Construction Environment, Safety, & Health Manual

Version 9

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
AHA	activity hazard analysis
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
APCD	Air Pollution Control Division (Colorado)
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BEC	building emergency coordinator
BMP	best management practice
CCR	Colorado Code of Regulations
CFHA	Construction Fall Hazard Analysis
CFR	Code of Federal Regulations
CMS	Central Monitoring Station
CPR	cardiopulmonary resuscitation
CRS	Colorado Revised Statute
CSWP	Construction Safe Work Permit
dB	decibel
dBA	decibel, A-weighted scale
DOP	di-octyl phthalate
DOE	U.S. Department of Energy
ECT	equivalent chill temperature
EEWP	Energized Electrical Work Permit
ESHQ	Environment, Safety, Health, Quality
EPA	U.S. Environmental Protection Agency
FHA	Fall Hazard Analysis
FM	facility manager

GFCI	ground fault circuit interrupter
HEPA	high efficiency particulate absolute
H&R	hoisting and rigging
IH	industrial hygiene
IPT	Integrated Project Team
ISM	Integrated Safety Management
LEED™	Leadership in Energy and Environmental Design
LO/TO	lockout/tagout
mA	milliamps
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
POD	plan of the day
PPE	personal protective equipment
PM	project manager
RCRA	Resource Conservation and Recovery Act
RFP	request for proposal
RSO	radiation safety officer
SAIA	Scaffold & Access Industry Association
SDS	safety data sheet
S/CI	suspect and counterfeit items

STM	South Table Mountain
SME	subject matter expert
SWPPP	stormwater pollution prevention plan
TOA	Task Order Agreement
TTCP	Temporary Traffic Control Plan
TLV	Threshold Limit Value
TWA	time-weighted average
UL	Underwriter's Laboratory
USC	United States Code

1 Introduction

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

1.1 Background

It is DOE policy that all construction 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

Activity Hazard Analysis: A work control document that identifies the work tasks, hazards, and controls of the work to be performed. It is conveyed to the workers for review, input, acceptance, and adherence.

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.

Construction Activity: Any combination of erection, installation, assembly, demolition, or fabrication activities involved to create a new facility or to alter, add to, rehabilitate, dismantle, or remove an existing facility. It also includes the alteration and repair (including dredging, excavating, and painting) of buildings, structures, or other real property, as well as any construction, demolition, and excavation activities conducted as part of environmental restoration or remediation efforts.

Construction 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 (TOA). A subcontractor's site tenure may vary depending on the nature of the project, and its employees are not considered a permanent construction force.

Construction Subcontractor Safety Orientation Checklist: An NLR form used to document the project-relevant Environment, Safety, Healthy, 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.

Construction Environment, Safety and Health Plan (CESHP): A document prepared by the subcontractor and submitted to the NLR ESHQ point of contact (POC) for review and concurrence. It describes the subcontractor's environment, safety, and health plan for a particular construction project and the activity hazard analysis (AHA) for every definable activity/feature of work.

Construction Manager (NLR): The individual or firm responsible to DOE for the supervision and administration of a construction project to ensure the construction contractor's compliance with requirements set forth in the construction project acquisition documents.

Construction Project Manager (NLR): NLR-delegated representative authorized to approve and accept work, provide technical liaison, and interpret NLR plans and specifications on behalf of NLR.

Construction Worksite: The area within the geographic limits necessary to perform the work described in the construction project acquisition documents. It includes the facility being constructed or renovated, all necessary staging and storage areas, and adjacent areas subject to project hazards. It does not include offsite offices of design personnel nor the facilities of fabricators or suppliers.

Designated Hot Work Area: A specific location designed and approved for hot work operations that is maintained for hot work, 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.

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. A graded approach is recommended for implementing the work planning and control (i.e., the CESHP and accompanying AHAs). The level of detail within each CESHP and corresponding AHA should be based on the size, complexity, and risk level of the construction project.

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.

Non-Combustible 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 Construction Superintendent: Responsible for ensuring that all project subcontractors, including all lower tiers, comply with project safety and health requirements. The construction superintendent is further responsible for coordinating with project subcontractors and other site contractors those safety and health plan elements addressing worksite hazards to which employees of other contractors may be exposed. The superintendent or another duly designated construction contractor representative shall be present on the worksite during the performance of any project work activities.

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

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

Subcontractor Safety Manager: An employee of the Subcontractor at the work site who is responsible for compliance with applicable laws and regulations. The qualifications of the Subcontractor's Safety Manager shall be listed in the subcontractor's CESHP. For some projects, the project specifications may require the Subcontractor to have the full-time on-site services of a more highly qualified individual (e.g., Certified Safety Professional, Qualified person, etc.).

Welding Blanket: A heat-resistant FM fabric listed, approved, 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, sand blasting, and light horizontal welding; 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 listed, approved, 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, sand blasting, and light horizontal welding; designed to prevent sparks from escaping an area.

Welding Pad: A heat-resistant fabric listed, approved, and designed to be placed directly under a hot work operation such as welding or cutting, intended for use in horizontal applications with severe exposures such as that resulting from molten substances or heavy horizontal welding; 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 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 as part of their CESHP. If there is a conflict between requirements, the Subcontractor is to apply the most stringent unless otherwise directed by the NLR ESHQ 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 the 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 also will identify any requirements specific to the NLR site and/or the DOE. Also presented in each chapter are issues of special emphasis that NLR has identified or for which additional risk control mechanisms are required (i.e., 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.

To help ensure on-going compliance, the prime Subcontractor Superintendent shall maintain a copy (hard or electronic) of the current version of this manual on each project. NLR specific requirements may affect what the subcontractor includes in their AHAs, Lockout-Tagout, method of procedures (MOPs), etc. and how the Subcontractor conducts work and the overall project schedule.

2 Program Policy

2.1 Applicability

The requirements of this section apply to all construction subcontractors and lower-tier subcontractors (hereafter referred to as "Subcontractor") 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 a safe and healthful workplace while also protecting the environment in compliance with DOE and 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, sewerage, 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 (FAR) Part 41, are not considered service contractors, and therefore not covered under 10 CFR 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

The NLR facilities are government-owned or leased facilities and subject to 10 CFR 851 Worker Safety & Health Program requirements. While the enforcement provisions of OSHA 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 1910) and Construction (29 CFR 1926); DOE will enforce compliance with these standards. The provisions of 10 CFR 851.23 require subcontractors to comply with specific safety and health standards, including:

- CFR 851, Worker Safety and Health Program
- Title 29 CFR, Parts 1904.4 through 1904.11, 1904.29 through 1904.33; 1904.44, and 1904.46, “Recording and Reporting Occupational Injuries and Illnesses”
- Title 29 CFR, Part 1910, "Occupational Safety and Health Standards," excluding 29 CFR 1910.1096, "Ionizing Radiation"
- Title 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, "Safe Use of Lasers” Latest Edition
- ANSI Z49.1, "Safety in Welding, Cutting and Allied Processes," Sections 4.3 and E4.3

Latest Edition

- 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”
- Title 10 Code of Federal Regulations (CFR) 850, "Chronic Beryllium Disease Prevention Program."
- CFR 707, “Workplace Substance Abuse Programs at DOE Sites”
- Controlled Substances Act (21 U.S.C. 812)
- Title 21 Code of Federal Regulations (CFR) 1308.11 - 1308.15.
- DOE-STD-1090-2007 Hoisting and Rigging.

Other regulations are listed at 10 CFR 851.23 but may not be applicable depending on the construction activities. It shall be understood that 10 CFR 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: Current version of regulation or standard applies if version not otherwise shown.

2.3 NLR Specific Requirements

2.3.1 Construction ESH Plan

Each subcontractor performing construction work at NLR is required to develop a Construction Environment, Health & Safety Plan (CESHP) prior to conducting any work activities on site. The Subcontractor shall ensure that the requirements in this Manual are incorporated into their CESHP and the associated Activity Hazard Analyses (AHAs). The CESHP shall be submitted in accordance with the contract requirements document and undergo a review and concurrence by the ESHQ POC and the NLR Project Manager or NLR Construction Manager prior to the Subcontractor being allowed to start work.

NLR provides each subcontractor with an electronic copy of the CESHP template to be used for their plan. A new CESHP shall be submitted for each construction project, regardless of whether the Subcontractor has performed prior work at NLR. The template is provided in electronic format to enable cut-and-paste functions for those subcontractors whose basic data remains unchanged yet tailor the hazard and controls information pertinent to the activities/materials/location of the project at hand.

For each separately definable construction activity (e.g., excavations, foundations, structural steel, roofing) the Subcontractor shall prepare and have accepted by NLR an activity hazard analysis prior to commencement of affected work. Such analyses shall:

- Address further hazards revealed by supplemental site information (e.g., site characterization data, as-built drawings) provided by the NLR project manager

- Provide drawings and/or other documentation of protective measures for which applicable Occupational Safety and Health Administration (OSHA) standards require preparation by a Professional Engineer or other qualified professional
- Identify competent persons required for workplace inspections of the construction activity, where required by OSHA standards and
- Ensure workers are aware of foreseeable hazards and the protective measures described within the activity analysis prior to beginning work on the affected activity.

NLR recommends using a graded approach in the development of CESHPs. This approach determines the level of rigor for implementing the work planning and control attributes based on the importance/significance of the activity in relation to the associated hazards and consequences. The level of detail within each CESHP and corresponding AHA should be commensurate with the size, complexity, and risk level of the construction project.

Field changes (e.g., red line, pen/ink changes) to the CESHP are acceptable. All affected Subcontractor supervision personnel involved in the work being performed shall review the CESHP and apply subsequent changes. The CESHP shall be kept at the worksite.

2.3.2 Safe Work Permit

After the CESHP and AHAs have been reviewed and accepted, a safe work permit shall be issued by NLR. Subcontractors shall not start work until a safe work permit is issued.

2.3.3 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.

Additional requirements to provide verification of worker training are identified on the CESHP template. 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, etc.), depending on the complexity of the project and hazards involved. NLR will identify this requirement in the request for proposal.

2.3.4 Safety Bulletin Boards

The Subcontractor is responsible for installing and maintaining a safety bulletin board at the location where most workers report to work. Workers shall be advised of the location of the nearest bulletin board. Workers

shall be responsible for reviewing the bulletin board to keep informed of safety-related information. Safety bulletin boards shall be sufficient size to display and post safety bulletins, newsletters, posters, accident statistics, and other safety educational material. At a minimum, the safety bulletin board shall display:

- DOE Occupational Safety and Health Poster DOE-F 5480.2 (Your Rights as a Worker)
- DOE Occupational Safety and Health Complaint Form 5480.4
- Requirements, provisions, and number of the Employee Concern Program Hotline (Whistleblower Protection)
- Citations and notices as appropriate
- OSHA 300A form during February 1 to April 30
- NLR-furnished safety bulletins and publications
- Stormwater discharge permit notice (as applicable).

Suggested additional items to be posted include:

- Topical safety and health posters
- Minutes of safety meetings
- Information on accidents and lessons learned
- Hazard communication information.

2.3.5 Subcontractor Incident Response and Notification

The Subcontractor shall report all incidents involving injury, property damage and near misses, spills, no matter how minor, to the NLR ESHQ POC and the NLR PM/CM 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 Security by:

- Utilizing any building red phone
- Dialing extension 1234 from any building landline
- By 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 911 and ask for Boulder County Dispatch
- Identify your location as the NLR Flatirons Campus and the nature of the emergency – stay on until directed to hang up.
- Then call security at 303-384-6811 to provide information on the emergency. All other

incident response requirements apply to work at the Flatirons Campus.

An OSHA compliant emergency action plan (29 CFR 1910.38) shall be maintained at the project location.

A site map showing assembly points and directions to the Subcontractor's authorized medical facilities shall be posted on site at the project location (e.g., site project office) and included as part of its CESHP (this should be the last page of the CESHP to facilitate easy of retrieval). Upon award of the work, the ESHQ POC will provide building evacuation routes and assembly areas to include in the CESHP as needed.

2.3.6 NLR Response to Emergencies on Construction Sites

Upon notification of an emergency on a construction site, NLR will provide notification to external and internal responders such as ESHQ and Security & Emergency Preparedness personnel.

2.3.7 Construction Subcontractor Event Investigation

After the response has occurred, do not disturb the scene, 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 to 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 5 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 PM/CM, ESHQ, or other authorities having jurisdiction.

2.3.8 Construction 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 information requested used 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 reviewed to 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 workman’s compensation insurance during the entire performance period of this Subcontract.

Additional information regarding the subcontractor screening process can be found on the NLR Construction

Subcontractor website at *www.NLR.gov/about/ehs-construction.html*.

2.4 NLR Special Emphasis

2.4.1 Integrated Safety Management (ISM) System

The Subcontractor shall incorporate the elements of ISM into its CESHP that conforms to NLR's Integrated Safety Management 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 the following 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.

- **Define the Scope of Work.** Translate missions into work, set expectations, identify, and prioritize tasks, and allocate resources.
- **Analyze the Hazards.** Identify, analyze, and categorize hazards and potential environmental impacts associated with the work.
- **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.
- **Perform Work Within Controls.** Confirm readiness and perform work safely and in the prescribed manner to protect workers, the public, and the environment.
- **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 (IDLH) 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 851, the Subcontractor shall establish a 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; (2) the magnitude of any hazard involved. 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 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 basis for the implementation of the Subcontractor Worker Safety and Health Program will be contained in the CESHP.

The Subcontractor has overall accountability for the safety of its 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 (ESHQ) 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.
- Implement the appropriate requirements of this manual into the CESHP.
- Designate a Subcontractor Safety Manager/designated on-site safety representative to oversee all activities.
- Develop, implement, and/or adhere to activity hazard analyses (AHAs) and other pre-job planning documents required by this manual.
- 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 pre-job 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.
- During periods of active construction (i.e., excluding weekends, weather delays, or other periods of work inactivity), the construction contractor shall have a designated representative on the construction worksite who is knowledgeable of the project's hazards and has full authority to act on behalf of the subcontractor. The subcontractor's designated representative shall make frequent and regular inspections of the construction worksite to identify and correct any instances of

noncompliance with project safety and health requirements.

2.6 References

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

3 ESHQ Meetings, Inspections, and Orientations

3.1 Applicability

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

3.2 Regulatory Requirements

Subcontractors are responsible for implementing a system for conducting ESHQ meetings, inspections, and employee orientations that will facilitate compliance as applicable with the following statutory requirements:

- 29 CFR 1926, Construction Standard Safety and Health Regulations for Construction
- 29 CFR 1910, Occupational Safety and Health Standards for General Industry
- Environmental Protection Agency Requirements.

3.3 NLR Specific Requirements

In addition to Section 7.2, all Subcontractor ESHQ meetings, inspections, and orientations, as applicable to the scope of the construction work activities and supporting offices/facilities shall meet the following specific NLR requirements.

3.3.1 Daily ESHQ Activity Briefings

ESHQ activity briefings shall be held each day prior to the start of work activities. The flexibility exists for each Subcontractor to integrate these requirements into their exiting program format if the required information is effectively provided to employees and documentation for these briefings and/or meetings is maintained. This may be accomplished through daily construction meetings, plan of the day (POD) meetings (see Section 7.3.2), pre-task activity reviews or other means which prove to be effective in the dissemination of the required information.

Records of these briefings, documenting the meeting content and attendance, shall be maintained as a part of the project record and available for review by NLR. All crew members shall acknowledge the disseminated information by signing the attendance roster.

The briefing content shall include at a minimum the following topics:

- Changes in work practices or environmental conditions
- Required daily inspection of contractor owned/rented equipment
- Previous day's incidents, near misses, lessons learned, and/or other relevant issues
- Work activities that may impact NLR facilities and/or operations
- New or modified site-wide procedures or requirements
- Review of AHA for new activities and/or revised existing AHAs
- Review of construction fall hazard analysis for elevated work and fall protection
- Review pre-job briefing for electrical work (50 VAC or more), including the method of procedure

(MOP) for lockout/tagout.

3.3.2 Plan of the Day Meeting

The plan of the day (POD) process is required to maintain daily positive control and to establish a high level of communication between subcontractors prior to the start of construction activities for the day. POD shall be submitted to NLR the prior day to work activities starting.

The basis of the POD process is in preplanning. Prime subcontractors and all lower-tier subcontractors shall identify all planned tasks on a POD form. The level of detail shall be appropriate to define all tasks that may present a hazard to people, property, or environment.

All crew members shall acknowledge the POD (daily "tailgate" meeting) by signing an attendance roster for the POD.

The completed POD shall be submitted to the prime subcontractor for review against conflicting operations, regulatory hold points, required permits and with an acceptable level of detail. The plan shall be submitted (the day before) to ensure that the prime subcontractor can perform a quality review of the plan. A representative for each subcontractor performing work that day shall have submitted their proposed POD to the prime subcontractor superintendent or designee prior to the start of the meeting for review and work approval. The prime subcontractor shall record what subcontractors attended the POD. Subcontractors that are not present at the POD shall not be authorized to perform work until their POD is submitted and approved by the prime Subcontractor.

Upon completion of the initial POD/AHA meeting, each subcontractor is then required to have break-out sessions (daily "tailgate" meeting) with each work crew member prior to the start of each work shift, or when an individual arrives at work. The meeting shall include a discussion of the specific POD and corresponding AHA for their work and additional safety topics of interest related to the site. Applicable, additional items identified in Section 7.3.1 of this manual shall also be discussed.

If during the course of the day, additional task(s) need to be performed that are not identified on the POD, then the Subcontractor's responsible supervisor shall pause work, notify NLR representatives of the change, add this task to the POD, revise the AHA as necessary, receive approval from the prime subcontractor superintendent or designee and then brief the affected crew of the work task changes and revised AHA. Affected crew members shall initial and date their re-review of the POD/AHA.

3.3.3 Weekly Toolbox Trainings

To facilitate continuous learning and engagement with lower-tiered contractors, the Subcontractor shall conduct informal toolbox safety and health training at least weekly for all employees on the worksite. Depending on the size and nature of the project, this may be accomplished in single or multiple sessions. Toolbox discussions may address different topics for different work crews.

The Subcontractor shall notify NLR of the time and location of all scheduled toolbox training sessions. Outlines of all toolbox talks shall be prepared by the Subcontractor and annotated with the date, time, and names of all employees in attendance. Efforts shall be made to capture all employees on site that may have missed the initial session.

3.3.4 Monthly Construction ESHQ Meetings

A monthly construction ESHQ meeting shall be held for all projects exceeding 30 days and shall include attendance by all site subcontractors and lower-tier subcontractor personnel. NLR reserves the right to increase the frequency of these meetings based upon project complexity/risk and/or subcontractor ESHQ performance. Supervisors, foremen, or other designated personnel shall conduct these meetings. Meetings can be held for the entire project or smaller breakout meetings can be held for each subcontractor and/or craft. A record of each meeting, documenting the meeting content and attendance shall be maintained. At a minimum, monthly ESHQ construction meetings shall include:

- ESHQ, health, and job-related issues/concerns related to the work activity
- Summary of relevant lessons learned from NLR and/or other Subcontractor projects, as applicable
- Near miss investigations conducted since the last meeting, to discuss if the cause of the unsafe acts or conditions were properly identified and corrected
- ESHQ inspection findings since the last meeting
- ESHQ or special emphasis training
- Other relevant ESHQ subject matter as determined by the Subcontractor or NLR.

3.3.5 Daily ESHQ Inspections and Permits

The Subcontractor shall ensure a qualified superintendent, supervisor, safety manager, and/or competent person(s) conducts daily documented safety inspections of the worksite, materials, and equipment. The Subcontractor shall ensure that all NLR required permits have been issued, reviewed, and followed. These inspections and/or permits include but are not limited to:

- Aerial Lifts
- Confined Space
- Cranes
- Elevated Work
- Environment
- Excavations
- Fire Protection System Outage
- Heavy Equipment
- Hot Work
- Material Handling Equipment
- Scaffold Systems
- Surface Penetrations

The Subcontractor shall maintain written inspection records and/or permits and make them available for review. The Subcontractor shall prohibit the use of any machinery, tool, material, equipment, or worksite condition that is not safe and/or does not comply with applicable requirement of these standards.

Tools and equipment brought onto the site for use shall be new or like new condition.

3.3.6 Weekly ESHQ Inspections

3.3.6.1 Weekly Site Wide ESHQ Inspections

The Subcontractor shall conduct and document regular (at least weekly) ESHQ inspections of the worksites, materials, equipment, and construction operations. At a minimum, the Subcontractor Qualified Superintendent, NLR PM/CM, and ESHQ POC shall be included in the inspections.

NLR reserves the right to increase the frequency of these inspections based upon project complexity/risk and/or Subcontractor ESHQ performance.

The following factors influence the frequency of inspections:

- Number and type of hazards involved
- Total level of risk to workers, property, and environment
- Previous experience with the Subcontractor
- Duration of the project
- Changes in scope of work.

The Subcontractor shall maintain documented inspection records and make them available for review upon request. The inspection report shall identify the hazard and the corrective actions taken or the corrective action plan with closed or anticipated completion date(s). Copies of the inspection results shall be discussed at the weekly construction meeting or other NLR accepted means applicable to the project.

During the inspection(s) any identified defective or unsafe equipment, tools and/or worksite locations shall be immediately corrected, tagged/barricaded, removed from the jobsite and/or other effective interim control measures taken.

Weekly inspection will be rated by NLR and result in one of four possible outcomes: Superior, Excellent, Satisfactory, and Unsatisfactory.

3.3.6.2 Gang Box Inspections

Prior to arriving on site, each subcontractor shall perform inspections of all equipment, tools and materials stored in the gang boxes. Defective tools and equipment shall be removed from the box prior to arriving on the site.

All gang boxes located on the site shall receive weekly documented inspections of equipment, tools, and materials in the gang box. Documented inspections shall be made readily available to the ESHQ POC or other NLR representative.

During the gang box inspection(s) any identified defective or unsafe equipment, tools or materials shall be immediately corrected, tagged, or removed from the jobsite.

3.3.7 Electrical Code Inspections and Expectations

NLR requires that all new or modified electrical equipment and/or installations must be inspected by the Electrical Safety Office against the National Electrical Code (NFPA 70) prior to energization. The following inspection expectations establish NLR's requirements for equipment status to ensure a safe work environment

for inspectors. Failure to follow this guidance will result in cancellation of the inspection.

3.3.7.1 NLR Electrical Code Inspection Requirements

1. Inspection requests must 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.

2. Prior to the inspector's arrival, the requestor must ensure that all equipment to be inspected is placed in an Electrically Safe Work Condition by a Qualified Electrical Worker (QEW):

a. Hazardous energy source(s) locked out by the requestor/QEW.

b. Absence of energy for each source verified at the equipment by the requestor/QEW.

c. Ground sets installed where necessary.

3. Covers, guards, and barriers must be removed to allow the inspector to access the equipment, wiring, and components being inspected.

4. Equipment in the area that is included in the inspection should be clearly identified. Alternatively, equipment excluded can be identified.

5. For equipment located in hazardous or difficult to access locations, provide all necessary monitoring and access equipment (personal gas detection monitors, ladders, scaffold, etc.).

6. Once the inspector arrives, the requestor/QEW must review the following with the inspector:

a. Review the scope of the inspection.

b. Discuss any hazards associated with the inspection.

c. Walk down the lock out applied for the inspection. This includes both a review of the physical application of the requestor's/QEW's locks as well as any necessary review of one-lines or schematics.

d. Demonstrate absence of energy for each source to the inspector.

7. Once all the above has been completed, the inspection can commence.

3.3.8 Subcontractor Employee ESHQ Orientation

All Subcontractor employees and lower-tier subcontractors working at NLR are required to receive Construction Safety and Security Orientation prior to the start of any work activities. They may attend NLR provided Construction Safety and Security Orientation, or orientation provided by the Prime Subcontractor. The Subcontractor shall ensure the content covered as part of this orientation and any other project relevant ESHQ information is effectively flowed down to all lower tier Subcontractor employees prior to the start of any work. The Subcontractor shall maintain a detailed outline of the orientation. A record of these orientations, documenting the meeting content and attendance shall be maintained on-site by the Subcontractor and available for review by NLR.

3.3.9 Bilingual Requirements

All subcontractors shall ensure that bilingual supervisors and trainers are available as necessary for orientations, training, meetings, and workplace supervision to ensure effective communication is maintained for "non-English" speaking members of the workforce.

Bilingual ESHQ posters, labels, signs, forms, and barriers shall be utilized as necessary to promote effective communication when members of the workforce are "non-English" speaking.

3.4 NLR Special Emphasis

3.4.1 Weekly ESHQ Report

Weekly ESHQ reports shall be compiled and maintained as part of the project record and made available for review by NLR. This report may be maintained as a hard copy report (on-site) or electronically. The report shall contain the following information as applicable for the week:

- Summary of significant ESHQ activities
- Copies of daily, weekly and/or monthly ESHQ meeting documentation and attendee sign-in sheets
- Copies of completed daily, weekly, or monthly site inspections and corrective actions
- Copies of initial or any daily inspections performed such as excavation inspections, hoisting and rigging inspections, and vehicle or equipment inspections
- Copies of any integrated personal sampling results, including data sheets, laboratory analytical results, exposure calculation sheets, and direct reading monitoring results/reports
- Copies of any approved changes to CESHP.
- Copies of the site first aid log if there are new entries for the week.

3.5 References

- CFR 851, Worker Safety and Health Program
- 29 CFR 1926, Construction Standards Safety and Health Regulations for Construction.

4 Drug and Alcohol Policy

4.1 Applicability

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

The purpose of this document 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.

4.2 Subcontractor Responsibilities

The Subcontractor is responsible for compliance with 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 on all NLR facilities/DOE property including leased properties.

4.3 Regulatory Requirements

- CFR 707, “Workplace Substance Abuse Programs at DOE Sites”
- Controlled Substances Act (21 U.S.C. 812)
- Title 21 Code of Federal Regulations (CFR) 1308.11 - 1308.15

5 Disciplinary Policy

5.1 Applicability

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

Subcontractors' 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.

They 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.

5.2 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, have read, and understand the requirements in the policy.

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

5.3 References

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

6 Occupational Medicine

6.1 Applicability

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

6.2 Regulatory Requirements

The Subcontractor shall establish and provide comprehensive occupational medicine services to workers on the site.as required in Appendix A.8. of 10 CFR Part 851-Worker Safety and Health Program.

- CFR Part 851 Appendix A-Worker Safety and Health Functional Areas
- CFR Part 851 Worker Safety and Health Program
- Executive Order 13335 Incentives for the Use of Health Information Technology
- CFR 712.38(b)(2) Maintenance of medical records
- USC Sec. 552a. Records maintained on individuals
- CFR Part 1008 Records maintained on individuals
- 29 CFR 1910.1020 Access to employee exposure and medical records
- 42 USC Sec. 7384 Energy Employees Occupational Illness Compensation Program Act.

6.3 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.

6.4 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 generally 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- Worker Safety and Health Program, which is a regulation unique to DOE sites and applicable at NLR.

6.5 Subcontractor Responsibilities

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

subcontractors and for insuring 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 work-site exposures of each employee
  - Personnel actions resulting in a change of job functions, hazards, or exposures.
- Subcontractors 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 EAPs
    - Subcontractor-sponsored or subcontractor-supported alcohol and other substance abuse rehabilitation programs
    - Subcontractor-sponsored or subcontractor-supported wellness programs.

6.6 References

- CFR Part 851 Appendix A-Worker Safety and Health Functional Areas
- CFR Part 851Worker Safety and Health Program
- Executive Order 13335 Incentives for the Use of Health Information Technology
- CFR 712.38(b)(2) Maintenance of medical records
- USC Sec. 552a Records maintained on individuals
- CFR Part 1008 Records maintained on individuals
- 29 CFR 1910.1020 Access to employee exposure and medical records
- 42 USC Sec. 7384 Energy Employees Occupational Illness Compensation Program Act.

7 Construction Hazard Identification and Control Process

7.1 Applicability

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

7.2 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 1926, Construction Safety and Health Regulations for Construction
- 29 CFR 1910, Occupational Safety and Health Standards for General Industry
- CFR 851, Worker Safety and Health Program.

7.3 NLR Specific Requirements

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

7.3.1 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. This shall be accomplished utilizing the AHA process described in Section 7.3.3 below. These analyses shall be listed in the CESHP.

7.3.2 Preparatory Meeting

The Prime Subcontractor shall conduct a preparatory meeting in accordance with the SOW addressing any definable feature of work and associated procedures and hazards with the lower-tier contractor performing the work and all affected parties to identify and coordinate logistics, controls and communications required for the activity. They must review the SOW, construction documents, training requirements, and any necessary quality inspections needed for the SOW. Each worker involved in that work shall review and sign the AHA prior to performing work.

7.3.3 Activity Hazard Analyses

For each separately definable construction activity (e.g., excavations, foundations, structural steel, roofing, electrical, mechanical, etc.), the Subcontractor shall develop an AHA prior to commencement of the associated work/definable feature.

A definable work activity is a task which is separate and distinct from other tasks, has separate control requirements. A definable work activity may be identified by different trades or disciplines, or it may be work

by the same trade in a different environment. Within each definable work activity there may be other sub-phases of work that warrant separate AHAs. It will be the responsibility of the Subcontractor to determine the best breakdown of separately definable activities and the subsequent work steps to produce clear, concise, and effective AHAs. The Subcontractor AHAs shall be kept with the CESHP and at the worksite for review by NLR ESHQ POC, and the NLR PM/CM.

NLR recommends using a graded approach in the development of AHAs; however, the Subcontractor AHAs shall be developed in sufficient detail to preclude confusion and misunderstanding and shall be commensurate with the size, complexity, and risk level of the construction project. When used appropriately, the graded approach will incorporate the level of rigor for implementing the work planning and control attributes based on the importance/ significance of the activity in relation to the associated hazards and consequences.

The analyses shall contain and/or meet the following elements as applicable to the activity:

- Identification of the definable work activity
- Identification of the job steps for each work activity
- Identification of foreseeable hazards for each step/activity and the planned protective measures to include appropriate protective devices and/or equipment as needed
- Identification of competent persons required for workplace inspections of the construction activity, where required by OSHA standards.
- Identification of Emergency Response Action relative information (e.g., gas shutoff valve location, etc.)
- Identification of project-required hold points or other logistical requirements
- Address additional hazards revealed by supplemental site information (e.g., site characterization data, as-built drawings)
- Provide drawings and/or other documentation of protective measures for which applicable OSHA standards require preparation by a Professional Engineer or other qualified professional
- Review and approval of the AHA by the Subcontractor's management
- Places for signatures of the involved workers to signify they have been briefed on and understand the requirements of the AHA and acknowledge their intended compliance with the AHA.

AHAs shall be submitted with the CESHP and require acceptance of the ESHQ POC and / or the NLR CM prior to starting that work phase. All AHAs shall be kept at the worksite to be available for review by workers and oversight personnel.

If, while working, it is discovered that the controls addressed in the AHA will not/do not provide adequate protection, the task at hand shall be stopped until the hazards have been re-assessed, the AHA updated, notification to the NLR ESHQ POC and / or NLR CM, and adequate controls implemented. In these instances, the Subcontractor may utilize field changes (i.e., pen/ink changes) as needed to reflect changing conditions associated with the activity. All contractor personnel involved in the work being performed shall review each AHA and subsequent updates/changes. The updated AHA shall be made available for review by NLR.

7.3.4 Pre-Task Planning

Pre-Task Planning (PTP) is an important step in the Hazard Identification and Control process as it supplements

the controls established in the AHA and applies them to day-to-day activities. PTPs shall be completed by field employees or crew leads to allow employee participation in the hazard analysis. A graded approach shall be implemented in the planning.

Subcontractors shall complete a pre-task planning form prior to the start of each day's activities. A separate PTP shall be filled out for each subcontractor performing work on a project.

Subcontractors may use their own company-specific forms if it has the following information:

- Scope of work is clearly defined
- Hazards associated with the work are identified
- Controls are developed
- Signature line for each employee covered by the PTP.

If the scope of work changes during the day, the work activity shall be stopped until the hazards have been reassessed, and the PTP revised.

7.3.5 Worker Training

The Subcontractor shall ensure affected workers are made aware of foreseeable hazards and protective measures described within the AHA prior to beginning work on that activity.

7.3.6 Record of Training

The Subcontractor shall ensure workers acknowledge being informed of the hazards and protective measures associated with assigned work activities and understand those requirements. Each worker involved in that work shall sign the AHA prior to performing work.

7.3.7 Method of Procedure

A Method of Procedure (MOP) may be required by this manual or the construction project documents. MOPs are required for but not limited to the following activities:

- Complex LOTO
- Energized electrical work
- Testing and startup of equipment
- Flushing
- Pressure testing

7.4 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 pre-job safety planning process
- Incorporates the controls into the AHAs

- Determines engineering devices, administrative controls, and personal protective equipment are available, appropriate, tested, and utilized 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.

7.5 References

- CFR 851, Worker Safety and Health Program
- 29 CFR 1926, Construction Standards Safety and Health Regulations for Construction.

8 Control of Hazardous Energy, Lockout/Tagout

8.1 Applicability

The requirements of this section apply to all construction subcontractors and lower-tier subcontractors (hereafter referred to as "Subcontractor") 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 startup of the machines, equipment, and systems could cause injury on NLR sites.

8.2 Regulatory Requirements

The Subcontractor control of hazardous energy program and associated work activities as defined in Section 8.1 where the unexpected release of hazardous energy or startup of the machines, equipment, and systems could cause injury shall be conducted in accordance with the following statutory requirements:

- 29 CFR 1910.147, The Control of Hazardous Energy (Lockout/Tagout)
- 29 CFR 1910.333, Selection and Use of Work Practices
- 29 CFR 1926, Safety and Health Regulations for Construction
- 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 1910.147(c)(6).

8.3 NLR Specific Requirements

In addition to Section 8.2, all work activities requiring the use of lockout/tagout shall meet the following NLR requirements as applicable in Sections 8.3.1- 8.4.1 of this manual.

8.3.1 NLR Building Equipment and Systems Lockout/Tagout

Prior to conducting any work which requires lockout/tagout within an existing NLR building or that interfaces with an existing NLR utility system, the Subcontractor shall notify the NLR PM, CM, and Facility Manager (FM) for coordination. This includes lockout/tag outs that occur on building construction temporary and/or permanent electrical power tie-ins at the point of NLR supplied power distribution. The NLR FM shall control, coordinate lockout/tagout work being conducted on these equipment/ systems and shall ensure that the subcontractors are aware of and comply with the requirements of the NLR lockout/tagout program. The Subcontractor shall ensure the ESHQ POC is provided with the provisions of the Subcontractor’s lockout/tagout program/procedures. When NLR equipment/system specific procedures are available, they shall be provided to the Subcontractor and utilized as part of the lockout/tagout.

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

8.3.1.1 *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 AHA and the CSWP.
- 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.

8.3.2 Equipment- Specific Lockout/Tagout Procedures

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

8.3.3 Subcontractor Lockout/Tagout Inspection Procedures

The Subcontractor shall ensure that weekly documented inspections are made for all active lockout/tagout 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 lockout/tag outs remain in place.

8.3.3.1 Simple vs. Complex Lockout/Tagout

Lockout applications of different systems pose a variety of hazards to employees based on the characteristics of the system. Lockout/Tagout (LOTO) 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 LOTO applications with different levels of planning for each.

Simple LOTO

Equipment meeting the following criteria may be classified as a simple LOTO application and will only require coordination with the site Facility Manager, knowledge of the affected systems, and verifiable training to be performed.

- The equipment does not have the potential for stored residual hazardous energy or re-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 LOTO

A complex LOTO is defined as a lockout condition that does not meet all the above criteria for a simple LOTO. When it is discovered that a future lockout condition will meet the criteria for a complex application, a MOP shall be developed by the construction contractor prior to energy isolation. MOPs for complex LOTO 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 LOTO being performed is for electrical systems.

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

8.3.4 Subcontractor Training Requirements

Subcontractors that are trained in accordance with the requirements identified in 29 CFR 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.

8.4 NLR Special Emphasis

8.4.1 Applying Lockout/Tagout

Every exposed Subcontractor worker 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 or multi-lock 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 lockout/tag outs are prohibited at NLR.**

8.5 References

- 29 CFR 1910.147, The Control of Hazardous Energy (Lockout/Tagout)
- 29 CFR 1910.333, Selection and Use of Work Practices
- 29 CFR 1926, Safety and Health Regulations for Construction

- NFPA 70E, Standard for Electrical Safety in the Workplace, Latest Edition.

9 Electrical Safety

9.1 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 otherwise specifically exempted by the NLR electrical Authority Having Jurisdiction (AHJ).

9.2 Regulatory Requirements

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

- 29 CFR 1926, Subpart K, Electrical
- 29 CFR 1910.269, Electric Power Generation, Transmission, and Distribution.
- 29 CFR 1910.333, Selection and Use of Work Practices
- 29 CFR 1910.147. The Control of Hazardous Energy (Lockout/Tagout)
- NFPA 70E, 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.

9.3 NLR Specific Requirements/Permits

In addition to Section 9.2, the Subcontractor electrical safety program shall meet the following NLR requirements as applicable.

9.3.1 Energized Electrical Work

Work on energized systems at NLR shall be strenuously avoided unless it has been approved by the NLR Electrical AHJ, and that 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 Project Manager 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 Project Manager with concurrence from the NLR Electrical AHJ.

Exception with approval of NLR Electrical AHJ: Taking voltage, 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 an issuance of an EEWP. All other hazard identification, control, and PPE requirements to include shock protection and arc flash protection continue to apply and shall be documented in the AHA 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.

9.3.2 General Electrical Work Safety Requirements

Subcontractors shall identify the electrical hazards associated within each definable feature of work and establish the controls necessary 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, AHA, MOP, or other work control document that provides an acceptable level of hazard identification and control for the associated task or work sequence. See Section 6.0 “Construction Hazard Identification and Work Control Process” for additional information on the AHA process.

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 appropriate personal protective equipment (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.

9.3.2.1 Personal Protective Equipment

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
- Non-conductive headgear (class E rated hardhat)
- Arc-Flash protective clothing as required by NFPA 70E
- Hot-sticks and similar tools.

9.3.2.2 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 are permitted to work on electrical systems at NLR. A QEW can lose their status at NLR if they demonstrate that they do not have the skills, knowledge, training, etc. 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, personal protective equipment, 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" utilized on the project.

9.3.3 Ground Fault Circuit Interrupter (GFCI) Protection

Subcontractors shall ensure use 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.

9.3.4 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 Facility Manager (FM) or your NLR Project Manager if this occurs.

9.3.5 Flexible Cords and Cables

Use UL-listed flexible cords suitable for conditions of 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.

9.3.6 Lockout/Tagout

Subcontractors shall ensure electrical systems and equipment are effectively isolated, locked, and tagged out in accordance with the requirements of Section 8.0 “Control of Hazardous Energy, Lockout/Tagout” of this manual 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 9.3.6 of this manual.

Note 1: Per the requirements of NFPA 70E workers are to conduct zero-energy verification when performing Lockout/Tagout (see Article 120.6 for details). This includes using an adequately rated portable test instrument which is a meter with leads, not a proximity tester (per 120.6 exception no. 2), and workers must verify correct meter operation on a known source before and after verifying zero-energy.

Note 2: 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.

9.3.7 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 Project Manager, Electrical AHJ and the ESHQ POC) that there is no other reasonable alternative course of action, the Subcontractor shall obtain an NLR EEWP in accordance with Section 9.3.6.1 from the NLR PM/CM 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 non-electrical tasks if the restricted approach boundary is not crossed.

9.3.7.1 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, subsequent changes in the scope of work or associated hazards require cessation of work and a timely reassessment of this 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.

9.3.8 Two-Worker Rule

When working with voltages greater than 150V, 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 cannot also serve as an attendant. The second worker shall be trained in cardiopulmonary resuscitation (CPR) and be prepared to initiate other emergency response procedures. Subcontractors shall ensure a second worker is present, as required above.

9.3.9 Safe Penetration of Building Surfaces

Subcontractors are required to obtain a "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 utilize an equivalent permit method when the potential exist to contact hidden hazards associated with live electrical conductors, natural gas, water lines, compressed air, etc.

9.3.10 Excavations

All excavations including hand digging, trenching, grading, drilling activities, including staking shall first be permitted by the appropriate NLR FM. Hydro excavation is required within five feet of de-energized underground utilities to prevent damage. The Subcontractor shall adhere to all the applicable electrical safety requirements as provided in Section 9.

9.4 References

- 29 CFR 1926, Subpart K, Electrical
- NFPA 70E, Standard for Electrical Safety in the Workplace, Latest Edition.

10 Excavations

10.1 Applicability

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

10.2 Regulatory Requirements

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

- 29 CFR 1926, Subpart P Excavations.

10.3 NLR Specific Requirements/Permit

10.3.1 NLR Excavation Permit

In addition to Section 10.2, 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 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.

10.3.1.1 Subcontractor Excavation Plan

If required, the Subcontractor is responsible for submitting to the NLR FM, Project Manager 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.

10.3.1.2 Utility Locates

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

When the Subcontractor is responsible for the underground utility location and identification, public utility locates 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 locates may require a private utility location company, (e.g., SiteWise, Consolidated Water Mutual) to complete. The NLR Architecture and Engineering Services (AES) group can provide drawings with approximate location 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 which require personnel to work at, or potentially be exposed to, unprotected heights of six feet or more shall require the use of fall protection.

10.3.1.3 Pothole Verification

The NLR Project Manager 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 five feet of underground utilities, the NLR Project Manager or NLR-designated representative may choose to be physically present. The preferred method is to hydro-excavate. Hydro excavation shall be performed within five feet 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.

10.3.1.4 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.

10.3.2 NLR Excavation Lockout/Tagout

All underground electrical (50 volts and above) and other systems covered by the lockout/tagout program shall be de-energized and locked out during excavations within five feet of those systems, unless otherwise approved in advance by the appropriate FM and ESHQ POC.

The lockout/tagout shall be in accordance with an NLR-accepted Subcontractor lockout / tagout 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.

10.3.3 Subcontractor Training Requirements

Subcontractor excavation Competent Person(s) that 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 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 job site 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 system(s) that are in place. In addition, all subcontractors working in or around excavations shall receive general excavation hazards awareness training.

10.4 NLR Special Emphasis

10.4.1 Munitions and Explosives of Concern and/or Cultural Resources

The laboratory facilities at the South Table Mountain (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 (MEC) and/or other cultural resources.

All MEC or suspect foreign objects encountered on the STM shall be treated as extremely dangerous. These items can be Unexploded Ordnance (UXO), Discarded Military Munitions (DMM), or Munitions Constituents (MC).

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 MEC and the required response actions. NLR ESHQ POC will assist in providing the necessary information to affected subcontractors on the types of MEC that may be found on the site and required response actions upon discovery.

In the event an employee discovers a 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 color 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 yards. Do not allow any co-workers 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 Jeffco 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 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.

10.5 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

- Investigate and report to the NLR PM/CM and ESHQ POC all incidents involving excavations, trenching, and shoring.

10.6 References

- 29 CFR 1926 Subpart P, Excavations.

11 Fire Protection and Prevention

11.1 Applicability

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

11.2 Regulatory Requirements

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

- 29 CFR 1926.24, Fire Protection & Prevention
- 29 CFR 1926, Subpart F, Fire Protection & Prevention
- 29 CFR 1926, Subpart J, Welding & Cutting.
- 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 Locally Adoptions)
- NFPA 51B, Standard for Fire Prevention During Welding, Cutting, and Other Hot Work (Latest Edition)

11.3 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.

11.3.1 Performance of Hot Work

The following requirements apply to subcontractors conducting activities with open flames, welding, cutting, or grinding and other flame/spark producing tasks (hereafter referred to as "Hot Work").

Subcontractors conducting hot work shall perform hot work under the NLR Hot Work Permit System. The NLR Hot Work Permit shall be obtained from the NLR FM. Subcontractors may be authorized to utilize 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 if 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.

11.3.1.1 Hot Work Location Selection Hierarchy

The location of hot work shall be determined by utilizing 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., pre-approved 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 *www.weather.gov* for red flag warning alert. If a red flag is posted, the Subcontractor is to 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.

11.3.1.2 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 non-metallic materials
- Orbital Welding
- Plastic pipe fusion

11.3.1.3 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

11.3.1.4 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.

11.3.1.5 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 not less than 30 minutes after the conclusion of the hot work operation, including breaks and lunch. The Facility Manager 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 Facility Manager.
- 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 him or her from his or her 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.

11.3.1.6 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-BC: rating shall be provided with ready access within 30 feet of the location where hot work is performed.
- Portable fire extinguishers shall be listed, labelled, 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.

11.3.1.7 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.

11.3.1.8 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 in intended physical orientation (horizontal vs vertical) and severity of heat exposure (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” 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.

11.3.1.9 Hot Work Protective Clothing

Subcontractors shall ensure the personnel 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.

11.3.1.10 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 cool down. Equipment shall be turned off and placed in a safe condition when unattended.

11.3.1.11 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.

11.3.1.12 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 wild land fire. If wind speeds exceed a constant velocity of 10 miles per hour, 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.

11.3.1.13 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 one year.

11.3.1.14 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 thoroughly cleaned, made inert, or purged in accordance with NFPA 326.

11.3.1.15 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 FP AHJ to verify that the requirements of NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations* are met.

11.3.1.16 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.

11.3.2 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 PM/CM 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.

11.3.3 Exits and Exits Access

The Subcontractor shall ensure that a clear path of at least 44 inches 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 re-routing of personnel to other exits.

11.3.4 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 marking 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.

11.3.5 Flammable and Combustible Liquids Storage

Flammable and combustible liquids shall be stored in approved containers and cabinets, such as those that are UL 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 5 gallons or less capacity, having a flash arresting screen, spring closing lid and spout cover, and so designed that 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 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.

11.3.6 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 job sites. Open fires are prohibited.

11.3.7 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.

11.3.8 Temporary Heating & Cooling Equipment

The flowing 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. (UL) or another nationally recognized test laboratory (NRTL).
- 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 utilized shall be inspected no less than daily for safe conditions.

Oil-fired heaters, LP-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 IFC, and NFPA 70.

11.3.9 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 job site 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, alternate routes, and the local Fire Department shall be notified. Any requested compensatory measures (such as signage) shall be implemented.

11.3.10 Fire Extinguishers

Job sites shall be provided with fire extinguishers so that the travel distance to any fire extinguisher does not exceed 50 feet. 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 one year of the current date. For roofing operations, there shall be at least one multipurpose 4-A:60-BC: portable fire extinguisher.

11.3.11 Utilities

All installation of gas piping shall be performed in accordance with NFPA 54. Hot taps shall be permitted, provided they are installed by a trained and experienced crew utilizing 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 feet 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-BC: within 50 feet.

11.3.12 Roofing Operations

Operations for asphalt and tar kettles shall comply with NFPA 241 and the IFC.

- There shall be at least one portable fire extinguisher having a rating of not less than 4-A:60-BC:

Operations for installing single-ply and torch-applied roofing systems shall comply with NFPA 241.

11.4 References

- 29 CFR l 926.24, Fire Protection & Prevention
- 29 CFR 1926, Subpart F, Fire Protection & Prevention
- 29 CFR 1926, Subpart K, Welding & Cutting
- ANSI Z49.1 - 2012 "Safety in Welding, Cutting and Allied Processes," Sections 4.3 and E4.3.

12 Hoisting and Rigging

12.1 Applicability

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

12.2 Regulatory Requirements

- 29 CFR 1926, Subpart CC, Cranes and Derricks in Construction
- Rigging of loads being lifted by cranes shall comply with the requirements of 29 CFR 1926.251, Rigging Equipment for Material Handling
- Hoisting and rigging during steel erection activities shall comply with the requirements of 29 CFR 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.

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

12.3 NLR Specific Requirements

In addition to Section 12.2, 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, 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.

12.4 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 an NCCCO license or other NLR accepted licenses/certification appropriate for the equipment from an accredited nationally recognized agency. NLR recognizes the NCCCO 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. (i.e., Mobile Crane Operator, Tower Crane Operator). Any other forms of crane certification shall be reviewed and accepted

by the NLR ESHQ POC.

12.4.1 Hoisting and Rigging Operating Requirements

12.4.1.1 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.

12.4.1.2 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 Project Manager and ESHQ POC.

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

- The weight of the load is 75 percent or more of the crane's rated capacity in the configuration that will be used during the lift.
- Lifts involving non-routine 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.
- 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 non-critical, 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.

12.4.1.3 Pre-Lift Meeting

Prior to performing any lift, the Subcontractor shall conduct a pre-lift 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 lifts, this meeting shall be documented utilizing the NLR Pre-Lift Meeting Checklist or other equivalent NLR ESHQ accepted checklist.

12.4.1.4 Communication

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

12.4.1.5 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 utilizing 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.

12.4.1.6 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.

12.4.1.7 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 cranes rated load capacity as directed and allowed by the crane manufacturer's operating manual.

12.4.1.8 Electrical Distribution Lines

Watch for overhead electrical distribution and transmission lines and maintain a safe working clearance of at least 10 feet 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.

12.4.2 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.

12.4.2.1 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 miles per hour 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.

12.4.2.2 Freezing Surfaces

Check surface conditions to determine if 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.

12.4.2.3 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.

12.4.3 Crane Inspection, Maintenance, and Testing

12.4.3.1 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 utilized 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. 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 utilize 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 utilizing 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.

12.4.3.2 Daily Pre-Operational 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.

Deficiencies: 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.

12.4.3.3 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.

12.4.3.4 Annual Inspections

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

12.4.3.5 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.

12.4.3.6 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.

12.4.3.7 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.

12.4.4 Rigging Safety Requirements

12.4.4.1 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 12.5.2 for additional information on suspect and counterfeit rigging and hoisting requirements.

12.4.4.2 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/or UV damage can degrade rigging performance.

12.4.4.3 Labeling

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

12.4.4.4 Rigging Safe Work Practices

The Subcontractor shall ensure the following safe work practices are utilized 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 de-ratings are applied based on sling angle and/or hitch angle considerations (choker angle de-rating).
- Verify shouldered eyebolts are installed in accordance with the manufacturer's recommendations. Beware of side pull applications. Eyebolts shall be de-rated when subject to side loads.
- Do not use shoulder-less 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.

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

12.4.5.1 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.

12.4.5.2 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.

12.4.6 Personnel Hoisting

12.4.6.1 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 utilized to document these lifts. The NLR Personnel Platform Lift Plan template can be obtained from the ESHQ POC. A pre-lift test is required.

12.4.6.2 Pre-Lift Meeting

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

12.5 NLR Special Emphasis

12.5.1 Department of Energy Hoisting and Rigging Standard

NLR adheres to the Department of Energy (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.

12.5.2 Suspect and Counterfeit (S/CI) Rigging and Hoisting 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 non-wearing area of the hook.

The following are some indicators of S/CI hoisting and rigging components wire rope clips:

- Metallurgy is suspect.
- Original markings have been ground off and re-stamped.
- 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").

12.6 References

- 29 CFR 1926, Subpart CC, Cranes and Derricks in Construction
- Rigging of loads being lifted by cranes shall comply with the requirements of 29 CFR 1926.251, Rigging Equipment for Material Handling
- Hoisting and Rigging during steel erection activities shall comply with the requirements of 29 CFR 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.

13 Fall Protection

13.1 Applicability

The requirements of this section apply to all construction subcontractors and lower-tier subcontractors (hereafter referred to as "Subcontractor") activities which require personnel to work or potentially be exposed to unprotected heights of six feet or more on NLR projects unless otherwise specifically exempted by NLR ESHQ POC.

13.2 Regulatory Requirements

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

- 29 CFR 1926, Subpart M Fall Protection
- Fall protection during steel erection activities shall also comply with the requirements of 29 CFR 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 1926.760) and Scaffold Activities (29 CFR 1926.451) do not apply at NLR.

13.3 NLR Specific Requirements

In addition to Section 13.2, all work activities and/or potential personnel exposures to unprotected falls of six feet or more shall meet the following NLR requirements as applicable in Sections 13.3.1- 13.3.4.2 of this manual.

13.3.1 Fall Protection Program

Subcontractors providing services to NLR that meet the applicability as defined in Section 13.1 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.

13.3.1.1 Fall Hazard Analysis

A fall hazard analysis (FHA) shall be conducted for each activity or similar activity prior to the start of the work activity and shall be referenced as part of the activity hazard analysis (AHA) for the subject activity and/or definable feature of 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 utilizing a personal fall arrest system (PFAS), identify the means to be utilized for the prompt rescue of employees in the event of a fall.

An NLR Construction Fall Hazard Analysis (CFHA) form, or an NLR Environment, Safety, Health, and Quality accepted equivalent FHA, shall be completed by the construction subcontractor fall protection competent person, prior to allowing workers to be exposed to fall hazards. However, for simple applications (which do not involve the use of an active fall protection system), an AHA may be accepted as determined by the NLR ESHQ POC.

At a minimum, a Construction Fall Hazard Analysis (CFHA) shall be completed when:

- An authorized worker is using an active fall protection system

Exceptions:

- Work performed from aerial lifts, scissor lifts, mobile or elevated work platforms, do not require a Fall Hazard Analysis 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 feet in height while using an installed ladder safety device or PFAS system does not require a Fall Hazard Analysis.
- 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 a CFHA (see above for minimum requirements), may be addressed through the subcontractor's own fall hazard analysis, 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 Construction Subcontractor website located at *www.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.

13.3.1.2 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 he or she 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.

13.3.1.3 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 remotely 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 cellular phones. The spotter shall have phone access if he or she needs to initiate an emergency response.

13.3.1.4 Personal Fall Arrest System Strength Requirements

Subcontractors shall ensure that the strength and testing requirements for personal fall arrest system (PFAS)s, 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.

13.3.1.5 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.

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.

13.3.1.6 Anchorages

The application and use of all fall protection anchorages (certified or non-certified) 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.

13.3.1.7 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.

13.3.1.8 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 1926, Subpart R, Steel Erection). Contact the NLR ESHQ POC for additional information on safety net systems.

13.3.1.9 Portable Ladders

General Requirements:

- Portable ladders shall be set up and used in compliance with Occupational Safety and Health Administration (OSHA) and manufacturer requirements. Additionally, the portable ladder shall be a minimum Type I (250 lbs. rated) Heavy Duty Classification. The capacity rating shall not be exceeded.
- Non-conductive 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 American National Standards Institute (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 a CFHA nor a fall arrest system are 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 him or her to other hazards including impalement, mechanical, electrical, chemical, or environmental.
- The portable ladder is 20 feet 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.

13.3.1.10 Mobile Elevated Work Platforms (MEWPs)

General Requirements:

- All personnel lifts shall be operated in accordance with Occupational Safety and Health Administration (OSHA), appropriate ANSI standard 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 utilized as required by OSHA, ANSI/SAIA, and the manufacturer.
- **Note:** 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.

13.3.1.11 Fall Protection on Roofs

Subcontractors performing work on low-slope roofs (means a roof having a slope less than or equal to 3 in 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 (CAZ), 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-feet 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 CAZ and the roof's edge without the use of an active fall protection system in place.

13.3.1.12 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 work.

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 feet from the roof edge. When mechanical equipment is being used, the warning line shall be erected not less than 6 feet from the roof edge which is parallel to the direction of mechanical equipment operation, and not less than 10 feet from the roof edge which 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 the worker(s) is 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.

13.3.1.13 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 feet 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 work rule prohibiting the employees from going past the warning line or CAZ unless the worker(s) is protected by a PFAS or restraint system when performing any activities in the area between the warning line or CAZ and the roof edge.
- Note: Working on a sloped roof having a pitch greater than 4:12 requires the use of a PFAS.

13.3.1.14 Holes

A hole is a gap or void 2" 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 2x the intended load. The hole cover must be visibly marked with the words "HOLE".

13.3.2 Subcontractor Training Requirements

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

13.3.3 NLR Special Emphasis

13.3.3.1 Presumption of Feasibility

NLR presumes that using conventional fall protection (that is, 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 convention fall protection is infeasible, this shall be identified in their Fall Hazard Analysis (refer to Section 13.3.1.1). 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.

13.3.3.2 Rescue Planning

A rescue procedure is required whenever a fall arrest system is used by an authorized person 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, suchas 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 CFHA 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.

13.3.3.3 Flatirons Campus

Work activities conducted 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.

13.4 References

- 29 CFR 1926, Subpart M: Fall Protection
- 29 CFR 1926, Subpart R: Steel Erection
- ANSI A14.1-2017, Ladders – Wood Safety Requirements
- ANSI Al0.32-2012, 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 Z359.2-2017, Minimum Requirements for a Comprehensive Managed Fall Protection
- ANSI Z359.12-2019, Connecting Components for Personal Fall Arrest Systems
- ANSI/SAIA A92.2-2021, Vehicle-mounted Elevating and Rotating Aerial Devices
- ANSI/SAIA A92.3-2006, Manually Propelled Elevating Aerial Platforms
- ANSI/SAIA A92.5-2006, Boom-supported Elevating Work Platforms
- ANSI/SAIA A92.6-2006, Self-propelled Elevating Work Platforms.

14 Scaffold

14.1 Applicability

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

14.2 Regulatory Requirements

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

- 29 CFR 1926, Subpart L, Scaffolds in Construction
- 29 CFR 1926, Subpart R, Fall Protection in Construction.

14.3 NLR Specific Requirements

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

14.3.1 Complex Scaffold Plan

If a subcontractor shall erect a scaffold that is multiple tiers or considered high risk, may be required to submit a Scaffolding Design Plan.

14.3.2 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 – SPECIAL CONDITIONS/ADDITIONAL CONTROLS – indicates special safety measures for use of the scaffold; examples include PFAS or head protection.

14.3.3 Competent Person

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

14.3.4 Scaffolding Fall Protection

Scaffolds erected 6 feet or more above the lower level required 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 utilized.

Cross bracing is acceptable in place of a midrail when the crossing point of two braces is between 20 inches and 30 inches above the work platform or as a toprail when the crossing point of two braces is between 38 inches and 48 inches above the work platform. The end points at each upright shall be no more than 48 inches apart.

1. A Construction Fall Hazard Analysis (CFHA) shall be completed when scaffold erectors (or authorized

workers) are required to utilize an active fall protection system.

2. A self-retracting lanyard shall be utilized for authorized workers ascending or descending a scaffold access ladder more than 20 feet in height (as measured from the base of the ladder to the top of upper work platform/deck accessible from the ladder).

14.4 NLR Special Emphasis

NLR presumes that using conventional fall protection (that is, 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.

14.5 References

- 29 CFR 1926, Subpart L, Scaffolds in Construction
- 29 CFR 1926, Subpart R, Fall Protection in Construction.

15 Hearing Conservation

15.1 Applicability

The requirements of this section apply to all construction subcontractors (hereafter referred to as "Subcontractor") hearing conservation on NLR Sites unless otherwise specifically exempted by the NLR.

15.2 Regulatory Requirements

Subcontractor Hearing Conservation Program shall meet or exceed requirements in the OSHA standard:

- American Conference of Governmental Industrial Hygienist, “Threshold Limit Values for Chemical Substances and Physical Agents and Biological Indices," Latest Edition
- 29 CFR 1910.95 Occupational Noise Exposure.

15.3 NLR Specific Requirements

The subcontractor hearing conservation program shall comply with Occupational Safety and Health Administration (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 (AL) and Permissible Exposure Limit (PEL). The ACGIH TLV has a criterion level at 85dBA and an exchange rate at 3dB, 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 1910.95. Elements consistent with hearing conservation programs include exposure monitoring, institution of engineering controls to limit exposure, provision of adequate hearing protection devices (HPDs), 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

15.3.1 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. Personal protective equipment (PPE).

15.3.2 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 decibels (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 8-hr TWA, or if impact/impulse noise exceeds 140 dBA. Noise exposure shall be determined without regard to hearing protection provided.

15.3.3 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.

15.4 References

- 29 CFR 1910.95 Occupational Noise Exposure
- American Conference of Governmental Industrial Hygienists, "Threshold Limit Values for Chemical Substances and Physical Agents and Biological Indices," Latest Edition.

16 Industrial Hygiene

16.1 Applicability

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

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

- Noise
- Hazardous materials
- Subcontractor work site 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.

16.2 Regulatory Requirements

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

- CFR 851, Worker Safety & Health Program
- ANSI Z88.2, "American National Standard for Respiratory Protection Current Edition

- 29 CFR 1926, Construction Safety and Health Regulations for Construction
- 29 CFR 1910, Occupational Safety and Health Standards for General Industry
- American Conference of Governmental Industrial Hygienist, "Threshold Limit Values for Chemical Substances and Physical Agents and Biological Indices," Latest Edition.

16.3 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.

16.3.1 General Requirements

16.3.1.1 Identification of Health Hazards

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

16.3.1.2 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 (PELs & TLVs). Subcontractors should strive to maintain exposures to as low as reasonably achievable (ALARA). Control measures to eliminate or reduce industrial hygiene-related exposures shall be identified during the pre-job planning process and delineated in the AHA.

The implementation of control measures shall follow the following hierarchy:

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

16.3.1.3 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 (integrated sampling, direct-reading instrumentation, modeling, etc.), as appropriate for the material(s) of concern, the site conditions and the type of data needed.

16.3.1.4 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 AHA as necessary.

16.3.1.5 Carcinogen Control

The Subcontractor shall make every attempt to substitute less hazardous substances for any carcinogenic material (as defined by OSHA in 29 CFR 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" (ALARA).

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

16.3.1.6 Subcontractor Worksite Dust Control

All subcontractor projects shall address dust control during pre-job planning. Outdoor areas to be cleared for construction 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 located at *www.NLR.gov/about/ehs-construction.html.*

During facility renovation activities, barriers are to be installed as needed to prevent dust migration from construction 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.

16.3.1.7 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 may be 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 which 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.

16.3.1.8 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 timeframe. Co-located 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.

16.3.2 Temperature Extremes

Provisions to prevent heat stress and cold stress shall be incorporated into the project AHA(s) when work conditions may reasonably be expected to present such hazards. The Thermal Stress section of the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold limit values (TLVs) shall be the governing guidelines.

16.3.2.1 Heat Stress

The Subcontractor shall provide appropriate mitigating measures prior to heat stress becoming an issue. The American Conference of Industrial Hygienists (ACGIH) Threshold limit value (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 (WBGT) are required to make WBGT-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.

16.3.2.2 Cold Stress

The American Conference of Industrial Hygienists (ACGIH) cold stress Threshold limit value (TLV) is the prescribed standard for cold exposure. When work involves continuous employee exposure to an equivalent chill temperature (ECT) 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. Non-emergency work is curtailed when the ECT 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.

16.3.3 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, subcontractor shall check NOAA weather reports *(http://www.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.

16.3.4 Lighting and Illumination

The minimum lighting level for construction areas both indoors and outdoors shall be an average of 5-foot candles measured 30 inches above the floor. Illumination for general construction areas shall maintain an average lighting level of 10-foot 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.

16.3.5 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.

16.3.6 Lead Program

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

16.3.7 Hexavalent Chrome

The Construction Industry Chromium (VI) Standard (29 CFR 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.

16.3.8 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 anti-laser protection devices.

16.3.8.1 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.

16.3.8.2 Class 3a and Class 3R Laser Use

Class 3a or 3R lasers used in construction 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.

16.3.8.3 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.

16.3.9 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, etc.). 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.

16.3.10 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 PM/CM, 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.

16.3.11 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 (CPR) 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.

16.3.12 Other Health Hazards

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

16.4 NLR Special Emphasis

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

16.5 Subcontractor Responsibilities

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

- Anticipates, identifies, evaluates, and controls potential and existing hazards/agents in the workplace through the pre-job safety planning process.
- Determines that engineering devices, administrative controls, and personal protective equipment are available, appropriate, tested, and utilized by employees.
- Determines employees are trained as required.

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

16.6 References

- 29 CFR 1910, Occupational Safety and Health Standards for General Industry
- 29 CFR 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.

17 Asbestos Management

17.1 Applicability

The requirements of this section apply to all construction contractors and lower-tier subcontractors (hereafter referred to as "Subcontractor") performing activities on NRE owned/leased buildings which will disturb or have potential to disturb asbestos containing materials (ACM), asbestos containing building materials (ACBM) and/or presumed asbestos-containing materials (PACM). If suspect asbestos- containing materials 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.

Non-friable asbestos containing material (ACM) 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 ACM include material placed on building surfaces, thermal system insulation (TSI), or previously categorized non-friable material that has become damaged to the extent that, when dry, it can be crumbled, pulverized, or reduced to powder by hand pressure. ACM 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 additionally NLR requirements, as identified below.

17.2 Regulatory Requirements

Asbestos controls are addressed through the following statutes/laws/regulations and guidance documents:

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

17.3 NLR Specific Requirements/Permit

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

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

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

17.3.2 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 feet, greater than 160 square feet, 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 a NLR Safe Work Permit (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 Department of Transportation (D.O.T.) and disposal facility requirements; waste disposal manifests may only be signed by NLR staff who have current D.O.T. 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.

17.4 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 (CDPHE) 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 five years.

17.5 References

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

18 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.

18.1 Applicability

The requirements of this section apply to all construction subcontractors and lower-tier subcontractors (hereafter referred to as "Subcontractor") performing activities on NLR-owned/leased buildings or properties which will disturb or have potential to disturb silica containing materials (SCM). 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.

18.2 Regulatory Requirements

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

- OSHA 29 CFR 1926.1153 Respirable Crystalline Silica
- OSHA 29 CFR 1910.1053 Respirable Crystalline Silica
- American Conference of Governmental Hygienists (ACGIH) TLVS/BEIs Latest Edition.

18.3 NLR Specific Requirements

A surface penetration permit is required, prior to disturbance of a building 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.

18.3.1 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 PEL). 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 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 PEL) 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 utilized to eliminate the hazard whenever feasible.
- Air monitoring or historical data are required to confirm the controls in place are working and whether personal protective equipment, 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.

HEPA 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 Competent Person
- Subcontractor respiratory protection program

- Workers' respiratory protection credentials indicate that they are medically qualified, trained, and fit-tested.
- Subcontractor medical surveillance program (required if using respiratory protection 30 or more days per year).

18.4 References

- OSHA 29 CFR 1926 1153 Respirable Crystalline Silica
- American Conference of Governmental Hygienists (ACGIH) TLVS/BEIs, Latest Edition.

19 Personal Protective Equipment (PPE)

19.1 Applicability

The requirements of this section apply to all construction subcontractors and lower-tier subcontractors (hereafter referred to as "Subcontractor") construction work activities on NLR sites unless otherwise specifically exempted by the NLR. This section provides the requirements for the use of personal protective equipment, 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.

19.2 Regulatory Requirements

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

- 29 CFR 1926, Construction, Subpart E; Personal Protective and Life Saving Equipment
- 29 CFR 1926, Construction, Subpart I; Personal Protective Equipment
- Code of Federal Regulations (CFR) 835, Occupational Radiation Protection
- Applicable American Standards Institute (ANSI) standards
- Manufacturers' recommendations.

19.3 NLR Specific Requirements

19.3.1 General Requirements

Personal protective equipment (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-inch 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 activity-specific AHA. Gloves specific for the task shall be required.

The subcontractor is responsible for supplying and requiring the wearing of appropriate personal protective equipment 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.

19.3.2 Training

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

19.3.3 PPE Hazard Assessment and Selection

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

assessment documentation include:

- Activity hazard analysis (AHA) or job safety analysis
- Fall Hazard Analysis
- Confined Space Entry Permit
- Hot Work Permit
- Electrical Safe Work Permit
- Building Surface Penetration Permit.

The AHA shall address at a minimum 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.

19.4 Subcontractor Responsibilities

The subcontractor shall:

- Perform an assessment identifying hazards or potential hazards and determine necessary PPE for activities to be performed
- Include PPE requirements in project AHAs as applicable
- Adhere to prescribed NLR postings and/or NLR pre-job 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.

19.5 References

- 29 CFR 1910, Occupational Safety and Health Standards for General Industry
- 29 CFR 1910.134, Respiratory Protection
- 29 CFR 1926, Safety and Health Regulations for Construction

- 29 CFR 1926, Subpart E; Personal Protective and Life Saving Equipment
- 29 CFR 1910, Subpart I; Personal Protective Equipment
- Code of Federal Regulations (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
- ASTM F2413-05 Standard Requirements for Protective Footwear
- ASTM F2413-11 Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear.

20 Hazard Communication

20.1 Applicability

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

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

20.2 Regulatory Requirements

The Subcontractor's Hazard Communication program shall be conducted in accordance with the following statutory requirements:

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

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

20.3 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.

20.3.1 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 safety data sheets (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. Project activity hazard analyses 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.

20.3.2 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 of how to read/understand their labeling system.

The subcontractor shall determine if 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 form or the way it will be used creates 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 subcontractor 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.).

20.4 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
- Bio-chemicals.

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.

20.5 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 identified in the AHA.
- 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.
- Remove chemicals from the work area and properly dispose of them when no longer needed.
- Comply with exposure monitoring and medical surveillance requirements associated with chemical use.

20.6 References

- CFR 851, Worker Safety & Health Program
- 29 CFR 1926, Safety and Health Regulations for Construction
- 29 CFR 1910, Occupational Safety and Health Standards for General Industry
- Title 10 Code of Federal Regulations (CFR) 850, "Chronic Beryllium Disease Prevention Program".

21 Confined Space

21.1 Applicability

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

21.2 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 1926.1203 Subpart AA, Confined Spaces in Construction.

21.3 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.

21.3.1 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.

21.3.2 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 based on the actual and/or potential hazards related to entry into the space while the confined space is in its normal operating condition.

21.3.2.1 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.

21.3.2.2 New or Previously Unidentified Confined Spaces

There is a possibility that construction 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 construction, 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 project manager and ESHQ POC whenever new confined spaces are identified or created.

21.3.2.3 Identifying a Confined Space

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

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

21.3.2.4 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 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.

21.3.3 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
- The entry team/authorized personnel-adequate number of workers to staff an entry teamincluding entry supervisor and that their training is current and documented
- Functioning, calibrated monitoring equipment and that their staff are familiar with the use ofthe equipment
- Appropriate PPE, ventilation equipment, supplemental lighting, if necessary, fall protectionand rescue equipment/plan.

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

21.3.4 Confined Space Entry Controls

Entries into confined spaces shall be controlled either through administrative controls for non-permit 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 (LOTO)

- Cleaning of confined space
- Electrical precautions
- Fire precautions
- PPE
- Communication procedures.

21.3.4.1 NLR Confined Space Entry Experience/History Review

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

21.3.4.2 Subcontractor Confined Space Post Entry Evaluation Review

Subcontractors may inform NLR ESHQ POC of their experience with the permit-required confined space following the entry by utilizing the "Entry Review/Critique" section contained in the NLR Confined Space Entry Permit or as part of 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.

21.3.5 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 Confined Space: Entries shall be coordinated with the Central Monitoring Station (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 construction.

21.3.6 Subcontractor Training Requirements

Subcontractors who are trained in accordance with the requirements identified in 29 CFR 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.

21.4 References

- 29 CFR 1926.1203 Subpart AA, Confined Spaces in Construction
- 29 CFR1910.147, The Control of Hazardous Energy (Lockout/Tagout).

22 Building Surface Penetrations

22.1 Applicability

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

22.2 Regulatory Requirements

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

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

22.3 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 Chapter 10, Excavations.

22.3.1 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.

22.3.1.1 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 Project Manager 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 Project Manager/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 board where the length of the nail or screw will not fully penetrate the wall material.
- Penetrations into masonry block wall that do not exceed ¾" in depth.
- Penetrations in pre-cast tilt-up concrete walls to mount signs and facility accessories. The 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 fiber optic 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 fiber optic scope to verify the absence of utilities prior to proceeding with work.
- Penetrations in drywall, sheetrock, or similar construction material with a non-conductive object. 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 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 Non-Standard 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.
- Lock out/tag out (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 ground fault circuit interrupter (GFCI) when using corded electrical power tools

unless a drill interrupter/stop is used.

- Require the use of electrical controls such as personal protective equipment 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.

22.3.1.2 Surface Penetration Permit, New Building Construction

Subcontractors performing building penetrations in or on new building construction shall utilize their own surface penetration permit system that meets or exceeds the requirements of Section 21.3.1.1. The subcontractor shall utilize the permit when construction 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.

22.4 References

- 29 CFR 1926, Safety and Health Regulations for Construction
- 29 CFR 1910, Occupational Safety and Health Standards for General Industry
- 29 CFR1910.147, The Control of Hazardous Energy (Lockout/Tagout).

23 Environmental Requirements

23.1 Applicability

The requirements of this section apply to all construction subcontractors and lower tier subcontractors (hereafter referred to as "Subcontractor") who perform construction work activities on NLR sites. This section provides guidance on activities which 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.

23.2 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 CCR 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).

23.3 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.

23.3.1 National Environmental Policy Act Requirements (NEPA)

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 if additional NEPA review is required prior to proceeding.

23.3.2 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 preparation of a Stormwater Pollution Prevention Plan (SWPPP). NLR shall review and accept the subcontractor SWPPP 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.

23.3.3 Air Emissions Requirements

23.3.3.1 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 earth work activities shall occur when sustained wind speeds exceed 30 mph, steep slopes shall be covered with mulch, netting (or equivalent) or watered at the end of each workday, and off property transport of visible emissions are prohibited.

23.3.3.2 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.

23.3.3.3 Refrigerants

The installation, replacement, and servicing or repair of equipment (appliances) containing refrigerants are subject to regulation and control under both CDPHE 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, CFC, HCFC, and HFC 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 pounds of CFC and HCFC refrigerant per compressor) are subject to specific repair, testing, and documentation requirements. If in doubt regarding these requirements, please consult the ESHQ POC.

23.3.3.4 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 two

years of temporary operation. If a portable source is to be in use at a specific location beyond two years, a determination shall be made whether an APEN form shall be submitted, or a permit obtained from the Colorado APCD. The Subcontractor shall contact the NLR ESHQ POC to coordinate an appropriate path forward.

23.3.3.5 Portable Tanks Requirements

NLR only allows the use of steel double-wall aboveground storage tanks (ASTs), and this guidance assumes that any NLR tank, portable or temporary is such an AST. The use of ASTs is governed by various regulations including Colorado DOPS AST regulations, NFPA and DOT requirements, UL 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 AST used with a temporary and/or portable emission source shall meet NLR AST Program requirements. Contact the NLR ESHQ POC to ensure compliance with portable tank requirements.

23.3.4 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 are to be collected daily and kept covered.

23.3.5 Wastewater

NLR limits wastewater discharges to sewer systems and does not allow any non-routine discharges to 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 (PVSD) and Metro Water Recovery (Metro) 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 PVSD system by more than 30%) require notification to the PVSD. Contact the ESHQ POC if such discharges are planned.

23.3.5.1 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, potential pollutants in the water used), and the Best Management Practices (BMPs) 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 PVSD or Metro may be required for discharges to the sanitary sewer system. Contact the ESHQ POC if such discharges are planned.

23.3.6 Hazardous Waste

NLR holds the necessary Resource Conservation and Recovery Act (RCRA) generator identification numbers to conduct waste generation and collection activities. NLR prohibits treating (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.

23.3.7 Noise

Per State of Colorado Noise Statute, construction projects are limited to permit conditions or 80 decibels (dBA) for the period within which the construction is to be completed or a reasonable amount of time. Notify the NLR Project Manager if after-hours work is anticipated.

23.3.8 Pesticide and Herbicide Use

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

23.3.9 Vegetation

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

23.3.10 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, and 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.

23.3.10.1 Nesting Birds

In general, for any construction-related activities (grading/clearing, heavy equipment uses, demolition activities, etc.) that occur between mid-March to 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 onsite nest boxes, or in building entryways or open areas. If raptor (hawks, owls, falcons) nests are found, buffer zones from 200 yards to 1/2 mile 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.

23.3.10.2 Snakes

Subcontractors shall not pursue, capture, harass, harm, or kill wildlife, including snakes, encountered onsite. 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 will arrive and relocate the snake.

23.3.10.3 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, entrapment, or drowning.

23.3.10.4 Wildlife Corridor

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

23.3.10.5 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.

23.3.11 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.

23.4 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.

23.5 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, 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 CCR 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).

24 Construction Barriers

24.1 Applicability

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

24.2 Regulatory Requirements

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

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

24.3 NLR Specific Requirements

In addition to Section 26.2, all subcontractor work activities shall meet the following specific NLR requirements for construction barriers.

24.3.1 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 areas
- Delineation of construction laydown areas
- Marking overhead obstructions such as sprinkler heads, racking, or other projections.

24.3.2 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

24.3.3 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 Facility Manager. Fencing shall be a minimum of 4 feet high and secured horizontally every 10 feet.

24.3.4 Signage for Construction Barriers

When construction barriers, including caution and danger tape, are erected, signage shall be created and posted

in conspicuous areas to alert others to the hazards. Construction subcontractors may use their own format for the development of the signage, but at minimum it shall include the following information:

- Identification of the hazard
- Contact information for the individual responsible for the area
- Contact information for the NLR PM and ESHQ POC
- Any other pertinent information.

24.4 Requirements

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

25 Temporary Traffic Control Requirements

25.1 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, and NLR staff who perform 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 work sites, 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.

25.2 Regulatory Requirements

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

- Manual on Uniform Traffic Control Devices (MUTCD) 23 Code of Federal Regulations (CFR), Part 655, Subpart F Revision 3
- Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130
- OSHA 29 CFR 1926 Subpart G Signs, Signals and Barricades.

25.3 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.

25.3.1 Temporary Traffic Control Plan

The TTCM identifies the need for traffic control planning, it provides acceptable controls for typical applications, and it identifies under what conditions a TTCP shall be submitted to the NLR Traffic Safety SME or designee for approval.

25.4 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 SME, where required, as a part of pre-planning construction work.

25.5 References

- Manual on Uniform Traffic Control Devices (MUTCD) 2009 Edition with Revision Numbers 1, 2, and 3, dated July 2022
- Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130
- OSHA 29 CFR 1926 Subpart G Signs, Signals and Barricades

- NLR Temporary Traffic Control Manual for Roadway Construction, Utility Work, and Maintenance Operations available at *www.NLR.gov/about/ehs-construction.html.*

26 Testing and Startup of Equipment

26.1 Applicability

The requirements of this section apply to all construction subcontractors and lower-tier subcontractor (hereafter referred to as "Subcontractor") activities which require the testing or startup of newly installed or modified equipment unless otherwise specifically exempted by NLR. This section provides the requirements for developing methods of procedure (MOPs) on NLR owned or leased sites.

26.2 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 1926, Construction Safety and Health Regulations for Construction
- 29 CFR 1910, Occupational Safety and Health Standards for General Industry
- CFR 851, Worker Safety and Health Program.

26.3 NLR Specific Requirements

In addition to Section 25.2, all subcontractor work activities shall meet the following specific NLR requirements for testing and startup of equipment.

26.3.1 Pressure Testing

Prior to performing pressure testing of newly installed or modified piping or equipment, the subcontractor shall develop a method of procedure (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 utilized during the testing
- Section for employees to acknowledge and sign the MOP.

26.3.2 Startup 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 startup of equipment (if available)
- Potential hazards associated with the startup 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 the National Electrical Code (NFPA 70) by a 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.

26.4 References

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