radius of 35 ft.
- Combustible floors (such as wood floors) shall be kept wet, covered with damp sand, or protected by a listed welding blanket, welding pad, or metal covering. Where floors have been wet down, personnel operating arc welding equipment or cutting equipment shall be protected from possible electric shock.
- Openings or cracks in floors within 35 ft of the hot-work area shall be covered or sealed with a noncombustible material (such as metal or as defined in Section 1.2) or a listed welding blanket or pad.

- To prevent the entrance of sparks, the edges of covers at the floor shall be tight, including at the point where covers overlap.

Walls, Partitions, Ceilings, and Roofs:

- If hot work is to be performed on a metal wall, partition, ceiling, or roof, precautions shall be taken to prevent ignition of combustibles on the other side due to conduction or radiation through penetrations or surfaces, preferably by relocating combustibles. Heat-affected area(s) shall be confirmed to be bare metal. Remove dust/lint or other combustible materials.
- If hot work is to be performed near walls, partitions, ceilings, or roofs of combustible construction, they shall be protected by a listed welding curtain, welding blanket, welding pad, or equivalent.
- Openings or cracks in walls, partitions, ceilings, roofs, or ducts within 35 ft of the hot-work area shall be covered or sealed with listed welding blanket, welding curtain, welding pad, or noncombustible material to prevent the passage of sparks to adjacent areas.
- Hot work that is performed on pipes or other metal that is in contact with combustible walls, partitions, ceilings, roofs, or other combustibles shall not be undertaken if the work is close enough to cause ignition by conduction.

10.3.1.5 Fire Watch

The subcontractor shall establish a fire watch to protect the safety of workers and assets. The fire watch observes staff conducting the welding, cutting, or grinding operations and monitors adjacent areas. The following requirements apply to fire watches:

- A continuous fire watch shall be provided during hot-work activities and shall continue for no less than 30 minutes after the conclusion of the hot-work operation, including breaks and lunch. The FM is authorized to extend the fire watch duration based on the hazards or work being performed. More than one fire watch shall be required if combustible materials that could be ignited by the hot-work operation cannot be directly observed by the initial fire watch. Examples include hot work conducted on an elevated level where the elevated level and affected level(s) below are not observable by a single individual.
- The fire watch shall understand the requirements of the hot-work permit and understand the basic hazards of any combustible construction involved with the hot-work area, the fire exposure hazard that hot work creates to areas adjacent to or below the hot-work operation, the hazards associated with the area, and the need to maintain proper isolation of hot-work operations from combustible or flammable materials.
- The fire watch shall be knowledgeable about fire and emergency reporting procedures to the CMS and fire alarm pull box locations in buildings, if applicable. Where the fire watch is remote from the hot work (on a different level, separated by a wall, etc.), a readily available form of communication shall always be maintained with the hot-work performer. Radio is recommended as the primary form of communication. Cell phones may be permitted where coverage is sufficient and allowed by the FM.
- The fire watch shall be trained in the use of fire extinguishing equipment.
- The fire watch shall watch for fires in exposed areas and try to extinguish them only when the fires are obviously within the capacity of the equipment available. If the fire watch determines that the fire is not within the capacity of the equipment, the fire watch shall sound the alarm immediately.

- The fire watch shall have the authority to stop hot-work operations if unsafe conditions develop.
- The fire watch may be permitted to perform additional tasks, but those tasks shall not distract them from their fire watch responsibilities. These tasks might include moving partitions relating to the hot work, sweeping in the immediate area, and minimal assistance to the operator.

10.3.1.6 Fire Extinguishers

The following requirements apply to fire extinguishers used to support hot-work operations:

- No less than one portable fire extinguisher with a minimum 4-A:60-B: C rating shall be provided with ready access within 30 ft of the location where hot work is performed.
- Portable fire extinguishers shall be listed, labeled, used, inspected, tested, and maintained in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*.
- If existing hose lines are located within the hot-work area defined by the permit, they shall be connected and ready for service but are not required to be unrolled or charged.
- Fire extinguishers dedicated to the hot-work activity shall be in the hot-work area. Do not remove a permanently mounted extinguisher in the facility from its storage rack except in case of fire.

10.3.1.7 Fire Protection Systems

The following requirements apply to fire protection systems as they relate to hot-work operations:

- Hot work is prohibited in buildings where fire suppression systems are impaired unless additional precautions are taken as determined by an NLR FPE.
- Where hot work is performed close to heat or smoke detectors, or the activity is expected to produce smoke quantities significant enough to risk setting off a smoke detector, the individual detectors may be temporarily covered or disabled during the hot-work operation by requesting a Fire Protection System Outage Permit from the FM. The rest of the fire alarm system shall remain in service for the duration of the hot-work operation. The detectors shall be returned to service as soon as possible following completion of the hot-work operation.
- Where hot work is performed within 3 ft of automatic sprinklers, noncombustible barriers shall shield the individual sprinkler heads and shall be removed when the work is completed. Shielding sprinkler heads is considered an impairment and shall be obtained by requesting a Fire Protection System Outage Permit from the FM. If the work extends over several days, the shields shall be removed at the end of each workday.

10.3.1.8 Welding Blanket, Curtain, and Pads

The following requirements apply to welding blankets, welding curtains, and welding pads used to shield combustible materials from sparks and embers:

- Welding blankets, welding curtains, and welding pads shall be approved by FM Global. Documentation shall be available to prove the product has been approved by FM Global or the product shall be labeled as FM Global approved.
- The permit holder shall inspect welding blankets, welding curtains, and welding pads before use to verify that they are in good condition and meet the FM Global approval requirements. Welding blankets, welding curtains, and welding pads shall be replaced if holes or tears are identified that could allow sparks or embers to pass through.

- Welding blankets, curtains, and pads shall be used for their designed intent. For example, welding curtains should not be used to fulfill the role of welding pads or welding blankets. The intended use for blankets, curtains, and pads differs in intended physical orientation (e.g., horizontal vs. vertical) and severity of heat exposure (e.g., light, moderate, severe heat exposure). See definitions in Section 1.2 for definitions of welding blankets, curtains, and pads.
- Welding curtains arranged vertically as partitions shall be arranged so that gaps do not exist between the floor/ground and the curtain.
- When more than one welding blanket, curtain, or pad is required to provide adequate shielding, the edges shall overlap by a minimum of 6 in to form a barrier that is impenetrable by sparks and embers.
- When hot work is performed above the overlapped section, the top blanket/curtain/pad should be overlapped over the lower blanket/curtain/pad to reduce the risk of sparks falling in between the overlapped sections.

10.3.1.9 Hot-Work Protective Clothing

Subcontractors shall ensure the personal protective clothing selected for hot work minimizes the potential for ignition, burning, trapping hot sparks and electric shock as identified in ANSI Z49.1, *Safety in Welding, Cutting and Allied Processes*, current revision.

10.3.1.10 Hot-Work Equipment

The following requirements apply to the use of hot-work equipment:

- Equipment used in welding and cutting operations shall be listed for their use.
- Equipment used in the operation shall be examined prior to work to verify it is in a safe operating condition. If found to be incapable of reliable, safe operation, the equipment shall be repaired by qualified personnel prior to its next use or be withdrawn from service.
- To minimize the potential for electric shock, electric hot-work machines shall be adequately grounded prior to use.
- Equipment shall be attended to during use and cooldown. Equipment shall be turned off and placed in a safe condition when unattended.

10.3.1.11 Hot Work Required Inspections

In addition to the fire watch requirements, the subcontractor's authorized worker/permit holder shall inspect the work area a minimum of once per day to verify compliance with permit requirements. Additionally, the responsible subcontractor personnel shall also perform periodic inspections to ensure continued compliance with the requirements of the permit. When inspections identify unsafe conditions or the scope of work departs from that defined in the permit, the hot work shall be stopped immediately.

10.3.1.12 Hot Work Outdoors

The subcontractor shall ensure that vegetation and other combustibles within 50 ft are removed, cut back, wetted, or otherwise protected to prevent ignition during hot work outdoors. A high level of caution shall be exercised to prevent wildland fire. If wind speeds exceed a constant velocity of 10 mph, hot work is not permitted outdoors without review and concurrence with the NLR fire protection AHJ or ESHQ POC. If a red flag warning is in effect, hot work outdoors is not permitted under any circumstances.

10.3.1.13 Designated Hot-Work Areas

A designated hot-work area is a specific location designed and approved for hot-work operations that is maintained for hot work, such as a maintenance/machine shop or a detached outside location, that is of noncombustible or fire-resistive construction, essentially free of combustible and flammable contents and suitably segregated from adjacent areas.

A Designated Hot-Work-Area Permit may be requested by the subcontractor and written/approved by an NLR FPE and NLR FM. Prior to the start of hot work each day in a designated hot-work area, the subcontractor shall verify that conditions specified on the Designated Hot-Work-Area Permit are followed. Designated Hot-Work-Area Permits may be written for a maximum duration of 1 year.

10.3.1.14 Hot Work on Containers or Piping That Contain or Have Contained Flammable Liquids, Gases, or Solids

Hot work shall not be performed on containers or equipment that contain or have contained flammable liquids, gases, or solids until:

- An evaluation of NFPA 326, *Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair,* is performed by a fire protection engineer.
- The containers and equipment have been cleaned, made inert, or purged in accordance with NFPA 326.

10.3.1.15 Roofing Operations That Involve Heat Sources and Hot Processes

Roofing operations that involve heat sources and hot processes, such as torch-applied roofing or the use of tar kettles, shall not be performed until the proposed work is reviewed in detail by an NLR fire protection AHJ to verify that the requirements of NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations,* are met.

10.3.1.16 Orbital Welding

Orbital welding is a lower-hazard operation compared to other forms of welding due to the heat source being internal to the equipment. Due to the reduced hazard, the following precautions shall be followed in lieu of providing a hot-work permit:

- Remove all combustibles within 5 ft of the orbital welding head.
- Compressed gas cylinders and their associated hoses and regulators shall be secured from damage and used in accordance with manufacturer's instructions.
- Follow all manufacturer instructions for the unit.
- Verify that fittings and connectors are properly seated to prevent poor connections, short circuits, and gas leaks.
- Do not touch components until they have cooled down.

10.3.2 Fire Protection System Outages and Impairments

Subcontractors performing work shall plan their work and take the necessary steps to minimize outages or impairments of fire suppression, detection, fire hydrants, or alarm systems. When outages are necessary to perform a particular scope of work, they shall be coordinated and approved by the NLR FM and the ESHQ POC. An NLR Fire Protection System Outage Permit shall be issued by the NLR FM. Compensatory measures

necessary to achieve a commensurate level of fire protection shall be incorporated into the permit.

10.3.3 Exits and Exits Access

The subcontractor shall ensure that a clear path of at least 44 in is maintained to exits on indoor projects. Exits shall be marked by a readily visible sign. Access to exits shall be marked by readily visible signs in all cases where the exit or way to reach it is not immediately visible to the occupants. Where construction requires temporary obstruction of any required exit, the NLR fire protection AHJ shall be consulted and any compensatory measures shall be implemented, such as temporary signage and rerouting of personnel to other exits.

10.3.4 Plastic Sheeting Used During Construction, Alteration, and Demolition Operations

Plastic sheeting used during construction, alteration, and demolition operations shall be certified by the manufacturer as having passed Test Method 2 of NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Film*. The sheeting used shall bear markings showing compliance with NFPA 701, Test Method 2, or markings that identify that the plastic as fire retardant if manufacturer-provided documentation is available that shows compliance with NFPA 701, Test Method 2.

Plastic sheeting shall not obstruct fire sprinkler without prior approval from the NLR FPE.

10.3.5 Flammable and Combustible Liquids Storage

Flammable and combustible liquids shall be stored in approved containers and cabinets, such as those that are Underwriter's Laboratories Inc. or FM Global listed, and quantities shall be limited to minimize fuel loading in accordance with NFPA codes.

Only approved containers and portable tanks shall be used for storage and handling of flammable and combustible liquids. Only approved safety cans or Department of Transportation (DOT) approved containers shall be used for the handling and use of flammable liquids in a closed container, quantities of five gallons or less capacity, having a flash arresting screen, spring closing lid, and spout cover, and designed so it will safely relieve internal pressure when subjected to fire exposure.

Any storage of gasoline or diesel fuel at NLR shall be in a flammable storage cabinet in a location approved by the NLR ESHQ POC. Rags used to apply flammable liquids are to be disposed of in a self-closing approved safety container designed for that use.

10.3.6 Smoking/Wildfire

Smoking and e-cigarettes shall be prohibited except in NLR-designated areas that incorporate appropriate facilities for the safe disposal of smoking materials. Smoking is prohibited on jobsites. Open fires are prohibited.

10.3.7 Housekeeping/Trash

The subcontractor shall inspect the work area frequently and maintain good housekeeping. Common garbage and other waste shall be disposed of at frequent and regular intervals. Containers shall be provided for the collection and separation of waste, trash, oily or used rags, and other refuse. Containers used for garbage and

other oily, flammable, or hazardous wastes, (such as caustics, acids, harmful dusts, or similar materials) shall be equipped with covers. Storage of excessive combustible materials, equipment, or packing materials shall not be permitted in unprotected structures unless authorized by the NLR fire protection AHJ. This includes unnecessary accumulations of lumber for scaffolding or other purposes.

Chemical agents or substances, which might react to create a hazardous condition, shall be stored and disposed of separately.

10.3.8 Temporary Heating and Cooling Equipment

The following requirements apply to portable electric heaters used on the jobsite:

- Portable electric heaters shall be equipped with a tip-over switch.
- Locate portable electric heaters in areas that minimize their fire hazards.
- Do not use portable electric heaters near flammable materials/liquids.
- Follow manufacturer's literature for clearance of listed portable electric heaters from combustible materials.
- Never place portable electric heaters on an unstable surface.
- Use only portable electric heaters approved by Underwriters Laboratories Inc. or another nationally recognized test laboratory.
- Portable electric heaters shall not be used with extension cords as most extension cords are not rated for the higher power demands of space heaters and may become overloaded and catch fire.
- Areas where portable heating equipment is used shall be inspected no less than daily for safe conditions.

Oil-fired heaters, liquid petroleum gas heaters, and other means of heating shall be approved by the NLR fire protection AHJ, electrical AHJ, and comply with applicable codes and standards including NFPA 241, the International Fire Code and NFPA 70.

10.3.9 Access—Fire Protection Equipment, Water Supplies, and Roads

Unobstructed access to fire hydrants and outside connections to standpipes, sprinklers, or other fire protection equipment, whether permanent or temporary, shall be maintained at all times. No material or construction activities shall interfere with access to fire protection features or equipment. During construction, the immediate jobsite shall have access for use of fire department apparatus. The access shall be approved by the NLR fire protection AHJ and local authorities as applicable and maintained from the start of the project until completion. Where a construction project requires a road closure, a map shall be developed showing the location of the road closure and alternate routes, and the local fire department shall be notified. Any requested compensatory measures (such as signage) shall be implemented.

10.3.10 Fire Extinguishers

Jobsites shall be provided with fire extinguishers so that the travel distance to any fire extinguisher does not exceed 50 ft. Additional extinguishers are required at special hazards, including flammable and combustible liquids, for storage and construction sheds, and at other locations as required by the NLR fire protection AHJ or NLR ESHQ POC. Fire extinguishers shall be in good condition, charged, and provided with an annual

inspection tag. The date on the tag shall be within 1 year of the current date. For roofing operations, there shall be at least one multipurpose 4-A:60-B:C portable fire extinguisher.

10.3.11 Utilities

All installation of gas piping shall be performed in accordance with NFPA 54, *National Fuel Gas Code Handbook*. Hot taps shall be permitted, provided they are installed by a trained and experienced crew using equipment specifically designed for such purposes.

A water supply, either temporary or permanent, for fire protection shall be made available as soon as significant combustible materials arrive on site unless approved by the NLR fire protection AHJ.

Portable generators shall be listed and labeled in accordance with UL 2201. They shall be operated only outdoors and a minimum of 5 ft from any building openings such as windows, doors, or air intakes. Portable generators require a fire extinguisher with a minimum rating of 4-A:60-B:C within 50 ft.

10.4 References

- 29 CFR Part 1910.39, Fire Prevention Plans
- 29 CFR Part 1910, Subpart E, Exit Routes and Emergency Planning
- 29 CFR Part 1910, Subpart H, Hazardous Materials
- 29 CFR Part 1910, Subpart Q, Welding, Cutting and Brazing
- ANSI Z49.1–2012 Safety in Welding, Cutting and Allied Processes, Sections 4.3 and E4.3

11 Hoisting and Rigging

11.1 Applicability

The requirements of this section apply to all subcontractors' and lower-tier subcontractors' (hereafter referred to as "subcontractors") hoisting and rigging (H&R) activities on NLR sites unless otherwise specifically exempted by NLR.

The equipment covered under this procedure includes H&R devices and associated equipment such as slings, ropes, and chains, which provide mechanical assistance in raising and lowering a load. This includes either power or manually operated equipment.

11.2 Regulatory Requirements

Subcontractor H&R activities shall be conducted in accordance with the following statutory requirements:

- 29 CFR Part 1926, Subpart CC, Cranes and Derricks in Construction
- 29 CFR Part 1910, Subpart N, Material Handling and Storage
- Rigging of loads being lifted by cranes shall comply with the requirements of 29 CFR Part 1926.251, Rigging Equipment for Material Handling
- Hoisting and rigging during steel erection activities shall comply with the requirements of 29 CFR Part 1926.753, Hoisting & Rigging
- American Society of Mechanical Engineers (ASME) B30.5, Mobile and Locomotive Cranes, 2014 or latest edition
- ASME B30.9, Slings, 2014 or latest edition
- ASME B30.10, Hooks, 2014 or latest edition
- ASME B30.20, Below-the-Hook Lifting Devices, 2013 or latest edition
- ASME B30.26, Rigging Hardware, 2015 or latest edition.

Exception: This section does not include requirements for powered industrial trucks.

11.3 NLR-Specific Requirements

In addition to Section 11.2, all subcontractor H&R activities shall meet the following specific NLR requirements as applicable.

Subcontractors bringing H&R equipment on-site shall be able to demonstrate their equipment is properly maintained and in safe operating condition, and that operators are experienced and qualified. Subcontractor crane operators are not permitted to operate NLR H&R equipment. All H&R equipment brought on-site shall be in a new or like-new condition free of hydraulic or oil leaks.

11.4 Operator Training and Certification

Subcontractors who provide and operate H&R equipment as part of a construction project or similar activity shall provide proof of training/certification. NLR requires proof of training, such as a National Commission for the Certification of Crane Operators license or other NLR-accepted licenses/certification appropriate for the

equipment from an accredited nationally recognized agency. NLR recognizes the National Commission for the Certification of Crane Operators national certification program as demonstrating that the certified H&R operator meets OSHA's and NLR's requirements for crane operator proficiency. This certification/license shall be current for the crane type they will be operating (e.g., mobile crane operator, tower crane operator). Any other forms of crane certification shall be reviewed and accepted by the NLR ESHQ POC.

11.4.1 Hoisting and Rigging Operating Requirements

11.4.1.1 Planning

The subcontractor shall evaluate and plan H&R operations in advance. A competent person shall identify the hazards and determine the controls necessary to maintain an acceptable level of risk. A H&R Lift Plan may be required for lifts. This plan shall be documented using the NLR H&R Lift Plan or similar plan accepted by the ESHQ POC.

11.4.1.2 Critical and Complex Lifts

The NLR H&R Lift Plan template can be obtained from the ESHQ POC. All critical and/or complex lift plans require the review and concurrence of the NLR PM and ESHQ POC.

Critical lifts are defined as lifts for which any of the following conditions exist:

- The weight of the load is 75% or more of the crane's rated capacity in the configuration that will be used during the lift.
- Lifts involving nonroutine or difficult rigging arrangements or where loads will require exceptional care in handling because of size, weight, close-tolerance installation, or high susceptibility to damage.
- The work involves hoisting of personnel with a crane or derrick.
- If the item being lifted were to be damaged or upset, it could result in a release of hazardous material into the environment or the release of airborne concentrations that could exceed established occupational exposure limits.
- The item being lifted is unique and, if damaged, would be irreplaceable or not repairable and is vital to a system, facility, or project operation.
- The cost to replace or repair the item being lifted, or the delay in operations of having the item damaged, would have a negative impact on the facility, organization, or construction project to the extent that it would affect project commitments.
- The item, although noncritical, is to be lifted above or in close proximity to a critical item or component.

Complex lifts are defined as lifts that present logistical difficulties or lift coordination complications, thus requiring a higher level of planning and execution. Complex lifts may involve the following:

- A lift involving multiple cranes
- Axial rotation of an object in the vertical plane or other complex movement of the load.

11.4.1.3 Prelift Meeting

Prior to performing any lift, the subcontractor shall conduct a prelift meeting with workers involved in the work activity. The following items shall be reviewed:

- The scope and sequence of work
- Roles and responsibilities
- Hazards and controls
- Other relevant information identified in the H&R Lift Plan.

When performing lifts designated as critical and/or complex, this meeting shall be documented using the NLR Prelift Meeting Checklist or other equivalent NLR ESHQ-accepted checklist.

11.4.1.4 Communication

The subcontractor shall require the use of ANSI B30.5 standard hand signals or voice/radio communications during crane operations.

11.4.1.5 Area Access Control

The subcontractor shall cordon off or manually control the lift area to prevent access by unauthorized workers by deploying barricades and warning signs and/or using personnel to monitor and control access to the area. The subcontractor shall cordon off the swing radius area for mobile cranes with red danger tape.

11.4.1.6 Protection of People

Do not place people in jeopardy by moving a suspended load over people or an occupied section of a facility. Work beneath a suspended load is prohibited unless the load is supported by cribbing, jacks, or a solid footing that safely supports the entire weight. All personnel shall remain clear of moving and shifting loads.

11.4.1.7 Rated Load Capacity

The rated load capacity of monorails and other H&R structural elements, such as jibs, shall match, at a minimum, the rated load capacity of a hoist employed.

Know the weight of the object being lifted or use a dynamometer or load cell to determine the weight. If the weight of the load is unknown, a minimum of 50% safety factor shall be employed. This means that the crane or hoist, slings, and rigging hardware shall have twice the capacity of the estimated load.

Fully extend outriggers or reduce the crane's rated load capacity as directed and allowed by the crane manufacturer's operating manual.

11.4.1.8 Electrical Distribution Lines

Watch for overhead electrical distribution and transmission lines and maintain a safe working clearance of at least 10 ft or as required from energized electrical lines. Any overhead wire shall be an energized line unless and until the NLR electrical AHJ or the electrical utility authorities indicate that it is not an energized line. Exercise caution when working near overhead lines having long spans as they tend to move laterally or vertically due to the wind, which could cause them to breach the safety zone.

11.4.2 Environmental Factors

Environmental factors, such as weather and terrain, can adversely affect a lift. When performing outdoor lifts, the following environmental factors shall be considered.

11.4.2.1 High Winds

Lifts shall be suspended if prevailing wind conditions may adversely affect the lift. As a general rule, this applies to wind speeds of 25 mph or more. However, based on the nature of the load—such as size, surface area, or fragility—a lower wind speed limit may warrant suspension of a lift. The H&R operator and/or lift master shall evaluate behavior of the load in prevailing winds and the stresses placed upon H&R equipment to the extent necessary to safely complete the lift.

11.4.2.2 Freezing Surfaces

Check surface conditions to determine whether the load may be frozen to the ground. Do not use H&R equipment to "break loose" a load that is frozen to the ground. This subjects H&R equipment to severe and unintended loads.

11.4.2.3 Ground Conditions

Check ground conditions around the hoisting equipment for proper support, including settling under and around outriggers, ground water accumulation, or other similar conditions.

11.4.3 Crane Inspection, Maintenance, and Testing

11.4.3.1 Crane Initial Inspection

Prior to being placed into service, all subcontractor-owned and/or rented cranes shall undergo an initial inspection. The NLR Subcontractor Crane Inspection Checklist or equivalent accepted checklist shall be used to document these inspections. When qualified third-party inspections are performed to meet the requirements of this inspection, a copy of the third-party inspection shall be attached to the Subcontractor Crane Inspection Checklist, which will satisfy the crane physical inspection portion of the checklist. The NLR ESHQ POC may elect to oversee the subcontractor's initial inspection of the crane.

All crane inspection deficiencies shall be identified and documented, and the safety implications shall be determined. The subcontractor shall maintain the original copy of the inspection report and provide a copy to the NLR ESHQ POC. The crane owner shall take immediate action to correct the identified deficiencies.

- **Mobile Boom Cranes:** For wheel-mounted or crawler type boom cranes, the subcontractor competent person shall inspect the crane. The subcontractor may elect to use a qualified independent third-party inspector to meet this requirement.
- **Lattice Boom or Tower Cranes:** Lattice boom and tower cranes require a thorough inspection prior to being placed into service on NLR property. If the subcontractor is using a lattice boom or tower crane, the crane shall undergo a thorough initial inspection prior to the start of work by a qualified independent third-party inspector. The subcontractorshall bear the expense of this inspection.

11.4.3.2 Daily Preoperational Inspections

H&R operators shall visually inspect the following items each day or prior to first use if the hoist has not been in regular service (records are required):

- Functional operating mechanisms for maladjustment interfering with proper operation
- Deterioration or leakage in lines, tanks, valves, drain pumps, and other parts of air systems
- Hooks for cracks, deformation, latch engagement, and damage from chemicals

- Hoist rope for significant wear, kinking, crushing, bird-caging, corrosion, or broken strands or wires
- Hoist chains, including end connections, for excessive wear, twist, distorted links interfering with proper function, or stretch beyond manufacturer's recommendations
- Primary hoist upper-limit device for proper operation.

H&R operators or other designated qualified workers shall examine deficiencies and determine whether the equipment should be removed from service or if a more detailed inspection is required.

11.4.3.3 Monthly Inspections

Cranes active on the site for periods extending beyond one month shall receive monthly documented inspections. The competent person shall at a minimum visually inspect the following items for damage, wear, or other deficiency that might reduce capacity or adversely affect the safety of the crane:

- Critical items such as brakes and crane hooks
- Hoist ropes.

Signed and dated inspection records shall be kept on file and shall be readily available. Before the crane is returned to service, correct deficiencies that could reduce its capacity or adversely affect its safety.

11.4.3.4 Annual Inspections

Annual crane inspections shall conform to the requirements identified in 29 CFR Part 1926, Subpart N, and as recommended by the manufacturer. Documentation of these inspections shall be available for review by NLR.

11.4.3.5 Idle Equipment

H&R equipment that is idle for a period greater than one month (fully operational but not used) does not require monthly inspections. Idle H&R equipment shall be removed from service and tagged with an administrative "CAUTION - Do Not Operate" label to alert potential users of the start-up inspection requirements to include the requirements contained in the daily and monthly inspections. Documentation of these inspections shall be available for review by NLR.

11.4.3.6 Maintenance

A preventive maintenance program shall be established and based on the recommendation of the crane manufacturer. If equipment maintenance procedures deviate from published manufacturer's recommendations, the alternate procedures shall be approved in advance by the manufacturer or another qualified person and be kept readily available. Dated maintenance records should be readily available to appointed personnel. Replacement parts shall be at least equal to the original manufacturer's specifications.

11.4.3.7 Rated Load Test

Prior to initial use, all cranes in which load sustaining parts have been modified, replaced, or repaired shall be load-tested by a qualified inspector or under the direction of that inspector. All rated load tests shall be performed in accordance with the manufacturer's recommendations.

11.4.4 Rigging Safety Requirements

11.4.4.1 Rigging Component Procurement

Rigging components shall be obtained from reliable sources and shall be rated for H&R applications. Do not use

damaged, suspect, or counterfeit rigging. Only shackles from reputable sources are permitted to be used. See Section 11.5.2 for additional information on suspect and counterfeit rigging and hoisting requirements.

11.4.4.2 Storage and Maintenance

Rigging equipment shall be stored and maintained in accordance with the manufacturer's recommendations. Protect rigging hardware from weathering and harsh environments. Rust, corrosion, and ultraviolet damage can degrade rigging performance.

11.4.4.3 Labeling

Rigging hardware shall be labeled for identification purposes with a durable tag.

11.4.4.4 Rigging Safe Work Practices

The subcontractor shall ensure the following safe work practices are used when rigging a load:

- Determine the weight of the load. The weight of the load shall be within the rated load capacity of the rigging.
- Determine the proper size for slings and components. Refer to the manufacturer's literature and the DOE Hoisting and Rigging Standard for details.
- Select slings so that the rated load capacity is adequate when the appropriate deratings are applied based on sling angle and/or hitch angle considerations (choker angle derating).
- Verify shouldered eyebolts are installed in accordance with the manufacturer's recommendations. Beware of side pull applications. Eyebolts shall be derated when subject to side loads.
- Do not use shoulderless eyebolts for lifting purposes.
- Use safety hoist rings (swivel eyes) as a preferred substitute for eyebolts when possible.
- Pad sharp and small-diameter edges to protect slings. Dense foam, tire rubber, or other dense, pliable materials may be suitable for padding.
- Do not use slings, eyebolts, shackles, hooks, or other hardware that appear to have been cut, welded, brazed, damaged, or are otherwise suspect.
- Determine the center of gravity and balance the load before moving it. Keep the attachment points of rigging accessories as far above the center of gravity as possible.
- Lift the load initially just a few inches to test the rigging and balance.
- Place blocks beneath loads prior to setting down the load to allow removal of the sling, where applicable.

11.4.5 Inspection Criteria for Slings, Below-the-Hook Lifting Devices, and Rigging Hardware

11.4.5.1 Prior-to-Use Inspection

At the beginning of each shift or prior to use, the competent person shall visually inspect the rigging equipment (slings, below-the-hook devices, and rigging hardware) in accordance with the appropriate ASME/ANSI standard or according to the manufacturer's instruction, whichever is more stringent. Defective rigging equipment shall be removed from service and destroyed to prevent reuse.

11.4.5.2 Periodic Inspections

Rigging equipment shall be inspected periodically in accordance with the appropriate ASME/ANSI standard or according to the manufacturer's instruction, whichever is more stringent. Inspection records shall be readily available.

11.4.6 Personnel Hoisting

11.4.6.1 Personnel Platform Lift Plan

The use of H&R equipment to hoist workers onto a platform is generally prohibited, except when the use of a conventional means of reaching the work area, such as a ladder, scaffold, or man lift, would be more hazardous or is not possible because of structural design or worksite conditions.

Personnel lifts shall be properly planned and executed. The NLR ESHQ POC shall authorize this type of activity in advance of the lift. The NLR Personnel Platform Lift Plan or other NLR ESHQ POC accepted equivalent plan shall be used to document these lifts. The NLR Personnel Platform Lift Plan template can be obtained from the ESHQ POC. A prelift test is required.

11.4.6.2 Prelift Meeting

A prelift meeting shall be conducted prior to initiating a personnel lift. Workers involved in the work activity shall attend the prelift meeting, including subcontractors, basket occupants, and the H&R operator.

11.5 NLR Special Emphasis

11.5.1 DOE Hoisting and Rigging Standard

NLR adheres to the DOE Hoisting and Rigging Standard as a best management practice. The Hoisting and Rigging Standard is a DOE-wide consensus standard for rigging, crane, and hoist operations. It references applicable industry standards and regulations governing this type of work.

11.5.2 Suspect and Counterfeit H&R Components

Per the DOE standard, shackles shall meet or exceed the requirements of Federal Standard RR- C-271D. Each shackle body shall be permanently and legibly marked in raised or stamped letters on the side of the bow and shall show:

- Manufacturer’s name or trademark
- Size
- Safe working load or working load limit.

The American Society for Testing and Materials standard for hooks requires that the manufacturer’s identification be forged, cast, or die-stamped on a low-stress or nonwearing area of the hook.

The following are some indicators of suspect and counterfeit H&R components:

- Metallurgy is suspect.
- Original markings have been ground off and restamped.
- Identification tags have altered markings.

- Item appears used.
- Parts are identified only as “China,” “Korea,” “Mexico,” “Thailand,” or “India.”
- Documentation does not exist or is incomplete.
- Red hooks are not labeled with Crosby Group markings (“Crosby” or “CG”).

11.6 References

- 29 CFR Part 1926, Subpart CC, Cranes and Derricks in Construction
- 29 CFR Part 1910, Subpart N, Material Handling and Storage
- Rigging of loads being lifted by cranes shall comply with the requirements of 29 CFR Part 1926.251, Rigging Equipment for Material Handling
- Hoisting and Rigging during steel erection activities shall comply with the requirements of 29 CFR Part 1926.753, Hoisting & Rigging
- ASME B30.5, Mobile and Locomotive Cranes, 2014 or latest edition
- ASME B30.9, Slings, 2014 or latest edition
- ASME B30.10, Hooks, 2014 or latest edition
- ASME B30.20, Below-the-Hook Lifting Devices, 2013 or latest edition
- ASME B30.26, Rigging Hardware, 2015 or latest edition

12 Fall Protection

12.1 Applicability

The requirements of this section apply to all subcontractors' and lower-tier subcontractors' (hereafter referred to as "subcontractors") activities that require personnel to work with, or potentially be exposed to, unprotected heights of 4 ft or more on NLR projects unless otherwise specifically exempted by the NLR ESHQ POC. This includes working at unprotected heights of 6 ft or more caused by excavation and trenching activities but excludes hydrovac work.

12.2 Regulatory Requirements

The subcontractor fall protection program shall be conducted in accordance with the following statutory requirements:

- 29 CFR Part 1910, Subpart D, Walking-Working Surfaces
- 29 CFR Part 1910.140, Personal Fall Protection Systems
- 29 CFR Part 1926, Subpart M, Fall Protection
- Fall protection during steel erection activities shall also comply with the requirements of 29 CFR Part 1926.760(a)(2), perimeter safety cable, and 1926.760(e), custody of fall protection.

Note: The increased height allowances for unprotected workers provided in Steel Erection (29 CFR Part 1926.760) and Scaffold Activities (29 CFR Part 1926.451) do not apply at NLR. Additionally, all workers who are constructing a leading edge 6 ft or more above a lower level shall be protected from falling by a guardrail system, restraint system, personal fall arrest system or safety net system. No exceptions allowed.

12.3 NLR-Specific Requirements

In addition to Section 12.2, all work activities and/or potential personnel exposures to unprotected falls of 4 ft or more shall meet the following NLR requirements as applicable in Sections 12.3.1–12.3.2 of this manual.

12.3.1 Fall Protection Program

Subcontractors providing services to NLR that meet the applicability as defined in Section 12.1 shall have in place a fall protection program ensuring that a procedure to identify and eliminate or control new and existing fall hazards is established and implemented. The program shall identify the key personnel as identified in 29 CRF, Subpart M, and subcontractors shall have the requisite knowledge and responsibility for the successful implementation of the program at the project.

12.3.1.1 Fall Hazard Analysis

An FHA shall be conducted for each activity or similar activity prior to the start of the work. The FHA shall be performed by a competent person and/or qualified person. Identify the fall hazards associated with the proposed activity.

Identify the controls that will be in place to eliminate or mitigate the fall hazard. The controls shall achieve 100% continuous fall protection.

When using a personal fall arrest system (PFAS), identify the means to be used for the prompt rescue of

employees in the event of a fall.

An NLR FHA form, or an NLR ESHQ-accepted equivalent FHA, shall be completed by the subcontractor fall protection competent person prior to allowing workers to be exposed to fall hazards. For simple applications (which do not involve the use of an active fall protection system), an activity hazard analysis or job safety analysis may be accepted as determined by the NLR ESHQ POC.

At a minimum, an FHA shall be completed when:

1. An authorized worker is using an active fall protection system.

   Exceptions:

   - Work performed from mobile elevating work platforms do not require an FHA provided (1) the integrity of the guardrail system is maintained and not compromised, (2) workers maintain their footing on the platform floor, and (3) workers do not transition in or out of an elevated work platform or basket.
   - Ascending or descending a fixed ladder more than 20 ft high while using an installed ladder safety device or PFAS system does not require an FHA.

2. An authorized worker is using either a fixed ladder or a portable ladder in an application that meets the (fixed or portable) ladder general requirements.

Elevated work activities that are not captured in an FHA (see above for minimum requirements) may be addressed through the subcontractor's own FHA, but shall, at a minimum, address the following elements:

- Location
- Scope of work
- Hazards
- Controls
- Specific anchorage type, location(s), and connecting means
- Falling object protection
- Rescue procedure (if an arrest system is used).

The FHA shall be revised and updated when changes occur that render the analysis obsolete. The ESHQ POC verifies that the FHA is being used where required.

A copy of the NLR Fall Hazard Analysis form can be found on the NLR Subcontractor website at NLR.gov/about/ehs-construction.html.

An authorized worker required to use an active fall protection system shall not work alone; a second authorized worker is required.

12.3.1.2 Fall Protection Hierarchy of Control and Mitigation Methods

The subcontractor shall incorporate the following hierarchy of control when selecting methods to eliminate or

mitigate fall hazards:

- **Hazard elimination:** First consider eliminating fall hazards. This might involve moving the work surface to ground level or changing a task so that workers do not approach the fall hazard.
- **Passive fall protection:** Take actions that isolate or effectively separate the hazard from workers, such as installing floor coverings or handrail/guardrail systems.
- **Fall restraint:** Establish a travel restraint system that prevents a worker from accessing a position from which they could fall.
- **Fall arrest:** Configure a PFAS designed to arrest a fall after it has begun.
- **Administrative fall protection system:** Establish controlled-access zones and safety- monitoring systems. Generally, these controls are considered ineffective and are prohibited at NLR unless specifically authorized by the ESHQ POC.

12.3.1.3 Fall Protection Equipment System Requirements

Fall protection equipment and systems shall be used in accordance with the manufacturer's recommendations and the requirements of this procedure. A competent person shall verify that the fall protection system is properly established and maintained. Misapplication or use of this equipment in a way contrary to those requirements is prohibited. A competent person shall supervise the work and verify that the fall protection system is properly established and maintained. An authorized worker required to use an active fall protection system shall not work alone. A second authorized worker is required when an authorized worker is required to use an active fall protection system or when aerial activities requiring the use of fall protection systems are conducted, such as use of an aerial work platform, tower climbing, or turbine climbing. The second authorized worker shall have as a spotter and be present in the immediate vicinity to monitor the aerial activity and facilitate safety. Aerial workers and spotters shall have adequate means of communication between them such as walkie-talkies or cell phones. The spotter shall have phone access if they need to initiate an emergency response.

12.3.1.4 Personal Fall Arrest System Strength Requirements

Subcontractors shall ensure that the strength and testing requirements for PFASs, components, and subsystems shall comply with the relevant provisions of ANSI Z359. All other applicable fall protection equipment and system requirements shall, at a minimum, meet the requirements of ANSI A10.32 Standard for Personal Fall Protection used in construction and demolition operations.

12.3.1.5 Fall Arrest System Inspections and Storage

- **Routine inspection:** PFAS equipment shall be inspected by the authorized worker prior to each use. Equipment inspections shall follow the guidelines established by the manufacturer. Damaged or questionable equipment shall be immediately removed from service and tagged accordingly. Contractors shall not repair damaged fall protection equipment.
- **Post-Fall inspection:** PFAS components subject to a fall shall be immediately removed from service and destroyed or returned to the manufacturer for inspection, repair, and recertification. Contact the manufacturer to determine the available options.

- **Periodic inspection:** A competent person, other than the user, shall periodically inspect PFAS equipment. This inspection shall follow the intervals and guidelines established by the manufacturer but shall not be greater than twelve months. The results of these inspections shall be recorded and available for review by NLR.
- **Equipment storage:** Fall protection equipment shall be stored in a manner that protects it from exposure to adverse conditions, such as ultraviolet light or harsh weather, that could result in damage or diminished performance and/or other specific requirements established by the manufacturer.

12.3.1.6 Anchorages

The application and use of all fall protection anchorages (certified or noncertified) shall be reviewed and accepted by a competent person. The design, selection, and installation of certified fall arrest anchorages shall be performed under the supervision of a qualified person.

Anchorages used for horizontal lifeline systems shall be certified and designed, prior to use, by a qualified person.

12.3.1.7 Horizontal Lifelines

The adequacy of the fall protection system shall be demonstrated through evaluation or load test by a qualified person. Unless otherwise specified, newly installed horizontal lifelines shall be either pre-engineered systems or systems approved by a qualified person.

12.3.1.8 Safety Net Systems

The use of safety net systems as the means of fall protection is not anticipated at NLR unless used in conjunction with other accepted means of fall protection and compliance with other regulatory requirements (i.e., 29 CFR Part 1926, Subpart R, Steel Erection). Contact the NLR ESHQ POC for additional information on safety net systems.

12.3.1.9 Portable Ladders

General requirements:

- Portable ladders shall be set up and used in compliance with OSHA and manufacturer requirements. Additionally, the portable ladder shall be a minimum Type I (250-lb-rated) Heavy Duty classification. The capacity rating shall not be exceeded.
- Nonconductive ladders shall be used for electrical work.
- Extension ladders shall be tied or secured to prevent displacement.
- Job-made ladders when constructed and used shall be built in accordance with the ANSI A14.1-2017 American National Standard for Ladders Portable Wood-Safety Requirements. Job-made ladders shall be inspected prior to use and have a weekly documented inspection.

Fall protection portable ladder exception: Neither an FHA or a PFAS is required when portable ladders are used in accordance with the general requirements and the following provisions:

- The ladder is not positioned next to an opening or edge, thus exposing the worker to a fall hazard greater than the distance to the base of the ladder, and the worker's elevated position does not expose them to other hazards, including impalement, mechanical, electrical, chemical, or environmental.

- The portable ladder is 20 ft or less in working length. Worker maintains three points of contact (when ascending or descending) with his or her body position centered between the rungs of the ladder.
- Extension ladders shall be tied or secured to prevent displacement.

12.3.1.10 Mobile Elevated Work Platforms

General requirements:

- All personnel lifts shall be operated in accordance with OSHA, appropriate ANSI standards, and manufacturer requirements.
- The operator shall be trained and qualified to operate the equipment.
- The equipment shall be inspected pre-use daily.

Fall protection:

- Fall protection shall be used as required by OSHA, ANSI/Scaffold & Access Industry Association (SAIA), and the manufacturer.
- The following activities require NLR ESHQ POC evaluation and acceptance prior to performing and shall be considered "hold points":
  - Compromising the guardrail system
  - Gaining elevation above the platform height
  - Transitioning in or out of an elevated work platform or basket.

12.3.1.11 Fall Protection on Roofs

Subcontractors performing work on low-slope roofs (means a roof having a slope less than or equal to 3:12, vertical to horizontal) are permitted to perform work as prescribed below without the use of a conventional fall protection system. When this method of work area control is employed, a warning line system or controlled access zone, as appropriate for the work tasks/conditions, shall be used for the purpose of keeping employees away from the roof edge. Warning line systems shall be established no less than 15 ft from the edge of the roof.

No work activity or personnel access is permitted to take place in the area between the warning line or controlled access zone and the roof's edge without the use of an active fall protection system in place.

12.3.1.12 Roofing Work

Roofing work, as defined by OSHA, means the hoisting, storage, application, and removal of roofing materials and equipment, including related insulation, sheet metal, and vapor barrier work but not including the construction of the roof deck.

The following requirements apply to roofing work on low-sloped (4:12 or less) roofs:

- When mechanical equipment is not being used, the warning line shall be erected not less than 6 ft from the roof edge. When mechanical equipment is being used, the warning line shall be erected not less than 6 ft from the roof edge that is parallel to the direction of mechanical equipment operation, and not less than 10 ft from the roof edge that is perpendicular to the direction of mechanical equipment operation.
- The warning line meets or exceeds the requirements in §1926.502(f)(2).
- The employer effectively implements a work rule prohibiting the employees from going past the

warning line unless they are protected by a PFAS or restraint system when performing any activities in the area between the warning line and the roof edge.

- The use of a safety monitor without employing other accepted controls is prohibited at NLR.

Note: Working on a sloped roof having a pitch greater than 4:12 requires the use of a PFAS.

12.3.1.13 Other Trades Working on Roofs

The following requirements apply to other trades performing work on roofs:

- A warning line is erected not less than 15 ft or more from the edge of a low-sloped roof, unless otherwise submitted in the project-specific fall protection plan (if required) and accepted by NLR.
- The warning line meets or exceeds the requirements in §1926.502(f)(2).
- A controlled access zone meets or exceeds the requirements in §1926.502(g).
- The employer effectively implements a rule prohibiting employees from going past the warning line or controlled access zone unless the worker(s) is protected by a PFAS or restraint system when performing any activities in the area between the warning line or controlled access zone and the roof edge.

Note: Working on a sloped roof having a pitch greater than 4:12 requires the use of a PFAS.

12.3.1.14 Holes

A hole is a gap or void 2 in or more in its least dimension in a floor, roof, or other walking working surface. The hole cover must be secured and be able to support two times the intended load. The hole cover must be visibly marked with the word “HOLE.”

12.3.2 Subcontractor Training Requirements

Subcontractors performing elevated work activities shall be trained by a competent person in accordance with the requirements identified in 29 CFR Part 1926, Subpart M. The subcontractor shall provide proof of such training for the review and acceptance by the ESHQ POC.

12.3.2.1 Flatirons Campus

Work activities conducted on structures at the NLR Flatirons Campus may be subject to additional fall protection system, training, and rescue requirements. Contact the NLR Flatirons Campus ESHQ POC for additional requirements that may be applicable to that site.

12.3.3 NLR Special Emphasis

12.3.3.1 Presumption of Feasibility

NLR presumes that using conventional fall protection (that is, guardrails, restraint systems, PFASs, or safety nets) is feasible and will not create a greater hazard to use. However, if circumstances exist when an employer believes convention fall protection is infeasible, this shall be identified in their FHA (refer to Section 12.3.1.1). The FHA shall explain the activity and identify the measures that will be taken to reduce or eliminate the fall hazard for workers who cannot be provided with protection using conventional fall protection systems.

12.3.3.2 Rescue Planning

A rescue procedure is required whenever an authorized person uses a fall arrest system to control a fall hazard. Typically, rescue shall be achieved by one of four means:

- Auto-rescue device
- Means of self-rescue
- Assisted rescue where the rescuer is not exposed to the same fall hazards as the victim
- Authorized rescuers (rescue professionals who perform or assist in workplace rescues, such as fire department rescue teams using high-angle rope access and suspended rescue techniques).

Workers are not permitted to serve as authorized rescuers. Rescue planning shall be addressed in the FHA form or NLR-accepted equivalent. NLR recommends employing suspension trauma straps on all full-body harnesses, but these alone do not constitute a rescue plan.

12.4 References

- 29 CFR Part 1910, Subpart D, Walking-Working Surfaces
- 29 CFR Part 1910.140, Personal Fall Protection Systems
- 29 CFR Part 1926, Subpart M, Fall Protection
- ANSI A14.1-2017, Ladders – Wood Safety Requirements
- ANSI Al0.32-2023, Fall Protection Systems for Construction and Demolition Operations
- ANSI Z359.0-2018, Definitions and Nomenclature Used for Fall Protection and Fall Restraint
- ANSI Z359.1-2020, The Fall Protection Code
- ANSI Z359.2-2023, Minimum Requirements for a Comprehensive Managed Fall Protection Program
- ANSI Z359.11-2021, Safety Requirements for Full Body Harnesses
- ANSI Z359.12-2019, Connecting Components for Personal Fall Arrest Systems
- ANSI Z359.13-2022, Personal Energy Absorbers and Energy Absorbing Lanyards
- ANSI Z359.14-2021, Safety Requirements for Self-Retracting Devices for Personal Fall Arrest and Rescue Systems
- ANSI/SAIA A92.2-2021, Vehicle-mounted Elevating and Rotating Aerial Devices
- ANSI/SAIA A92.3-2014, Manually Propelled Elevating Aerial Platforms
- ANSI/SAIA A92.5-2014, Boom-supported Elevating Work Platforms
- ANSI/SAIA A92.6-2014, Self-propelled Elevating Work Platforms

13 Scaffold

13.1 Applicability

The requirements of this section apply to all subcontractors' and lower-tier subcontractors' (hereafter referred to as "subcontractors") activities that require personnel to perform activities from scaffolds or potentially access a scaffold in any manner.

13.2 Regulatory Requirements

All subcontractor scaffold activities shall be conducted in accordance with the following statutory requirements:

- 29 CFR Part 1926, Subpart L, Scaffolds in Construction
- 29 CFR Part 1926, Subpart R, Fall Protection in Construction
- 29 CFR Part 1910, Subpart D, Walking-Working Surfaces.

13.3 NLR-Specific Requirements

In addition to the above regulatory requirements, all work activities shall meet the following NLR-specific requirements as applicable.

13.3.1 Complex Scaffold Plan

If a subcontractor shall erect a scaffold that is multiple tiers or considered high risk, they may be required to submit a scaffolding design plan.

13.3.2 Shift Inspections

Constructed scaffolding shall be inspected by a competent person prior to each shift and the inspection documented through a color-coded tagging system installed at the access point.

- Red tag—KEEP OFF/DO NOT USE—prohibits use of the scaffold as the unit is undergoing some stage of erection, alteration, or dismantling.
- Green tag—SCAFFOLD IS ERECTED TO CODE/APPROVED FOR USE—indicates that the scaffold is complete, meets erection requirements, and is safe to use for its intended purpose.
- Yellow tag—SPECIAL CONDITIONS/ADDITIONAL CONTROLS—indicates special safety measures for use of the scaffold (e.g., PFAS or head protection).

13.3.3 Competent Person

NLR requires documented training for designated competent personnel inspecting or erecting scaffolding.

13.3.4 Scaffolding Fall Protection

Scaffolds erected 4 ft or more above the lower level require the use of a passive or active fall protection system. Guardrails shall be constructed to comply with 1926.502 (b)–(e). Cross braces may be allowed to be used as guardrail system if the below is followed. Otherwise, an active system shall be used.

Cross bracing is acceptable in place of a midrail when the crossing point of two braces is between 20 in and 30

in above the work platform or as a top rail when the crossing point of two braces is between 38 in and 48 in above the work platform. The end points at each upright shall be no more than 48 in apart.

1. An FHA shall be completed when scaffold erectors (or authorized workers) are required to use an active fall protection system.
2. Authorized workers ascending or descending a scaffold access ladder to access a work platform more than 20 ft above the lower/base level must use a self-retracting lanyard.

13.4 NLR Special Emphasis

NLR presumes that using conventional fall protection (i.e., guardrails, restraint systems, personal fall arrest systems, or safety nets) is feasible and will not create a greater hazard to use. However, if circumstances exist when an employer believes conventional fall protection is infeasible during erection or in use, this shall be identified in a written fall protection plan and scaffolding design plan to be reviewed and accepted by the ESH POC.

13.5 References

- 29 CFR Part 1926, Subpart L, Scaffolds in Construction
- 29 CFR Part 1926, Subpart R, Fall Protection in Construction
- 29 CFR Part 1910, Subpart D, Walking-Working Surfaces

14 Hearing Conservation

14.1 Applicability

The requirements of this section apply to all subcontractor (hereafter referred to as "subcontractor") hearing conservation on NLR sites unless otherwise specifically exempted by NLR.

14.2 Regulatory Requirements

The subcontractor hearing conservation program shall meet or exceed the following statutory requirements:

- American Conference of Governmental Industrial Hygienists, *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Indices*, latest edition
- 29 CFR Part 1910.95, Occupational Noise Exposure.

14.3 NLR-Specific Requirements

The subcontractor hearing conservation program shall comply with OSHA requirements on occupational noise exposure. NLR follows the OSHA standard for the development and administration of a Hearing Conservation Program but has adopted the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value (TLV) in lieu of the OSHA Action Level and Permissible Exposure Limit. The ACGIH TLV has a criterion level at 85 decibels, A-weighted scale (dBA) and an exchange rate at 3 dB, providing a more protective noise limit for employees. Table 1 below displays the relationship between dose, sound pressure levels, and permitted exposure periods.

When employees are exposed above the ACGIH TLV, they are to be enrolled in an effective hearing conservation program as defined in 29 CFR Part 1910.95. Elements consistent with hearing conservation programs include exposure monitoring, institution of engineering controls to limit exposure, provision of adequate hearing protection devices, audiometric testing, and employee training.

Table 1. Threshold Limit Values for Noise

Duration per Day ACGIH TLV (100% dose)	Sound Level (dBA)
24 hours	80
16 hours	82
8 hours	85
4 hours	88
2 hours	91
1 hour	94
30 minutes	97
15 minutes	100
7.5 minutes	103

3.75 minutes	106
1.88 minutes	109
.94 minutes	112

14.3.1 Control Measures

NLR uses a hierarchy of control measures to reduce noise levels as low as feasible. The order of precedence for mitigating hazards establishes the actions to be considered in an order of effectiveness to achieve intended risk reduction. The hierarchy is as follows:

1. Elimination or substitution of the hazards
2. Engineering controls
3. Work practices and administrative controls that limit worker exposures
4. PPE.

14.3.2 Noise Evaluation

Every feasible effort shall be made to "engineer out" noise exposures greater than or equal to an eight-hour, time-weighted-average (TWA) sound level of 85 dB (ACGIH TLV in dBA) on the A-weighted scale prior to using personal hearing protection as a noise attenuation device.

When controls are not feasible or fail to reduce noise to acceptable levels, hearing protection sufficient to reduce exposure to 85 dBA TWA or below shall be required. Additionally, if work is to be performed in an environment that is suspected to exceed the allowable noise exposures, mandatory hearing protection requirements shall be implemented.

The subcontractor shall survey and evaluate suspected high noise areas and work efforts. Employees may conduct surveys and evaluations, and the results shall be made available to employees. Subcontractors shall control employee exposures when noise levels meet or exceed 85 dBA as an eight-hour TWA, or if impact/impulse noise exceeds 140 dBA. Noise exposure shall be determined without regard to hearing protection provided.

14.3.3 High Noise Area Posting

Signs indicating a requirement for the use of hearing protection devices are posted in areas or on equipment where sources of noise may expose workers at or above the 85 dBA TWA TLV.

14.4 References

- 29 CFR Part 1910.95, Occupational Noise Exposure
- American Conference of Governmental Industrial Hygienists, *Threshold Limit Values forChemical Substances and Physical Agents and Biological Indices*, latest edition

15 Industrial Hygiene

15.1 Applicability

The requirements of this section apply to all subcontractors' and lower-tier subcontractors' (hereafter referred to as "subcontractors") activities regarding industrial hygiene matters as they relate to work activities on NLR sites unless otherwise specifically exempted by NLR.

This section defines the requirements and responsibilities for anticipating, recognizing, evaluating, and controlling employee exposures to chemical, physical, and biological agents encountered during work activities. The subcontractor industrial hygiene program shall address the following elements (as applicable to the project):

- Noise
- Hazardous materials
- Subcontractor worksite dust control
- Sanitation
- Personal exposure monitoring
- Respiratory protection
- Temperature extremes
- Lightning
- Lighting and illumination
- Lead
- Hexavalent chrome
- Lasers
- Safety showers and eyewash apparatus
- Ionizing radiation
- Blood-borne pathogens
- Other significant project-related hazards
- Ventilation.

The subcontractor shall provide personnel adequately trained/qualified to manage and implement their industrial hygiene program to a level required for the scope of work.

15.2 Regulatory Requirements

The subcontractor industrial hygiene program shall be conducted in accordance with the following statutory requirements:

- 10 CFR Part 851, Worker Safety and Health Program
- ANSI Z88.2, *American National Standard for Respiratory Protection,* current edition

- 29 CFR Part 1926, Construction Safety and Health Regulations for Construction
- 29 CFR Part 1910, Occupational Safety and Health Standards for General Industry
- American Conference of Governmental Industrial Hygienists, *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Indices,* latest edition.

15.3 NLR-Specific Requirements

In addition to the requirements in Section 15.2, the subcontractor industrial hygiene program shall meet the following NLR requirements as applicable.

15.3.1 General Requirements

15.3.1.1 Identification of Health Hazards

The subcontractor shall identify and document existing and potential physical, chemical, and biological health hazards. The SWP should address those and any additional hazards revealed by supplemental site information provided by NLR (e.g., site characterization data, as-built drawings, information regarding adjacent operations) and should be kept updated to reflect significant changes in exposure potential, new information, monitoring data, etc.

15.3.1.2 Implementation of Control Measures

The subcontractor's industrial hygiene program shall require that controls are implemented to eliminate or reduce employee exposure to below recognized occupational exposure limits (permissible exposure limits and TLVs). Subcontractors should strive to maintain exposures as low as reasonably achievable. Control measures to eliminate or reduce industrial hygiene-related exposures shall be identified during the prejob planning process and delineated in the SWP. The implementation of control measures shall follow the following hierarchy:

1. Substitute with a less hazardous material if possible.
2. Use engineering controls.
3. Use administrative controls.
4. Use PPE.

15.3.1.3 Exposure Assessment

The subcontractor shall perform monitoring as necessary to document employee exposure to chemical and physical hygiene hazards. Negative exposure assessments are encouraged even when not specifically required by a substance-specific standard. Exposure assessments may be performed using various methodologies (e.g., integrated sampling, direct-reading instrumentation, modeling), as appropriate for the material(s) of concern, the site conditions, and the type of data needed.

15.3.1.4 Control of Hazardous Materials

A hazardous material is any substance that presents a physical or health hazard to humans. Hazardous material exposures should be maintained at the lowest exposure levels practical. A chemical shall not be used in any situation unless an individual has information indicating how the material can be used safely. Control measures to prevent overexposure to chemicals shall be incorporated into the SWP as necessary.

15.3.1.5 Carcinogen Control

The subcontractor shall make every attempt to substitute less hazardous substances for any carcinogenic material (as defined by OSHA in 29 CFR Part 1910.1200). If hazardous materials containing carcinogenic components are used, the subcontractor shall ensure that exposures are eliminated or effectively maintained as low as reasonably achievable.

Where the subcontractor's use of carcinogens may impact NLR workers, NLR may impose additional specific controls upon the subcontractor.

15.3.1.6 Subcontractor Worksite Dust Control

All subcontractor projects shall address dust control during pre-job planning. Outdoor areas to be cleared for work shall be limited to keep dust generation to a minimum. Earthwork activities shall be suspended when winds exceed 30 mph. Fugitive dust emissions resulting from grading and/or wind shall be controlled in accordance with the requirements of the Colorado Department of Public Health and Environment. Construction of permanent roadways and parking areas should be scheduled during the early stages of a project. During construction, frequent watering shall be provided to roadways and disturbed areas that are not otherwise treated.

Information regarding the silica guide can be found on the NLR construction subcontractor website at NLR.gov/about/ehs-construction.html.

During facility renovation activities, barriers are to be installed as needed to prevent dust migration from work areas to other occupied space. Sufficient equipment shall be kept at the jobsite to control dust whenever a nuisance or hazard occurs. Indoors, dry sweeping is discouraged.

15.3.1.7 Sanitation

Housekeeping shall be maintained on a daily basis. All work areas, shops, and offices shall be kept clean to the extent the nature of the work allows. Walking/working surfaces shall be maintained, so far as practicable, in a dry condition. Waste receptacles that do not leak and are thoroughly cleaned and maintained in a sanitary condition shall be used. All sweepings, wastes, refuse, and garbage shall be removed in a timely and sanitary manner. Cleaning and sweeping shall be done in a manner that minimizes the contamination of the air with dust or particulate matter. Building entrances and openings shall be maintained to minimize the entry of vermin.

When provided, water facilities and containers shall be maintained, cleaned, and sanitized in accordance with applicable regulations. Use of common utensils (e.g., sharing the same cup) is prohibited. Adequate and fully equipped toilets and wash stations shall be readily accessible to workers and maintained in a sanitary manner at all times.

15.3.1.8 Personal Exposure Monitoring

The subcontractor shall perform monitoring as necessary to document employee exposure to chemical and physical hygiene hazards, and to meet regulatory requirements. Negative exposure assessments are encouraged even when not specifically required by a substance-specific standard. Workers shall be informed of monitoring results within the OSHA-specified time frame. Colocated workers (who have similar exposure potential as those who were monitored) shall also be informed of the results after removing any personal/confidential information.

The subcontractor shall notify the NLR ESHQ POC of the results of monitoring as soon as they are obtained and provide NLR with copies of the results, field notes, and other associated documentation along with the weekly ESHQ report.

15.3.2 Temperature Extremes

Provisions to prevent heat stress and cold stress shall be incorporated into the SWP when work conditions may reasonably be expected to present such hazards. The thermal stress section of the ACGIH TLVs shall be the governing guidelines.

15.3.2.1 Heat Stress

The subcontractor shall provide appropriate mitigating measures prior to heat stress becoming an issue. The ACGIH TLV guidelines shall be followed for developing and implementing heat stress mitigation strategies. The use of heat stress controls shall be addressed during the planning stages for all work that is to be performed in elevated temperature environments and whenever impermeable clothing or multiple layers of clothing shall be worn to conduct work. Wet bulb globe thermometers are required to make wet bulb globe-thermometer-based heat exposure assessment determinations specified in the TLVs.

Subcontractors working in outdoor environments between April and September shall develop and implement a heat stress prevention program. This program shall be made available for review by NLR.

15.3.2.2 Cold Stress

The ACGIH cold stress TLV is the prescribed standard for cold exposure. When work involves continuous employee exposure to an equivalent chill temperature below 10°F, the following safe work practices shall be observed:

- Workers are instructed on symptoms of frostbite and hypothermia, and appropriate preventive and first aid measures.
- Warming areas are conveniently available, and workers shall be allowed to access the warming areas at will.
- Work is conducted using the “buddy system” or under continued supervision. Nonemergency work is curtailed when the equivalent chill temperature in the work area is below -25°F.

Workers who experience physical illness or injury from cold exposure are to be immediately moved to a warm area and then examined by a physician.

15.3.3 Lightning

Subcontractors shall train all workers on lightning safety. Training should be provided for each outdoor worksite, so that supervisors and workers know in advance where a worksite’s safe shelters are and the time it takes to reach them. Prior to beginning any outdoor work, the subcontractor shall check National Oceanic and Atmospheric Administration weather reports (weather.gov/nwr) and radio forecasts for all weather hazards. If you hear thunder or see lightning, even a distant rumble, get to a safe place immediately. Remain in the shelter for at least 30 minutes after hearing the last sound of thunder or sign of lightning.

15.3.4 Lighting and Illumination

The minimum lighting level for work areas both indoors and outdoors shall be an average of 5 ft candles measured 30 in above the floor. Illumination for general work areas shall maintain an average lighting level of 10 ft candles. Auxiliary lighting shall be used when needed for task-specific activities. Care shall be exercised

with the use of halogen lamps so fire hazards are not created.

15.3.5 Ventilation

Local exhaust ventilation is a primary engineering control and is required to reduce concentrations of hazardous, irritating, and odiferous air contaminants below allowable exposure limits (where feasible). The operability of such systems shall be evaluated prior to the start of the work. The ACGIH's Industrial Ventilation Manual is the reference of standard for the design, testing and operation of ventilation systems.

15.3.6 Lead Program

Prior to performing work activities involving the use or potential release of lead, the subcontractor shall provide a Lead Compliance Plan to the NLR ESHQ POC for review and concurrence.

15.3.7 Hexavalent Chrome

The OSHA Chromium (VI) standard (29 CFR Part 1910.1026 and 29 CFR Part 1926.1126) will apply to all work performed by the subcontractor that may expose workers to airborne hexavalent chromium. The subcontractor shall be responsible for compliance with all requirements of the standard.

15.3.8 Laser Use

Class 1 laser systems incorporated into commercially available devices for use by the public are exempt from these requirements, unless opened, serviced, or modified. Laser equipment shall bear a conspicuously displayed label to indicate hazard classification.

Class 2 lasers shall read and abide by the safety documentation provided in the operator's manual. Only qualified and trained personnel may service, adjust, or repair laser equipment. Employees, when working in areas in which a potentially hazardous exposure to direct or reflected laser radiation exists, shall be provided with antilaser protection devices.

15.3.8.1 Class 1M and Class 2M Laser Use

Users of Class 1M and 2M lasers shall read and abide by the safety documentation provided in the operator's manual. Further, the use of collective optics (such as binoculars, telescopes, microscopes, etc.) shall not be used to view the laser beam directly. The subcontractor contact information shall be posted at the entrance to the work area.

15.3.8.2 Class 3a and Class 3R Laser Use

Class 3a or 3R lasers used in work activities that emit green laser light and have a stated power output of 5 MW shall be evaluated by the NLR laser safety officer to ensure there is no additional, invisible infrared light being emitted as well.

15.3.8.3 Class 3B and Class 4 Laser Use

Class 3B and 4 laser equipment shall not be used without the express written permission of the NLR laser safety officer.

15.3.9 Safety Showers and Eyewashes

Suitable facilities for quick drenching or flushing of the eyes and body (e.g., eyewash/shower apparatus) shall be provided within the work area for immediate emergency use where the eyes or body of any person may be

exposed to injurious corrosive materials (e.g., corrosives, skin sensitizes). An eyewash/shower apparatus shall be located such that it would require no more than 10 seconds to reach from the hazard. Access shall be free of any impediments.

Employees who may have a need for an eyewash/shower apparatus shall know where the nearest eyewash/shower apparatus is located and how to operate it. Monthly inspections of eyewash/shower apparatus shall be documented. The potable water provided for a portable eyewash/shower apparatus shall be flushed or changed according to manufacturer's specifications.

15.3.10 Ionizing Radiation

Radioactive materials, sealed radioactive sources, or devices that generate ionizing radiation shall not be brought on the NLR site without notifying the NLR TM, FM, radiation safety officer, and ESHQ POC. Any subcontractor needing to bring radioactive material, sources, or radiation-generating devices onto NLR property shall allow sufficient lead time in their schedule for NLR's review of their program, documentation, training records, other submittals, etc.

15.3.11 Blood-Borne Pathogens

Employees who may reasonably be expected to be exposed to blood or other body fluids shall comply with OSHA requirements relating to this subject. First aid kits shall contain "Universal Precautions" items, including chemical splash goggles, medical gloves, cardiopulmonary resuscitation masks (with one-way valve), antiseptic hand cleaner, drying cloths, and red bags labeled "BIOHAZARD." Medical waste generated as a result of a first aid response shall be placed in labeled red bags and disposed of according to local regulations.

15.3.12 Other Health Hazards

Other hazards that may be present during the subcontractor's work that are not specifically addressed in this manual shall be identified by the subcontractor and addressed in their SWP. Subcontractors are encouraged to discuss potential hazards in advance with the NLR ESHQ POC and/or the NLR TM.

15.4 NLR Special Emphasis

Some chemicals are considered by NLR to be extremely hazardous and have additional requirements for bringing them onto NLR property and/or specific worker exposure monitoring requirements. The subcontractor shall submit a list of chemicals they plan to bring on-site to the ESHQ POC prior to starting work activities.

15.5 Subcontractor Responsibilities

The provisions of this procedure apply to the development and implementation of the subcontractor's industrial hygiene program. The subcontractor shall be responsible for implementing an effective industrial hygiene program that:

- Anticipates, identifies, evaluates, and controls potential and existing hazards/agents in the workplace through the prejob safety planning process
- Determines that engineering devices, administrative controls, and PPE are available, appropriate, tested, and used by employees
- Determines employees are trained as required

- Stops work that is not being performed safely
- Reports occupational exposure data to affected employees in a timely manner.

15.6 References

- 29 CFR Part 1910, Occupational Safety and Health Standards for General Industry
- 29 CFR Part 1926, Safety and Health Regulations for Construction
- American Conference of Governmental Industrial Hygienists, *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Indices,* latest edition
- American Conference of Governmental Industrial Hygienists manual, *Industrial Ventilation*, latest edition
- Colorado Department of Public Health and Environment, Regulation 3—Stationary Source Permitting and Air Pollutant Emission Notice Requirements

16 Asbestos Management

16.1 Applicability

The requirements of this section apply to all subcontractors and lower-tier subcontractors (hereafter referred to as "subcontractors") performing activities on NLR-owned/-leased buildings that will disturb or have potential to disturb asbestos-containing materials (ACMs), asbestos-containing building materials, and/or presumed asbestos-containing materials. If suspect ACMs are unexpectedly encountered during the course of construction activities, the subcontractor shall immediately cease work and contact the NLR PM and the NLR ESHQ POC.

Nonfriable ACMs can be found in materials such as asbestos-containing cement board (Transite) in laboratory hoods and in chemical storage compartments under laboratory hoods, select laboratory countertops/backsplashes, roofing materials, floor tile/adhesives, sealants, heat-producing equipment gaskets, and asbestos gloves. Examples of friable ACMs include material placed on building surfaces, thermal system insulation, or previously categorized nonfriable material that has become damaged to the extent that, when dry, it can be crumbled, pulverized, or reduced to powder by hand pressure. ACMs should be identified by the NLR PM and/or ESHQ POC based on the scope of work and the building materials that shall be disturbed.

NLR and its subcontractors shall perform work in compliance with federal and state requirements and additional NLR requirements, as identified below.

16.2 Regulatory Requirements

Asbestos work activities shall be conducted in accordance with the following statutory requirements:

- Colorado Department of Public Health and Environment Regulation No. 8
- OSHA 29 CFR Part 1926.1101 Asbestos
- OSHA 29 CFR Part 1910.1001 Asbestos.

16.3 NLR-Specific Requirements/Permit

In addition to the regulatory requirements, all work activities shall meet the requirements identified in the NLR Asbestos Management laboratory-level procedure, PROC 600-36. The subcontractor shall request a copy of this procedure from the NLR PM when the need to disturb ACMs is identified, typically based on the scope of work or through the design review process.

16.3.1 Subcontractor Responsibilities

Asbestos work shall comply with applicable laws and regulations. The general contractor/asbestos abatement subcontractor shall submit an asbestos work plan to NLR for review and acceptance prior to start of work.

The asbestos subcontractor shall submit copies of the following to NLR, following acceptance of the work plan:

- General abatement contractor certificate
- Asbestos supervisor certification
- Asbestos worker certifications
- Supervisor's and workers' respiratory protection certification indicating that they are medically

qualified, trained, and fit-tested

- Proof of insurance covering asbestos abatement activities that extends the length of the project.

The asbestos subcontractor shall submit copies of the following to NLR while performing abatement work:

- Copies of personal air monitoring data collected at NLR
- Copies of clearance monitoring and the Air Monitoring Specialist certification.

Critical barriers shall be removed until NLR has accepted clearance monitoring results, where clearance monitoring is required.

16.3.2 Permits

The asbestos subcontractor is required to submit notification or obtain a permit from the state of Colorado if the amount of ACM to be removed is greater than 260 linear ft, greater than 160 ft^2, or the volume of one 55-gallon drum. The asbestos subcontractor shall provide a copy of the notification/permit to the ESHQ POC.

The subcontractor shall obtain an NLR SWP to address asbestos activities prior to the start of work. The general contractor/subcontractor shall contact the NLR ESHQ POC prior to the removal of any waste from the NLR project/location. Asbestos shall be managed in accordance with DOT and disposal facility requirements. Waste disposal manifests may only be signed by NLR staff who have current DOT hazardous materials shipper training/certification (e.g., Waste Management or Shipping & Receiving staff). The ESHQ POC shall retain a copy of the final manifest. Asbestos waste may not be combined with waste from other projects.

16.4 NLR Special Emphasis

Prior to awarding a contract to an asbestos abatement subcontractor, the ESHQ SME shall:

- Review the Colorado Department of Public Health and Environment asbestos website to verify the proposed subcontractor does not have enforcement actions against its company.
- Review NLR incidents related to the proposed subcontractor.
- Verify the subcontractor has been in business for more than 5 years.

16.5 References

- Colorado Department of Public Health and Environment Regulation No. 8
- OSHA 29 CFR Part 1926 1101, Asbestos
- OSHA 29 CFR Part 1910.1001, Asbestos

17 Silica Management

Silica is the main component found in sand, quartz, shale, and granite rock. Excessive amounts of silica dust may be generated during activities including, but not limited to, sandblasting, rock drilling, grinding concrete, stonecutting, drilling, quarrying, brick concrete cutting, gunite operations, asphalt grinding, opening and pouring bags of cement products, demolition operations, jackhammering, chipping, soil excavation, and sweeping concrete or masonry dust.

17.1 Applicability

The requirements of this section apply to all subcontractors and lower-tier subcontractors (hereafter referred to as "subcontractors") performing activities on NLR-owned/leased buildings or properties that will disturb or have potential to disturb silica containing materials. If suspect silica containing materials are unexpectedly encountered during work activities, the subcontractor shall immediately cease work and contact the NLR FM or ESHQ POC.

NLR and its subcontractors shall perform work in compliance with federal and state requirements and additionally NLR requirements, as identified below.

17.2 Regulatory Requirements

Silica controls are addressed through the following statutes, laws, regulations, and guidance documents:

- OSHA 29 CFR Part 1926.1153, Respirable Crystalline Silica
- OSHA 29 CFR Part 1910.1053, Respirable Crystalline Silica
- American Conference of Governmental Hygienists (ACGIH) Threshold Limit Values/Biological Exposure Indices, latest edition.

17.3 NLR-Specific Requirements

A surface penetration permit is required prior to disturbance of a building's surface and shall be obtained from the NLR FM. A surface penetration at NLR is defined as an opening made by drilling, cutting, hammering, or otherwise piercing a wall, floor, ceiling, roof, or other building surface.

Surface penetration may expose subcontractors to silica as well as electrical and other hazards. Consult Chapter 21, "Building Surface Penetrations," for NLR requirements before conducting any building surface penetrations.

17.3.1 Subcontractor Responsibilities

The subcontractor is responsible for keeping worker exposures to crystalline silica at or below the ACGIH TLV (0.025 mg/m3, respirable fraction, which is one-half of the OSHA permissible exposure limit). Engineering controls such as wet methods or ventilation shall be employed whenever dust-producing activities are anticipated. Compliance with the TLV will require wet methods, local exhaust ventilation, or other engineering controls. Control methods described in Table 1 of 1926.1153 may not be sufficient to control respirable silica concentrations to at or below the TLV. Use of engineering and control methods described in NLR's Modified Table 1 as well as respiratory protection is required unless the subcontractor can demonstrate through personal air monitoring that exposures are at or below the TLV. The subcontractor may use historical air monitoring results obtained during similar work (NLR shall evaluate data prior to acceptance) to prove that their control

methods are likely to result in exposures at or below the TLV during work at NLR. Specific OSHA requirements as identified in 1926.1153/1910.1053 (excluding the permissible exposure limit), such as exposure monitoring, written exposure control plan(s), hazard communication, respiratory protection program (where respirator use is required), and medical surveillance, shall be complied with for work conducted at NLR.

To determine whether a product contains silica, the safety data sheet shall be obtained and inspected by the subcontractor. In the event silica is present in the products, the following safe working procedures shall be followed to eliminate or control silica dust exposure:

- Engineering controls shall be used to eliminate the hazard whenever feasible.
- Air monitoring or historical data are required to confirm the controls in place are working and whether PPE (and type) is adequate.

After working with products that contain silica, everyone will be required to thoroughly wash their hands and face before eating, drinking, or smoking. Eating, drinking, or smoking near silica dust is strictly prohibited.

Wet down dry materials and surfaces before cutting, chipping, grinding, sanding, sweeping, or cleaning. All block-cutting operations shall be performed by the wet cut method.

Use power tools with built-in dust extraction units to capture the dust before it is released into the air.

For abrasive blasting, replace silica sand with safer materials. NLR does not allow the use of sand or any abrasive material that contains more than 0.1% crystalline silica. Gamet, slags, steel grit, and shot may be good substitutes.

High-efficiency particulate air vacuums used to control silica dust in indoor or outdoor environments where NLR employees, guests, passers-by, etc., may be exposed due to the risk of leaky vacuums, shall be maintained per the manufacturer's recommendations, and equipment shall be in good working condition with no missing parts.

Examples of work activities/demolition operations known to cause the release of silica dusts, including with or without controls, include but are not limited to:

- Chipping, sawing, grinding, hammering, or drilling of concrete, rock, brick, etc.
- Work with cementitious materials or other products that may contain silica such as grout, masonry mortar, stucco, gunite, shotcrete, plaster, sheetrock joint/taping compound, soil, etc.
- Dry sweeping or sanding of materials that generate dust originating from concrete/cement, rock, or sheetrock joint/taping compound.

The subcontractor shall submit copies of the following to NLR:

- An exposure control plan, including:
  - A description of the tasks involving disturbance to respirable crystalline silica
  - A description of the engineering controls, work practices, and respiratory protection used to limit employee exposure
  - Housekeeping measures used to limit employee exposure

  - Training documentation on silica
  - Identification of a competent person
- A subcontractor respiratory protection program
- Workers' respiratory protection credentials indicating that they are medically qualified, trained, and fit-tested
- A subcontractor medical surveillance program (required if using respiratory protection 30 or more days per year).

17.4 References

- OSHA 29 CFR Part 1926.1153, Respirable Crystalline Silica
- OSHA 29 CFR Part 1910.1053, Respirable Crystalline Silica
- American Conference of Governmental Hygienists, Threshold Limit Values/Biological Exposure Indices, latest edition

18 Personal Protective Equipment

18.1 Applicability

The requirements of this section apply to all subcontractors' and lower-tier subcontractors' (hereafter referred to as "subcontractors") work activities on NLR sites unless otherwise specifically exempted by the NLR. This section provides the requirements for the use of PPE, where substitution, engineering, or administrative controls are inadequate to fully protect the worker's body (including eyes, face, feet, hands, head, and hearing) from hazards capable of causing injury, illness, or impairment of any bodily function.

18.2 Regulatory Requirements

The selection, use, and design of PPE shall comply with the following requirements:

- 29 CFR Part 1926, Construction, Subpart E, Personal Protective and Life Saving Equipment
- 29 CFR Part 1926, Construction, Subpart I, Personal Protective Equipment
- 29 CFR Part 1910, Subpart I, Personal Protective Equipment
- 10 CFR Part 835, Occupational Radiation Protection
- ANSI standards
- Manufacturers' recommendations.

18.3 NLR-Specific Requirements

18.3.1 General Requirements

PPE is not a substitute for engineering and administrative controls. These controls shall be implemented, to the extent feasible, to mitigate the hazard so that the need for PPE is reduced or eliminated. Subcontractors shall provide PPE to its employees in accordance with OSHA requirements.

At a minimum, all subcontractor personnel shall wear sturdy work boots with safety toe, ANSI rated safety glasses with rigid side shields, hard hats, long pants, and shirts with 4-in sleeves when performing work. Personnel working outdoors or around heavy equipment shall also wear reflective, high-visibility (e.g., orange) traffic safety vests (minimum ANSI Class 2). Exceptions to these minimum requirements shall be approved by the NLR ESHQ POC and notated in the SWP. Gloves specific for the task shall be required.

The subcontractor is responsible for supplying and requiring the wearing of appropriate PPE in all operations where there is an exposure to hazardous conditions and/or where this manual indicates the need for using such equipment to reduce the hazards to the employees.

18.3.2 Training

Subcontractors shall provide training to each employee who is required to use PPE. Each affected employee shall show understanding of training related to their specific PPE. Retraining may be necessary if work activities change or the employee exhibits a lack of understanding of the PPE.

18.3.3 PPE Hazard Assessment and Selection

The appropriate PPE for the work being performed shall be specified in the applicable SWP. The PPE selection shall be based on the hazard assessment results conducted for the work activity. Examples of applicable hazard assessment documentation include:

- Hazard assessment
- Fall hazard analysis
- Confined space entry permit
- Hot-work permit
- Electrical SWP.
- Building surface penetration permit.

The SWP shall address, at a minimum, the following PPE requirement, as applicable to the work activity:

- Foot protection
- Hand protection
- Respiratory protection
- Head protection
- Eye and face protection
- Hearing protection
- Body protection
- Fall protection.

18.4 Subcontractor Responsibilities

The subcontractor shall:

- Perform an assessment identifying hazards or potential hazards and determine necessary PPE for activities to be performed.
- Adhere to PPE requirements identified in project SWP, as applicable.
- Adhere to prescribed NLR postings and/or NLR prejob planning documentation requiring use of PPE.
- Provide adequate PPE for all its employees.
- Properly maintain, use, and store PPE.
- Remove damaged and/or defective equipment from service.
- Provide appropriate training to PPE users and document through site-specific training and/or daily safety meetings.

18.5 References

- 29 CFR Part 1910, Occupational Safety and Health Standards for General Industry
- 29 CFR Part 1910.134, Respiratory Protection
- 29 CFR Part 1926, Safety and Health Regulations for Construction
- 29 CFR Part 1926, Subpart E, Personal Protective and Life Saving Equipment
- 29 CFR Part 1910, Subpart I, Personal Protective Equipment
- CFR 835, Occupational Radiation Protection
- ANSI Z87.1, Occupational and Educational Personal Eye and Face Protection Devices, latest edition
- ANSI Z89.1, Protective Headwear for Industrial Workers, latest edition
- ANSI Z88.2, American National Standard for Respiratory Protection, latest edition
- American Society for Testing and Materials F2413-05, Standard Requirements for Protective Footwear
- American Society for Testing and Materials F2413-11, Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear

19 Hazard Communication

19.1 Applicability

The requirements of this section apply to all subcontractors' and lower-tier subcontractors' (hereafter referred to as "subcontractors") activities involving hazardous materials as they relate to the work activities on NLR sites unless otherwise specifically exempted by NLR.

This section defines the requirements and responsibilities for subcontractors who use, apply, store, or generate hazardous materials at NLR.

19.2 Regulatory Requirements

The subcontractor's hazard communication program shall be conducted in accordance with the following statutory requirements:

- 10 CFR Part 851, Worker Safety and Health Program
- 29 CFR Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Standards
- 29 CFR Part 1926.59, Hazard Communication, Safety and Health Regulations for Construction.

The hazard communication program shall comply with the applicable statutory requirements of 29 CFR Part 1910.1200, Hazard Communication. Required components of a hazard communication program include hazard determination, safety data sheets (SDSs), labels and other forms of warning, employee information training, and a written hazard communication program.

19.3 NLR-Specific Requirements

In addition to the requirements in Section 19.2, the subcontractor's hazard communication program shall meet the following NLR requirements as applicable.

19.3.1 General Requirements

When selected for subcontract award, submit for approval, prior to beginning work, a list of all hazardous materials to be used on the project to the NLR ESHQ POC.

The subcontractor is responsible for maintaining an up-to-date chemical inventory and copies of material SDSs (only of those chemicals brought on-site). These shall be maintained at the project and made readily available for review by site workers or NLR employees.

Prior to using any newly introduced hazardous material or product, supervisors shall obtain a copy of the appropriate SDS and review it with their employees. The SWP should be updated to reflect health and safety controls specific to chemical use.

Each original container of hazardous materials shall have the manufacturer's label affixed to it or be labeled, marked, or tagged showing the identity of the hazardous chemicals, the appropriate hazard warning, and the name and address of the chemical manufacturer, importer, or other responsible party.

Secondary and subsequent containers of hazardous chemicals shall be labeled, marked, or tagged prior to use

with the identity of the hazardous materials and the appropriate hazard warnings. The only exception to this is for portable containers into which hazardous chemicals are transferred, which need no label if all the following conditions are met:

- The contents of the portable container are for the immediate use of only the person making the transfer, and the container remains under their direct control.
- The unlabeled portable container is used only during the work shift during which it was originally filled.

19.3.2 Specific Communication Requirements

If the subcontractor uses a labeling system that is an unusual format, or not readily understandable, the subcontractor shall inform other affected workers how to read/understand their labeling system.

The subcontractor shall determine whether their use of hazardous materials may affect (expose or pose a potential danger in the event of an emergency) other subcontractor or NLR employees. If the hazardous materials—or the way they will be used—create a potential for affecting other employees, the subcontractor shall take appropriate notification steps. The subcontractor shall inform the other employer(s) of any precautionary measures that need to be taken to protect other subcontractors and/or NLR employees from inadvertent/unnecessary exposure to the subcontractor's hazardous materials during normal operating conditions and in foreseeable emergencies.

Work areas where chemical and/or biological hazards are known to pose an exposure potential shall be clearly designated as such (with signs, placards, postings, etc.) along with control requirements (PPE requirements, ventilation, authorization for access required, etc.).

19.4 NLR Special Emphasis

Some chemicals are considered by NLR to be extremely hazardous and have additional requirements for bringing on NLR property. Extremely hazardous materials at NLR include the following classes of chemicals:

- Alkali metals
- Beryllium
- Perchloric acid and other peroxide-forming chemicals
- Unstable, reactive, pyrophoric, or explosive chemicals
- Hydrofluoric acid
- Radioactive materials
- Highly toxic chemicals and reproductive toxins (depending upon the form, the quantity andmethod of application or use)
- Pesticides/herbicides
- Biochemicals.

Use of these chemicals at NLR may necessitate additional control mechanisms, such as establishing dedicated use areas, specific postings/warning signs, notification to adjacent workers, ventilation controls, decontamination procedures, personal hygiene facilities, etc. It is the subcontractor's responsibility to notify the

NLR ESHQ POC prior to bringing the material on-site (preferably during the project planning stages) if intending to use extremely hazardous materials on their project, to ensure that the proper controls are built in.

19.5 Subcontractor Responsibilities

The subcontractor is responsible for:

- Administering their own hazard communication program
- Maintaining an on-site list of hazardous materials and SDSs to be used on the project
- Determining the hazards of materials used in the workplace, making SDSs available to employees, labeling containers, and providing information and training to employees on hazardous materials
- Developing work practice requirements for hazardous materials
- Bringing on-site only those chemicals needed to perform the work for which they are contracted, and only in quantities needed for the job at hand
- Identifying when the subcontractor's use of hazardous materials may affect (expose or pose a potential danger in the event of an emergency) other subcontractors, or NLR's employees, and taking appropriate notification steps
- Storing and using chemicals in accordance with the manufacturer's instructions, applicable regulations, and best management practices
- Removing chemicals from the work area and properly disposing of them when no longer needed
- Complying with exposure monitoring and medical surveillance requirements associated with chemical use.

19.6 References

- 10 CFR Part 851, Worker Safety and Health Program
- 29 CFR Part 1926, Safety and Health Regulations for Construction
- 29 CFR Part 1910, Occupational Safety and Health Standards for General Industry
- 10 CFR Part 850, Chronic Beryllium Disease Prevention Program.

20 Confined Space

20.1 Applicability

The requirements of this section apply to all subcontractors' and lower-tier subcontractors' (hereafter referred to as "subcontractors") activities that require personnel to work in permit-required and non-permit-required confined spaces on NLR sites, unless otherwise specifically exempted by NLR.

20.2 Regulatory Requirements

The subcontractor confined space entry program and the associated work activities conducted in permit-required and non-permit-required confined spaces shall be accordance with the following statutory requirements:

- 29 CFR Part 1926.1203 Subpart AA, Confined Spaces in Construction
- 29 CFR Part 1910.146, Permit-Required Confined Spaces.

20.3 NLR-Specific Requirements

In addition to meeting the OSHA requirements in Section 20.2, all work activities conducted in permit-required and non-permit-required confined spaces shall meet the following NLR requirements, as applicable.

20.3.1 Confined Space Work at NLR

NLR will describe the confined space, whether it is permit-required or non-permit-required, and the known hazards of the space. NLR will request and review a copy of the subcontractor's written confined space program. NLR will require the subcontractor to have a competent person, workers who are properly trained in confined space entry, and all the necessary equipment to perform work in the confined space.

20.3.2 Confined Space Classification

NLR has established a system for classifying (consistent with OSHA definitions) confined spaces as permit-required or non-permit-required based on the actual and/or potential hazards related to entry into the space. Prior to entry, all confined spaces will be evaluated and classified as either permit-required or non-permit-required based on the actual and/or potential hazards related to entry into the space while the confined space is in its normal operating condition.

20.3.2.1 Labeling and Signage

When feasible, identified confined spaces are posted with a sign stating "Confined Space, Entry by Permit Only" or "Non-Permit Confined Space. Contact the NLR Central Monitoring Station (303-384-6811) and Facility Manager Before Entering." When signage is not feasible, subcontractors will be informed of the location and classification of known confined spaces.

20.3.2.2 New or Previously Unidentified Confined Spaces

There is a possibility that work activities may create new confined spaces (such as new utility vaults, manholes, ventilation ducts, tanks, sumps, and/or elevator pits). It is also possible that, during work activities, subcontractors may encounter a confined space that had not been previously identified. During project design, NLR will attempt to identify situations that may result in the creation of new confined spaces; however, it is not always possible to anticipate every potential confined space.

It is the subcontractor's responsibility to watch for new or previously unidentified confined spaces and to inform the NLR PM and ESHQ POC whenever new confined spaces are identified or created.

20.3.2.3 Identifying a Confined Space

All subcontractors should be on the lookout for confined spaces. As defined by OSHA, a confined space:

- 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 (e.g., tanks, vessels, silos, storage bins, hoppers, vaults, and pits or spaces that may have limited means of entry)
- Is not designed for continuous employee occupancy.

20.3.2.4 Hazard Recognition

Confined spaces shall be considered hazardous until determined to be otherwise. Hazards will be identified and evaluated by a competent person prior to entry. The subcontractor shall be watchful of confined space work activities that may increase hazards, such as hot work, painting, cleaning, or electrical work. Such work may change from a non-permit-required confined space into a permit-required confined space.

The subcontractor will continuously evaluate confined space conditions and will stop working if hazards increase or change. Additional controls shall be implemented to control the new hazards. In addition to the requirement for an entry supervisor and attendant for permit-required entries, non-permit entries require a partner or buddy to be involved with each entry.

20.3.3 Verification of Subcontractor's Compliance with Confined Space Entry

NLR requires verification that the subcontractor is able to safely perform confined space entries. NLR will verify the subcontractor has the following:

- A confined space competent person
- Entry team/authorized personnel comprising an adequate number of workers to staff an entry team, including entry supervisor, with current and documented training
- Functioning, calibrated monitoring equipment, and staff members who are familiar with the use of the equipment
- Appropriate PPE, ventilation equipment, supplemental lighting, if necessary, fall protection plan, and rescue equipment/plan.

NLR and the subcontractor will discuss acceptable entry conditions. NLR may request a copy of the subcontractor's LO/TO program if energy isolation is necessary. The NLR ESHQ POC may observe subcontractor confined space entries until NLR is comfortable that all performance expectations are being met. A copy of each completed confined space entry permit shall be submitted to the NLR ESHQ POC.

20.3.4 Confined Space Entry Controls

Entries into confined spaces shall be controlled either through administrative controls for nonpermit confined spaces or through the permit procedure for permit-required confined spaces. Controls for confined space entries include but are not limited to:

- Mechanical ventilation

- Use of isolation procedures (LO/TO)
- Cleaning of confined space
- Electrical precautions
- Fire precautions
- PPE
- Communication procedures.

20.3.4.1 NLR Confined Space Entry Experience/History Review

The NLR ESHQ POC shall inform subcontractors of NLR's experience, if any, with the confined space being entered, by reviewing Confined Space Evaluations, associated confined space classification, and previous cancelled permits for the space in question, if available.

20.3.4.2 Subcontractor Confined Space Post Entry Evaluation Review

Subcontractors may inform the NLR ESHQ POC of their experience with the permit-required confined space following the entry by using the Entry Review/Critique section contained in either the NLR Confined Space Entry Permit or the subcontractor's accepted Confined Space Entry Permit. Completed NLR permits or copies of the subcontractor's permit shall be made available to ESHQ POC.

20.3.5 Confined Space Entry Notification

In general, the following coordination and notification is required for permit and non-permit-required confined spaces prior to entry.

- **Non-permit-required confined space:** Entries shall be coordinated with the CMS and the FM.
- **Permit-required confined space:** Entries shall be coordinated with CMS, FM, and ESHQ POC.

Exact notification requirements may vary from job to job, particularly in cases of new confined spaces arising during work.

20.3.6 Subcontractor Training Requirements

Subcontractors who are trained in accordance with the requirements identified in 29 CFR Part 1926.1207, Confined Spaces, will be considered as meeting the necessary confined space entry training requirements for working at NLR. The subcontractor shall provide proof of such training upon request to the ESHQ POC.

20.4 References

- 29 CFR Part 1926.1203 Subpart AA, Confined Spaces in Construction
- 29 CFR Part 1910.146, Permit-Required Confined Spaces
- 29 CFR Part 1910.147, The Control of Hazardous Energy (Lockout/Tagout).

21 Building Surface Penetrations

21.1 Applicability

The requirements of this section apply to all subcontractors' and lower-tier subcontractors' (hereafter referred to as "subcontractors") activities involving the penetration of building surfaces such as walls, floors, ceilings, and roofs, specifically with respect to preventing contact with hidden hazards such as live electrical conductors and other significant hazards such as natural gas, water lines, and compressed air as they relate to the work activities on NLR sites unless otherwise specifically exempted by NLR.

21.2 Regulatory Requirements

The subcontractor's building surface penetration activities shall be conducted in accordance with the following statutory requirements as applicable:

- 29 CFR Part 1926, Safety and Health Regulations for Construction
- 29 CFR Part 1910, Occupational Safety and Health Standards for General Industry.

21.3 NLR-Specific Requirements

In addition to the requirements in Section 21.2, the subcontractor shall conduct surface penetrations in accordance with the following NLR requirements.

Note: All outside excavations, including trenching, grading, or drilling activities, shall be performed in accordance with Section 9.0.

21.3.1 Surface Penetrations

A surface penetration at NLR is defined as an opening made by drilling, cutting, hammering, or otherwise piercing a wall, floor, ceiling, roof, or other building surface. Subcontractors shall ensure that the provisions and necessary steps are in place to provide protection against contact with unseen enclosed electrical lines, gas lines, waste lines, water lines, steam lines, high-pressure lines, or other utilities that, if disturbed, may injure workers or damage equipment.

The subcontractor will be responsible for providing all the required materials, personnel, and protective equipment necessary to conduct safe surface penetration.

21.3.1.1 Surface Penetration Permit—Existing NLR Buildings and Facilities

Subcontractors conducting surface penetrations in existing NLR buildings and facilities shall perform this work activity in accordance with the NLR Surface Penetration Permit. Prior to performing any building surface penetrations, the subcontractor shall coordinate the activity through the NLR PM and the building FM. The NLR FM will issue the surface penetration permit to the subcontractor.

In accordance with the requirements of the permit, the subcontractor shall perform an initial evaluation to include a walk-down of the area, if necessary, with the NLR PM/FM and the ESHQ POC. The walk-down shall identify:

- Any visible indications that utilities and equipment might be present

- Any utilities and equipment that might be disturbed during the work activity.

Surface penetration permit work performed using standard surface penetration methods: A walk-down of accessible sides of the surface that will be disturbed shall be performed to identify:

- Hanging pictures or boards where the length of the nail or screw will not fully penetrate the wall material
- Penetrations into masonry block wall that do not exceed 0.75 in depth
- Penetrations in precast tilt-up concrete walls to mount signs and facility accessories; penetration cannot exceed the thickness of the wall
- Penetrations in drywall, sheetrock, or similar construction material with a drill bit fitted with a stop to prevent penetration beyond the depth of the material; once a hole is made just through the material, use a fiberoptic scope to verify the absence of utilities prior to proceeding with work
- Penetrations in drywall, sheetrock, or similar construction material with a utility knife where the blade is adjusted to prevent penetration beyond the depth of the material; if the size of the opening does not allow for visual verification, use a fiberoptic scope to verify the absence of utilities prior to proceeding with work
- Penetrations in drywall, sheetrock, or similar construction material with a nonconductive object; if the size of the opening does not allow for visual verification, use a fiberoptic scope to verify the absence of utilities prior to proceeding with work
- Penetrations in drywall, sheetrock, or similar construction material with a laminate trimmer with the cutting bit adjusted to prevent penetration beyond the depth of the material; if the size of the opening does not allow for visual verification, use a fiber optic scope to verify the absence of utilities prior to proceeding with work
- Penetrations into a single layer of drywall, sheetrock, or similar construction material where both sides can be visually inspected to verify the absence of utilities that may be disturbed.

The permit may include additional subcontractor project controls and work instructions as deemed necessary by the FM.

Surface penetration permit work performed using nonstandard surface penetration methods. This permit covers penetrations that, by intention, go completely through the surface and penetrations that affect floors, ceilings, roofs, and post tension concrete systems.

- Review facility and the utility drawings.
- Perform nondestructive examination of the area with utility locate equipment.
- Maintain a specified distance from identified and marked utilities within the work area.
- LO/TO utilities within the work area require this control when one of the standard surface penetration methods cannot be used. Based upon the risk assessment, this control may be required when performing a surface penetration near known or suspected utilities, or when there are potential interferences present that may limit the accuracy of the utility locate equipment, or as a defense-in-depth practice to minimize the risk to workers.
- Require the use of a drill interrupter/stop. Require this control when one of the standard surface

penetration methods cannot be used or when core drilling. This equipment instantly interrupts the power to a drill when it encounters grounded metal.

- Require the use of a GFCI when using corded electrical power tools unless a drill interrupter/stop is used.
- Require the use of electrical controls, such as PPE and dielectric mats, when performing surface penetrations. Require this control when one of the standard surface penetration methods cannot be used.

Other controls to consider:

- Relocate the planned surface penetration. Consider this control if utilities or equipment could be disturbed during work activity.
- Identify other controls that may be appropriate to the surface penetration being performed.
- Use typical construction practices as an indicator of the potential for utility systems to be disturbed.
- Other as applicable.

In all instances, the subcontractor shall immediately stop work if:

- Unexpected utilities are encountered.
- The tools encounter unexpected resistance.
- Utilities are damaged during work activity.

21.3.1.2 Surface Penetration Permit, New Building Construction

Subcontractors performing building penetrations in or on new building construction shall use their own surface penetration permit system that meets or exceeds the requirements of Section 21.3.1.1. The subcontractor shall use the permit when work activities—such as drilling, cutting, hammering, or otherwise piercing a wall, floor, ceiling, roof, or other building surface—have a possibility of contacting or penetrating energized unseen enclosed electrical lines, gas lines, waste lines, water lines, steam lines, high-pressure lines, or other utilities that, if disturbed, may injure workers or damage equipment.

21.4 References

- 29 CFR Part 1926, Safety and Health Regulations for Construction
- 29 CFR Part 1910, Occupational Safety and Health Standards for General Industry
- 29 CFR Part 1910.147, The Control of Hazardous Energy (Lockout/Tagout).

22 Environmental Requirements

22.1 Applicability

The requirements of this section apply to all subcontractors and lower tier subcontractors (hereafter referred to as "subcontractors") who perform work activities on NLR sites. This section provides guidance on activities that have the potential to affect natural resources that include requirements associated with work activities that have the potential to affect the environmental aspects described below.

22.2 Regulatory Requirements

Environmental protection is addressed through the following statutes/laws/regulations and guidance documents:

- 40 CFR Part 122, Subpart B, National Pollutant Discharge Elimination System
- Bald and Golden Eagle Protection Act
- Clean Air Act, various sections
- Clean Water Act, Section 402(p)—Municipal Separate Storm Sewer System
- Clean Water Act, Section 404—Permits for dredged or fill material
- Colorado Department of Public Health and Environment, Air Quality Control Division, Regulation No. 1: Emission Control for Particulate Matter, Smoke, Carbon Monoxide and Sulfur Oxides
- Colorado Department of Public Health and Environment, Air Quality Control Division, Regulation No. 3: Stationary Source Permitting and Air Pollutant Emission Notice Requirements
- Colorado Division of Wildlife Recommended Buffer Zones and Seasonal Restrictions for Colorado Raptors, 2008
- Colorado Noxious Weed Act (CRS 35-5.5-101 through 119) and associated regulations, Rules Pertaining to the Administration and Enforcement of the Colorado Noxious Weed Act (8 Colorado Code of Regulations 1206-2)
- Endangered Species Act
- Migratory Bird Treaty Act of 1918
- National Environmental Policy Act (NEPA)
- National Historic Preservation Act
- Resource Conservation and Recovery Act
- State of Colorado Noise Statute (CRS 25-12-101 through CRS 25-12-109).

22.3 Environmental Requirements

NLR operations and facilities are subject to several local, state, and federal regulations and requirements. It is the responsibility of subcontractors performing work at NLR site to comply with these.

In addition to Section 22.2, all work activities shall meet the following NLR requirements, as applicable.

22.3.1 NEPA Requirements

NLR is responsible for completing the applicable NEPA review prior to authorizing the start of construction. Requirements from that review are reflected in the subcontract requirements for construction, as appropriate. Should the scope of work or proposed method of execution change after construction commences, contact NLR to determine whether additional NEPA review is required prior to proceeding.

22.3.2 Stormwater Discharge Requirements

Stormwater discharges associated with construction sites that disturb one acre or greater at NLR's STM and Flatirons campuses are regulated by the U.S. Environmental Protection Agency (EPA) via the EPA General Construction Permit. Subcontractors performing construction activities at NLR are responsible for obtaining coverage under the EPA's Construction General Permit. This requires filing a notice of intent with the EPA and preparing a stormwater pollution prevention plan. NLR shall review and accept the subcontractor stormwater pollution prevention plan in advance of applying for coverage under the EPA's Construction General Permit, and prior to beginning construction activities.

Construction activities that disturb less than one acre do not require coverage under the EPA Construction General Permit. Subcontractors shall adhere to NLR's stormwater management programs and the prohibition of illicit discharges to NLR's stormwater infrastructure.

22.3.3 Air Emissions Requirements

22.3.3.1 Construction Fugitive Dust

The subcontractor shall adhere to NLR's Particulate Emissions Control for Construction Activities. Surface areas disturbed at any one time shall be minimized, vehicle speeds on unpaved roads and disturbed areas shall not exceed 15 mph, no earthwork activities shall occur when sustained wind speeds exceed 30 mph, steep slopes shall be covered with mulch or netting (or equivalent) or watered at the end of each workday, and off-property transport of visible emissions are prohibited.

22.3.3.2 Vehicular Emissions

Construction vehicles, equipment, and subcontractor's personal vehicles shall be operated to minimize emissions. Unnecessary idling of vehicles and equipment is prohibited. Idling of vehicles for occupant heating/cooling comfort is prohibited. Emergency vehicles are exempt from this requirement.

22.3.3.3 Refrigerants

The installation, replacement, and servicing or repair of equipment (appliances) containing refrigerants are subject to regulation and control under both Colorado Department of Public Health & Environment and EPA refrigerant regulations or NLR best practice requirements. Any NLR appliances subject to such activities shall be serviced by technicians holding an EPA-approved training certificate and comply with all applicable requirements. More specifically, chlorofluorocarbon, hydrochlorofluorocarbon, and hydrofluorocarbon refrigerants are subject to specific requirements and limitations. Willful release of any refrigerant other than specifically exempt refrigerant is prohibited. In general, appliances removed from service and leaking appliances shall be the refrigerant recovered for reuse or recycling. Large appliances (more than 50 lbs. of chlorofluorocarbon and hydrochlorofluorocarbon refrigerant per compressor) are subject to specific repair, testing, and documentation requirements. If in doubt regarding these requirements, please consult the ESHQ POC.

22.3.3.4 Portable Generators and Other Emission Sources

Engines for NLR generators are subject to multiple regulations and requirements. Portable generators or similar temporary sources, including space heaters, may be exempt from certain requirements depending on the type of source, fuel, burner size, and other factors. Most portable sources (those that use fuel to generate electricity or heat intended for temporary use) are exempt from Colorado emission reporting and permitting for up to 2 years of temporary operation. If a portable source is to be in use at a specific location beyond 2 years, a determination shall be made whether an Air Pollution Emissions Notice shall be submitted or a permit obtained from the Colorado Air Pollution Control Division. The subcontractor shall contact the NLR ESHQ POC to coordinate an appropriate path forward.

22.3.3.5 Portable Tanks Requirements

NLR only allows the use of steel double-wall aboveground storage tanks, and this guidance assumes that any NLR tank, portable or temporary, is such an aboveground storage tank. The use of aboveground storage tanks is governed by various regulations including Colorado Division of Oil and Public Safety aboveground storage tank regulations, NFPA and DOT requirements, Underwriter Laboratories Inc. requirements, and other codes and standards. Portable tanks (those tanks used in vehicles and other portable equipment) shall meet DOT standards. It may be possible to purchase a portable generator meeting DOT standards and not be able to use that fuel tank if it becomes a permanent fuel storage tank. Any aboveground storage tank used with a temporary and/or portable emission source shall meet NLR aboveground storage tank program requirements. Contact the NLR ESHQ POC to ensure compliance with portable tank requirements.

22.3.4 Trash, Construction Debris, and Sanitary Waste

The subcontractor shall provide waste storage and removal as required to maintain all work areas in a clean and orderly condition with periodic disposal of waste off-site. Open free-fall chutes and containers without lids are prohibited. Trash and debris are prohibited from migrating outside the construction area. All trash and debris is to be collected daily and kept covered.

22.3.5 Wastewater

NLR limits wastewater discharges to sewer systems and does not allow any nonroutine discharges into the septic system. NLR does not permit other direct wastewater discharges to the environment, including land and surface water. NLR complies with Pleasant View Sanitation District and Metro Water Recovery prohibitions, criteria, restrictions, and notification requirements for wastewater discharges. Certain types of discharges, in addition to large volumes of wastewater (when the planned discharge will result in exceeding the normal average daily wastewater discharge into the Pleasant View Sanitation District system by more than 30%) require notification to the Pleasant View Sanitation District. Contact the ESHQ POC if such discharges are planned.

22.3.5.1 Pipe Flushing

Pipeline flushing of new water lines, storm and sanitary sewer lines, or fire line flushing requires an MOP that describes the location and nature of activity to be performed, description of the discharge (duration, anticipated volume and rate, source of the water, and potential pollutants in the water used), and the best management practices to be used to prevent potential pollutants from reaching the storm drainage system, a stream, drainage channel, ditch, or groundwater. This MOP shall be reviewed and accepted by NLR. Special approval/permitting from the Pleasant View Sanitation District and Metro Water Recovery may be required for discharges to the

sanitary sewer system. Contact the ESHQ POC if such discharges are planned.

22.3.6 Hazardous Waste

NLR holds the necessary Resource Conservation and Recovery Act generator identification numbers to conduct waste generation and collection activities. NLR prohibits treating (e.g., evaporation, neutralization, dilution, or reduction of volume or toxicity) or disposing of hazardous waste on-site. The subcontractor shall contact NLR prior to any construction activity that will generate hazardous or chemical waste. Special handling, storage, and labeling requirements may apply depending upon the type and quantity of chemical waste. Additionally, the subcontractor shall have the resources and capability to manage a spill of any chemical material that they are using, either through a contracted response service or properly trained staff. Upon completion of any project, the subcontractor shall be responsible for the removal of all unused chemical products from the site.

22.3.7 Noise

Per state of Colorado noise statute, construction projects are limited to permit conditions or 80 dBA for the period within which the construction is to be completed or a reasonable amount of time. Notify the NLR PM if after-hours work is anticipated.

22.3.8 Pesticide and Herbicide Use

All pesticide and herbicide use shall be accepted by NLR prior to application.

22.3.9 Vegetation

Disturbance and elimination of existing grass cover, trees, and shrubs shall comply with the approved plans submitted by the designers.

22.3.10 Natural Resources—Wildlife

Natural resource protection at NLR is guided by NEPA, the Migratory Bird Treaty Act, the Colorado Division of Wildlife recommended buffer zones, seasonal restrictions for Colorado raptors, the Threatened and Endangered Species Act, and other applicable state and federal wildlife guidelines. The following topics represent areas that may impact individual project costs and schedules.

22.3.10.1 Nesting Birds

In general, for any construction-related activities (e.g., grading/clearing, heavy equipment uses, demolition activities) that occur between mid-March and mid-September, NLR shall conduct a nesting bird survey prior to the beginning of construction activities.

NLR shall be notified at least seven days prior to the start of construction to ensure the availability of staff to conduct the survey. Surveys shall be completed within 48 hours before construction, depending on local and species-specific breeding activities at the time of construction.

Project delays of a few days to several weeks may occur if an active nest is found in the construction area, with the duration of delays dependent upon the species, the nesting progress, the species' relative tolerance to human/construction activities, and the amount of activity that will occur near the nest.

Active nests may occur on the ground, in shrubs or trees, in on-site nest boxes, or in building entryways or open areas. If raptor (hawk, owl, falcon) nests are found, buffer zones from 200 yd to 0.50 mi shall be kept free of

construction activities until the young leave the nest. Early coordination with NLR can help mitigate issues before they arise.

Note: Walking in ground-nesting habitat is permitted. If a bird is spotted flying from the ground, avoid the area by several feet, as a nest may be occupied or under construction.

22.3.10.2 Snakes

Subcontractors shall not pursue, capture, harass, harm, or kill wildlife—including snakes—encountered on-site. Minimal project delays may occur if a snake is discovered in a project area. When a snake is discovered in an area frequented by workers or visitors, the observer shall call Laboratory Protection at 303-384-6811 to report its location. NLR staff will arrive and relocate the snake.

22.3.10.3 Other Wildlife Species

Subcontractors shall avoid adverse impacts to other wildlife species, including coyotes, deer, salamanders, bats, small rodents, rabbits, squirrels, swarms of bees, and any other form of wildlife encountered. Concrete washout pits/utility vaults, and other similar structures shall be constructed and operated in a manner to preclude entrapment and drowning of wildlife. During construction and installation, such structures shall be covered nightly or otherwise protected to prevent wildlife from falling in, becoming entrapped, or drowning.

22.3.10.4 Wildlife Corridor

Subcontractors shall comply with the design specifications, plans, or NEPA determination to minimize disturbances to the wildlife at NLR.

22.3.10.5 Historical Resources

Prior to earth-disturbing activities, subcontractors shall be aware of the potential to encounter cultural resources. In the event that potential cultural resources, such as historical or archeological items, are unearthed or discovered during construction, work in the area shall stop. NLR will make a determination within 24 to 48 hours if work in the construction site can continue. Potential cultural items may not be moved or stockpiled upon discovery.

22.3.11 Wetland and Drainage Areas

Work within jurisdictional wetlands requires permitting through the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act. Any required permitting shall be coordinated with NLR. At this time, no jurisdictional wetlands have been identified at the STM Campus. Several areas of jurisdictional wetlands, including stream channels, have been identified at the Flatirons Campus.

22.4 Subcontractor Responsibilities

The provisions of this document apply to subcontractors performing activities that have the potential to affect natural resources. The subcontractor and all lower-tier subcontractors shall be responsible for implementation and compliance with all federal, state, and local laws as well as the environmental aspects described above.

22.5 References

- 40 CFR Part 122, Subpart B, National Pollutant Discharge Elimination System
- Bald and Golden Eagle Protection Act

- Clean Air Act, various sections
- Clean Water Act, Section 402(p), Municipal Separate Storm Sewer System
- Clean Water Act, Section 404, Permits for dredged or fill material
- Colorado Department of Public Health and Environment, Air Quality Control Division, Regulation No. 1, Emission Control for Particulate Matter, Smoke, Carbon Monoxide and Sulfur Oxides
- Colorado Department of Public Health and Environment, Air Quality Control Division, Regulation No. 3, Stationary Source Permitting and Air Pollutant Emission Notice Requirements
- Colorado Division of Wildlife Recommended Buffer Zones and Seasonal Restrictions for Colorado Raptors, 2020
- Colorado Noxious Weed Act (CRS 35-5.5-101 through 119) and associated regulations, Rules Pertaining to the Administration and Enforcement of the Colorado Noxious Weed Act (8 Colorado Code of Regulations 1206-2).
- Endangered Species Act
- Migratory Bird Treaty Act of 1918
- NEPA
- National Historic Preservation Act
- Resource Conservation and Recovery Act
- State of Colorado noise statute (CRS 25-12-101 through CRS 25-12-109)

23 Controlled Access Barriers

23.1 Applicability

The requirements of this section apply to all subcontractors and lower-tier subcontractors (hereafter referred to as "subcontractors") performing work at NLR owned or leased facilities. The section provides the requirements for erecting controlled access barriers such as caution tape, danger tape, and snow fencing on construction projects.

23.2 Regulatory Requirements

Subcontractor methods for erecting and maintaining controlled access barriers shall be conducted in accordance with the following statutory requirements:

- 29 CFR Part 1926.200, Accident prevention signs and tags
- 29 CFR Part 1910.145, Specifications for accident prevention signs and tags.

23.3 NLR-Specific Requirements

In addition to Section 23.2, all subcontractor work activities shall meet the following specific NLR requirements for controlled access barriers.

23.3.1 Caution Tape (Yellow)

Caution tape at NLR shall only be used for low-hazard areas. Acceptable uses for caution tape at NLR include:

- Delineation for construction/work activity areas
- Delineation of laydown areas
- Marking overhead obstructions such as sprinkler heads, racking, or other projections.

23.3.2 Danger Tape (Red)

Danger tape on NLR projects shall be used to warn individuals of immediate hazards within a defined area. Danger tape must be used to delineate the following areas:

- Areas directly below overhead work
- Areas where hot work is occurring
- Areas currently under a pressure test
- Any other serious recognized hazard.
-

23.3.3 Snow Fencing

Situations may arise where danger tape is not sufficient for the protection of the public, such as areas with high foot traffic or heavy equipment. In these situations, snow fencing is an alternative that affords a higher degree of safety. When snow fencing is installed with the use of T-posts, an excavation permit will need to be obtained from the NLR FM. Fencing shall be a minimum of 4 ft high and secured horizontally every 10 ft.

23.3.4 Signage for Controlled Access Barriers

When controlled access barriers, including caution and danger tape, are erected, signage shall be created and posted in conspicuous areas to alert others to the hazards. Subcontractors may use their own format for the development of the signage, but at minimum it shall include the following information:

- Identification of the hazardous or potentially hazardous situation
- The conditions to be avoided and results that may occur if not avoided
- Contact information for the individual responsible for the area
- Contact information for the NLR PM and ESHQ POC
- Any other pertinent information.

23.4 Requirements

- 29 CFR Part 1926, Construction, Safety and Health Regulations for Construction
- 29 CFR Part 1910, General Industry, Occupational Safety and Health Standards for General Industry
- ANSI 535.2-2023, Environmental and Facility Safety Signs

24 Temporary Traffic Control Requirements

24.1 Applicability

The *NLR Temporary Traffic Control Manual for Roadway Construction, Utility Work, and Maintenance Operations* (TTCM) is issued as a supplement to the *Manual on Uniform Traffic Control Devices* (MUTCD) and is intended for any subcontractor, utility company, service provider, or NLR staff member who performs any work within the NLR roadways, which includes streets, parking lots or structures, and pedestrian walkways.

The TTCM identifies the minimum needs for traffic control measures and devices required at worksites, establishes responsibility for traffic controls, defines the Temporary Traffic Control Plan (TTCP) review and approval process, and provides typical traffic control applications relevant to NLR campuses. The primary goal of the TTCM is to increase awareness of the need for proper traffic control in work zones to ensure safe completion of construction and maintenance operations.

24.2 Regulatory Requirements

Temporary traffic controls are addressed through the following statutes, laws, regulations, and guidance documents:

- Manual on Uniform Traffic Control Devices 23 Code of Federal Regulations, Part 655, Subpart F, Revision 3
- Americans with Disabilities Act of 1990, Title II, paragraph 35.130
- Occupational Safety and Health 29 CFR Part 1926 Subpart G, Signs, Signals and Barricades.

24.3 NLR-Specific Requirements

In addition to the above regulatory requirements, all work activities shall meet the requirements identified in the TTCM for roadway construction, utility work, and maintenance operations. The TTCM serves as a site supplement to the MUTCD for work performed on NLR-owned property, including STM Campus, Flatirons Campus, and STEP Campus. The TTCM is not intended to replace the MUTCD but to provide standard practices for specific conditions on NLR campuses.

24.3.1 Temporary Traffic Control Plan

The TTCM identifies the need for traffic control planning, provides acceptable controls for typical applications, and identifies under what conditions a TTCP shall be submitted to the NLR traffic safety subject matter expert or designee for approval.

24.4 NLR Special Emphasis

The subcontractor shall ensure they are in compliance with the TTCM. This includes the submission of a TTCP to the NLR traffic safety subject matter expert, where required, as a part of planning construction work.

24.5 References

- Manual on Uniform Traffic Control Devices 2009 Edition with Revision Numbers 1, 2, and 3, dated July 2022

- Americans with Disabilities Act of 1990, Title II, paragraph 35.130
- Occupational Safety and Health 29 CFR Part 1926 Subpart G, Signs, Signals and Barricades
- NLR Temporary Traffic Control Manual for Roadway Construction, Utility Work, and Maintenance Operations available at NLR.gov/about/ehs-construction.html

25 Method of Procedure Development

25.1 Applicability

The requirements of this section apply to all subcontractors and lower-tier subcontractors (hereafter referred to as "subcontractors") performing activities that require testing or start-up of newly installed or modified equipment and the shutdown or start-up of a building/facility unless otherwise specifically exempted by NLR. This section provides the requirements for developing MOPs on NLR-owned or -leased sites.

25.2 Regulatory Requirements

Subcontractor methods for identifying, controlling, and documenting hazards associated with subcontractor work activities shall be conducted in accordance with the following statutory requirements:

- 29 CFR Part 1926, Construction Safety and Health Regulations for Construction
- 29 CFR Part 1910, Occupational Safety and Health Standards for General Industry
- 10 CFR Part 851, Worker Safety and Health Program.

25.3 NLR-Specific Requirements

In addition to the requirement identified in this manual Chapters 6, 7, 8, and Section 25.2, all subcontractor work activities shall meet the following specific NLR requirements for shutdown, testing, and start-up of equipment and the shutdown or start-up of buildings/facilities.

25.3.1 Pressure Testing and Flushing

Prior to performing pressure testing or flushing of newly installed or modified piping or equipment, the subcontractor shall develop a MOP for each affected system. MOPs may be developed on a contractor's format so long as it includes the following information:

- A step-by-step explanation for how the work will be performed
- Identification of the method used for testing, i.e. ASME B31.3, ASHRAE
- A drawing highlighting the equipment being tested, location of test apparatus, and safety devices
- System test pressures, durations, and criteria for deciding if the test passed or failed
- Criteria for the protection of employees and the public
- Equipment to be used during the testing
- Section for employees to acknowledge and sign the MOP.

25.3.2 Start-Up of New or Modified Equipment

Newly installed or modified equipment may expose employees to hazards that are not immediately understood. In order to mitigate the potential for injury during equipment commissioning, a procedure shall be developed by the subcontractor for non-standard/routine equipment. At a minimum, procedures shall include:

- Manufacturer's procedure for start-up of equipment (if available)

- Potential hazards associated with the start-up of equipment
- Steps to take in the event of equipment failure
- Criteria for the protection of employees and the public.

In addition to the above requirements, newly installed or modified electrical equipment requires an inspection to be completed for compliance with NFPA 70 by an NLR electrical safety officer prior to being energized.

Inspection requests shall be submitted to the electrical safety office at least 48 hours in advance of the needed inspection time. The inspector will coordinate the exact date/time with the requestor.

25.3.3 Building Shutdowns and Start-Ups

Building or facility shutdowns and start-ups must be coordinated in advance with the NLR Facility Manager, and an MOP shall be developed by NLR with the service subcontractors' engagement/acceptance.

25.4 References

- 29 CFR Part 1926 Construction, Safety and Health Regulations for Construction
- 29 CFR Part 1910 General Industry, Occupational Safety and Health Standards for General Industry
- 29 CFR Part 1910.333, Selection and Use of Work Practices
- 29 CFR Part 1910.147 General Industry, The Control of Hazardous Energy (lockout/tagout)
- NFPA 70E, *Standard for Electrical Safety in the Workplace*, latest edition