WS&H Document
Change Management Form

Pacific Northwest
NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

Document No: CESH Manual

Rev No: 18

Title: Contractor Environment Safety and Health Manual

Effective Date: September 30, 2019

NOTES:

USQ Review

USQD/SES No:

USQT No:

Revision History Statement

Added the word "eye" to section 5.9 Lasers, paragraph 3 - reads:...anti-laser eye protection devices. Added another paragraph to section 5.9 Lasers, saying: "Laser units shall be set up for operation above the heads of employees, when possible." to reflect 296-155-155 (11) requirement. Revised table of contents to include 5.12 Welding Hazards. Changed references from 5.12 to 5.13. Deleted reference of WEA and JPP out of paragraph 8.4.1 and 8.4.2. Added site conditions and facility hazards such as beryllium, asbestos, lead, magnet fields, IOPS. Added electrical assured grounding and steel erection as competent persons in section 2.3.3. Added section 5.12 Welding hazards to include manganese and changed references from 5.12 to 5.13. Added note in section 9.0 Safety orientation that contractor may submit their own new orientation for approval by Battelle. Added Contractor may submit their own new hire safety orientation for approval in section 9.3. Added Note under 10.2 in-frequent contractors shall be a point of emphasis for daily jobsite inspections. Added note under 13.3 once a week contractor shall perform clean-up activities that include; removal of debris from inside buildings, general organization of materials and barricades, sweeping of floors, roll-up of cords, adjustment of lights, trash removal, walk around exterior of building to ensure barricades and debris are picked-up. Added note that unknown underground utilities shall use the same precautions as hand digging around energized direct buried cables. Added section 16.4.2 smooth face bucket and always dig parallel to the utility never across the top. Penetrating solid concrete requires a blind penetration permit. Added Battelle utility owner approval when machine digging within 5 feet. Added Eight criteria under 21.4.1 to match HDI requirements. Added peer review under 21.4.2 to match HDI requirements. Section 23.3.2.4 changed 30 minute fire watch to 1 hour. Section 25.3 Added baker scaffolds 6 feet and greater require standard guardrails. Updated section 20 to reflect NFPA 70 and NFPA 70E references to 2015 date.

WS&H Document
Change Management Form

Pacific Northwest
NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

Approvals Required

AUTHOR Name / Title: ML Deichman, SME - WSH Services

Name / Title: JJ Sweesy, Manager - WSH Programs

Name / Title: CR Buchanan, Manager - WSH Services

Name / Title: DE Faulk, Performance Assurance Lead - WSH Division

Concurrence as Appropriate

Name / Title: CN Taylor, Records Custodian - WSH Division

Name / Title:

Name / Title:

Change Management Needed

☐ RODs ☐ HDI ☐ Variance ☐ File Plan

	Required Reading	Briefing	Hands On Instruction	Other	Not Required
Managers	☐	☐	☐	☐	✔
Services Staff	☐	☐	☐	☐	✔
Program Staff	☐	☐	☐	☐	✔
Safety Engineering Staff	☐	☐	☐	☐	✔

Change Management Summary

N/A

The online .PDF version is the only official copy of this document. Before using a printed copy, verify that it is the most current version by checking the effective date on the website.

PNNL-18290 Rev_18

Contractor Environment, Safety & Health Manual

for Work Conducted at

Battelle
Pacific Northwest Division
Richland, WA 99352

July 2019

LEGAL NOTICE

This report was prepared by Battelle Memorial Institute (Battelle) as an account of sponsored research activities. Neither Client nor Battelle nor any person acting on behalf of either:

MAKES ANY WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, process, or composition disclosed in this report may not infringe privately owned rights; or

Assumes any liabilities with respect to the use of, or for damages resulting from the use of, any information, apparatus, process, or composition disclosed in this report.

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by Battelle. The views and opinions of authors expressed herein do not necessarily state or reflect those of Battelle.

This document was printed on recycled paper.

(9/2003)

Contractor Environment, Safety & Health Manual

for Work Conducted at

Battelle
Pacific Northwest Division
Richland, WA 99352

July 2019

Acronyms and Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
ALARA	As Low as Reasonably Achievable
ANSI	American National Standards Institute
CFR	Code of Federal Regulations
BCR	Battelle Contract Representative
CM	Construction Manager
CPR	Cardiopulmonary Resuscitation
CSHP	Construction Safety and Health Plan
dBA	Decibels
DOE	U.S. Department of Energy
ECT	Equivalent Chill Temperature
EU	Electrical Utilities
EWP	Electrical Work Permit
GFCI	Ground Fault Circuit Interrupters
HAZCOM	Hazard Communication
HGET	Hanford General Employee Training
IARC	International Agency for Research on Cancer
IDLH	Immediately Dangerous to Life and Health
IH	Industrial Hygiene
ISM	Integrated Safety Management
JSA	Job Safety Analysis
MSDS	Material Safety Data Sheet
NEC	National Electric Code
NFPA	National Fire Protection Association
NRR	Noise Reduction Rating
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
PNWD	Pacific Northwest Division
PPE	Personal Protective Equipment
TLV	Threshold Limit Value
TWA	Time-weighted-average
UNP	Unbound Engineered Nanoparticle
WAC	Washington Administrative Code
WBGT	Wet Bulb Globe Temperatures
WISHA	Washington Industrial Safety and Health Act

Contents

Acronyms and Abbreviations iv
1.0 Introduction 1
1.1 Integrated Safety Management System 1
2.0 Program Policy 3
2.1 Purpose 3
2.2 Definitions 3
2.3 Requirements 3
2.3.1 Responsibility 3
2.3.2 Contractor/Subcontractor Responsibilities 4
2.3.3 General Requirements 5
2.3.4 Safety Requirements 6
2.3.5 Safety Rights 6
2.3.6 Safety Responsibilities 7
2.3.7 Safety Bulletin Boards 8
2.3.8 Adverse Weather Conditions 8
2.4 References 9
2.5 Records 9
2.6 Forms 9
2.7 Exhibits 9
3.0 Environmental Protection Plan 11
3.1 Purpose 11
3.2 Definitions 11
3.3 Requirements 11
3.3.1 Cultural and Biological Resource Protection 12
3.3.2 Excavation 12
3.3.3 Erosion Control 12
3.3.4 Dust Control 13
3.3.5 Hazardous Material Storage 13
3.3.6 Waste Accumulation and Inspection 13
3.3.7 Waste Disposal 15
3.3.8 Spill Control 15
3.3.9 Liquid Effluent Management 15
3.3.10 Waste Minimization and Pollution Prevention (P2) Program 16
3.3.11 Equipment and Waste Transportation 17

3.3.12 Miscellaneous Wastes 17
3.4 References 19
3.5 Records 19
3.6 Forms 19
4.0 Occupational Medicine 21
4.1 Purpose 21
4.2 Definitions 21
4.3 Requirements 21
4.4 References 21
4.5 Forms 22
4.6 Exhibits 22
5.0 Industrial Hygiene 23
5.1 Purpose 23
5.2 Responsibility 23
5.3 General Requirements 24
5.4 Programs 25
5.4.1 Hearing Conservation 25
5.5 Sanitation 28
5.6 Temperature Extremes 29
5.6.1 Heat Stress 29
5.6.2 Working Conditions 29
5.6.3 Cold Stress 30
5.7 Lighting and Illumination 30
5.8 Ventilation 30
5.9 Lasers 30
5.10 Contractor Work Site Dust Control 31
5.11 Safety Showers and Eyewash Apparatus 31
5.12 Welding Hazards
5.13 References 32
6.0 Personal Protective Equipment 33
6.1 Purpose 33
6.2 Definitions 33
6.3 Requirements 33
6.3.1 Responsibility 33
6.3.2 General Requirements 33
6.3.3 Procedure 34

6.4 References 37
6.5 Records 38
6.6 Forms 38
7.0 Respiratory Protection 39
7.1 Purpose 39
7.2 Responsibility 39
7.3 Application 39
7.4 General Requirements 39
7.4.1 Assigned Protection Factors 39
7.4.2 Program Administration 40
7.4.3 Medical Examination 40
7.4.4 Training 40
7.4.5 Fit Testing 41
7.4.6 Exposure Assessment 41
7.4.7 Respirator Issue, Control, and Use 41
7.4.8 Cleaning, Maintenance, and Storage 42
7.5 Voluntary Respiratory Use Policy 42
7.5.1 Information for Employees Voluntarily Using Respirators 43
7.6 References 43
7.7 Records 43
8.0 Pre-job Planning 45
8.1 Purpose 45
8.2 Definitions 45
8.3 General Requirements 45
8.4 Hazard Assessment and Control Process 46
8.4.2 Job Safety Analysis Process 46
8.5 References 47
8.6 Records 47
8.7 Forms 48
9.0 Safety Orientations 49
9.1 Purpose 49
9.2 Responsibility 49
9.3 General Requirements 49
9.4 References 50
9.5 Records 50
9.6 Forms 50

10.0 Safety Meetings and Inspections 51
10.1 Purpose 51
10.2 Responsibility 51
10.3 General Requirements 51
10.4 References 52
10.5 Records 52
10.6 Forms 52
11.0 Hazard Communication 53
11.1 Purpose 53
11.2 Responsibility 53
11.3 General Requirements 53
11.4 Procedure 54
11.4.1 Hazard Determination 54
11.4.2 Labels and Other Forms of Warning 54
11.4.3 Employee Information and Training 55
11.5 References 56
11.6 Records 56
12.0 Event Investigating and Reporting 57
12.1 Purpose 57
12.2 Responsibilities 57
12.3 Recordkeeping Requirements 57
13.0 Housekeeping 59
13.1 Purpose 59
13.2 Responsibility 59
13.3 General Requirements 59
13.4 References 60
14.0 Chronic Beryllium Disease Prevention Program 61
14.1 Background Information 61
14.2 Applicability 61
14.3 Program Elements 62
14.3.1 Baseline Beryllium Inventory and Facilities List 62
14.3.2 Hazard Assessment 62
14.3.3 Exposure Monitoring 62
14.3.4 Exposure Risk Reduction and Minimization 63
14.3.5 Access Control and Signage 63
14.3.6 Protective Clothing and Equipment 64

14.3.7 Respiratory Protection 64
14.3.8 Release of Beryllium Contaminated Material 65
14.3.9 Housekeeping 65
14.3.10 Waste Disposal 66
14.3.11 Medical Surveillance, Consent, and Removal from Potential Exposure 66
14.3.12 Training 66
14.3.13 Recordkeeping 67
14.3.14 Performance Feedback 67
15.0 Demolition 69
15.1 Purpose 69
15.2 Responsibility 69
15.3 General Requirements 69
15.3.1 Preparation 69
15.3.2 Work Area Access 70
15.3.3 Use of Chutes 71
15.3.4 Removal of Walls, Masonry Sections, and Chimneys 71
15.3.5 Manual Removal of Floors 71
15.3.6 Removal of Walls, Floors, and Material with Equipment 71
15.3.7 Debris and Material Storage 72
15.3.8 Removal of Steel Construction 72
15.3.9 Mechanical Demolition 72
15.3.10 Use of Explosives for Demolition 73
15.4 References 73
16.0 Excavation 75
16.1 Purpose 75
16.2 Responsibility 75
16.3 General Requirements 75
16.3.1 Inspections 76
16.4 Procedure 78
16.4.1 Preparation 78
16.4.2 Hand Excavation 78
16.4.3 Protective Systems 79
16.5 References 80
16.6 Records 80
16.7 Form 81
16.8 Exhibit 81

17.0 Floor Openings, Open Sides, and Ramps 83
17.1 Purpose 83
17.2 Responsibility 83
17.3 General Requirements 83
17.3.1 Floor Openings 83
17.3.2 Open Sided Surfaces 84
17.3.3 Ramps 84
17.3.4 Fall Protection 85
17.4 References 85
18.0 Signs and Barricades 87
18.1 Purpose 87
18.2 Responsibility 87
18.3 General Requirements 87
18.4 Procedure 87
18.4.1 Construction Activities 87
18.4.2 Traffic Control 88
18.5 References 88
19.0 Confined Space Entry 89
19.1 Purpose 89
19.2 Responsibility 89
19.3 General Requirements 89
19.3.1 Identifying Confined Spaces 89
19.4 Classifying Confined Spaces 90
19.4.1 Working on Telecommunication or Electrical Equipment in Manholes or Underground Vaults 91
19.4.2 Non-Permit Confined Spaces 92
19.4.3 Preparing for Entry into Permit Required Confined Spaces 92
19.4.4 Multi-Employer Entries 93
19.4.5 Contractor Activity Interface 93
19.4.6 Unusual Conditions 94
19.4.7 Atmospheric Testing For Permit Required Confined Spaces 95
19.4.8 Applying Hazard Controls 95
19.4.9 Emergency Response and Rescue for Permit Required Confined Space 96
19.5 Training/Qualifications 97
19.6 References 98
19.7 Records 98

19.8 Attachments 98
20.0 Electrical Work Safety 105
20.1 Purpose 105
20.2 Definitions 105
20.3 Requirements 106
20.3.1 Training 106
20.3.2 Underground or Temporary Electrical Installations 107
20.3.3 Shock Analysis 107
20.3.4 Arc Flash Hazard Analysis 108
20.3.5 Working within the Limited Approach Boundary of Exposed Energized Electrical Parts 108
20.3.6 Working within the Restricted Approach Boundary of Exposed Energized Electrical Parts 109
20.3.7 Electrical Work Permit Process 110
20.3.8 Diagnostic Testing, and Commissioning on Live, Energized Parts 110
20.3.9 Personal Protective Equipment 112
20.3.10 Insulated/ Nonconductive Equipment Use 112
20.3.11 Measuring and Testing Instruments 112
20.3.12 Use of Ground Fault Circuit Interrupter (GFCI's) 113
20.3.13 Flexible Cords and Cables 113
20.3.14 Entering a Space 114
20.3.15 Blind Penetrations 114
20.3.16 National Electrical Code Compliance 117
20.3.17 Work Affecting Electrical Utilities Operations 117
20.3.18 Working Near Conduits (Flexible, PVC, EMT, Rigid and MC) 117
20.3.19 Working on Flexible metal/non-metallic conduits (performing electrical work): 118
20.4 References 119
20.5 Forms 119
20.6 Exhibits 119
21.0 Lockout and Tag out 121
21.1 Purpose 121
21.2 Definitions 123
21.3 Planning for Lockout and Tagout 123
21.3.1 General Requirements 123
21.3.2 Required Procedure 124
Evaluate the Potential for Unexpected Release of Hazardous Energy 124

21.4 Perform Authorized Worker Lockout and Tagout with Verbal Authorization 125
21.4.1 Applicability 125
21.4.2 Required Procedure 126
Authorize LOTO with Verbal Authorization 126
Inform Affected Workers of Work Being Performed 126
Shut Down the Component or System 126
Isolate the Hazardous Energy Source Based on Verbal Authorization 127
Install Authorized Worker LOTO with Verbal Authorization and Perform Safe-to-Work Check 127
Perform Work Under LOTO with Verbal Authorization 127
Remove Authorized Worker LOTO with Verbal Authorization and Inform Affected Workers 127
21.5 Perform Authorized Worker Lockout and Tagout with Written Instructions 128
21.5.1 Applicability 128
21.5.2 Required Procedure 128
Prepare Written Instructions, Authorize Shutdown and LOTO 128
Inform Affected Workers of Work Being Performed 128
Shut Down the Component or System 128
Isolate the Hazardous Energy Source Using Written Instructions 129
Install Authorized Worker LOTO Using Written Instructions and Perform Safe-to-Work Check 129
Perform Work Under LOTO with Written Instructions 129
Remove Authorized Worker LOTO with Written Instructions and Inform Affected Workers. 130
Review the Written Instruction for Completeness 130
21.6 Perform Controlling Organization Lockout and Tagout 130
21.6.1 Applicability 130
21.6.2 Required Procedure 130
Prepare Written Instructions, Authorize Shutdown and LOTO 130
Inform Affected Workers of Controlling Organization LOTO 131
Shut Down the Component or System 131
Isolate the Hazardous Energy Source for Controlling Organization LOTO 131
Apply the Controlling Organization LOTO 131
Install Authorized Worker LOTO Using Written Instructions and Perform Safe-to-Work Check 132
Perform Work Under LOTO with Written Instructions 132
Remove Authorized Worker LOTO Using Written Instructions 132
Clear Controlling Organization LOTO and Inform Affected Workers 133

Review Written Instructions for Completeness 133
21.7 Training 133
21.7.1 Required Procedure 133
21.8 References 134
21.8.1 Records 134
21.8.2 Forms 134
21.8.3 Exhibits 135
22.0 Hand and Power Tools 137
22.1 Purpose 137
22.2 Responsibility 137
22.3 General Requirements 137
22.4 Procedure 138
22.4.1 Hand-Tools 138
22.4.2 Electric Tools 138
22.4.3 Pneumatic Tools 138
22.4.4 Fuel Powered Tools 138
22.4.5 Hydraulic Powered Tools 139
22.4.6 Powder Actuated Tools 139
22.4.7 Abrasive Wheels and Tools 139
22.4.8 Woodworking Tools 140
22.5 References 140
23.0 Cutting, Welding, Grinding 141
23.1 Purpose 141
23.2 Definitions 141
23.3 Requirements 141
23.3.1 Working with Open Flame, Welding, Cutting, or Grinding 141
23.3.2 Fire Safety Precautions 142
23.3.3 Personal Protective Equipment 144
23.4 References 144
23.5 Records 145
23.6 Forms 145
24.0 Fall Protection 147
24.1 Purpose 147
24.2 Responsibility 147
24.3 General Requirements 147
24.3.1 Training Requirements 149

24.3.2 Fall Protection Work Plan 150
24.3.3 Fall Protection Equipment/Systems 150
24.4 References 152
24.5 Records 152
25.0 Scaffolds 153
25.1 Purpose 153
25.2 Responsibility 153
25.3 General Requirements 153
25.4 Procedure 154
25.5 Training 156
25.6 References 156
25.7 Records 157
25.8 Forms 157
25.9 Exhibit 157
26.0 Ladders 159
26.1 Purpose 159
26.2 Responsibility 159
26.3 General Requirements 159
26.4 Procedure 160
26.4.1 Use of Ladders 160
26.4.2 Care of Ladders 161
26.4.3 Training Requirements 161
26.5 References 161
26.6 Records 162
26.7 Forms 162
27.0 Aerial Lifts 163
27.1 Purpose 163
27.2 Responsibility 163
27.2.1 General Requirements 163
27.3 References 164
27.4 WAC 296-155, Safety Standards for Construction Work Records 164
28.0 Hoisting and Rigging 165
28.1 Sling Inspection 165
28.1.1 Initial Inspection 165
28.1.2 Frequent Inspection 165
28.1.3 Periodic Inspection 165

28.2 Portable A-Frame Assembly 165
28.3 Planning 166
28.4 References 166
28.5 PNNL Hoisting and Rigging Manual Records 166
29.0 Unbound Engineered Nanoparticles 167
29.1 Purpose 167
29.2 Applicability 168
29.3 Battelle Unbound Engineered Nanoparticle Tasks and Potential Exposures 168
29.4 Designated Nanomaterial Workers 168
29.5 Training 168
29.6 Exposure and Risk Assessment 169
29.7 Controls 169
29.8 Protective Clothing and Equipment 174
29.9 Respiratory Protection 174
29.10 Emissions Monitoring 174
29.11 Exposure Monitoring 174
29.12 Unbound Engineered Nanoparticle Emergencies 174
29.13 Unbound Engineered Nanoparticle Posting and Labeling 175
29.14 Release of Unbound Engineered Nanoparticle Contaminated Material 176
29.15 Housekeeping 176
29.16 Waste Disposal 176
30.0 Equipment and Motor Vehicle Operation 176
30.1 Purpose/Scope 176
30.2 Responsibility 176
30.3 Requirements 177
30.3.1 General Vehicle Use Safety Practices 177
30.3.2 Vehicles and Equipment 177
30.3.3 Control of Roadways during Contractor Activities 178
30.3.4 Accident Management 179
30.3.5 Training 179
30.4 References 179
30.5 Records 179
31.0 Respirable Crystalline Silica Control 179
31.1 Purpose 179
31.2 Responsibility 179
31.3 General Requirements 180

31.4 Exposure Assessment Requirements 180
31.4.1 Performance Option 180
31.4.2 Scheduled Monitoring Option 180
31.4.3 Reassessment of Exposures 181
31.5 Exposure Sampling Requirements 181
31.5.1 Methods of Sample Analysis 181
31.5.2 Employee Notifications 181
31.6 Engineering and Work Practice Controls 182
31.6.1 Required Exposure Control Methods 182
31.7 Restricted Areas Requirements 182
31.7.1 Written Plan to Restrict Access 182
31.8 Written Exposure Control Plan 182
31.9 Respiratory Protection 183
31.10 Housekeeping 183
31.11 Medical Surveillance 183
31.11.1 Initial Medical Surveillance 183
31.11.2 Periodic Examinations 184
31.12 Information provided to the PLHCP 184
31.12.1 PLHCP Written Medical Report for the Employee 184
31.12.2 PLHCP's Written Medical Opinion for PNNL 185
31.12.3 Additional Examinations 185
31.12.4 Communication of Hazards to Employees 185
31.13 Recordkeeping 186
31.13.1 Air Monitoring Data 186
31.13.2 Objective Data 186
31.13.3 Medical Surveillance 187
31.14 References 187
Appendix A: Definitions 177
Appendix B: Exhibits 189
Appendix C: Forms 191

1.0 Introduction

The Contractor Environment, Safety & Health (CESH) Manual (hereafter referred to as "this Manual") has been developed to identify the minimum requirements for Contractors and Subcontractors performing industrial, construction, service, or maintenance work for Battelle Memorial Institute (Battelle) in Battelle and U.S. Department of Energy (DOE) facilities.

In this Manual, Contractor means the person or organization entering into a contract with Battelle.

Subcontractor means any Subcontractor or supplier at any tier who supplies goods and/or services to the Contractor in connection with the Contractor's obligation under the same contract.

This Manual contains excerpts from, and references to, numerous regulations, codes, and standards, including the following documents:

- U.S. Department of Energy (DOE) Orders
- Occupational Safety and Health Administration (OSHA) 29 Code Of Federal Regulations (CFR) 1910 and CFR 1926
- Washington Industrial Safety and Health Act (WISHA) WAC 296-155
- American National Standards Institute (ANSI)
- National Fire Protection Association (NFPA).

This Manual does not state the requirements of these regulations, codes, and standards in their entirety.

Each Contractor/Subcontractor is responsible for compliance with ALL applicable requirements that govern their work at Battelle facilities, including any consensus standards incorporated therein by reference.

This Manual also contains sample forms that exhibit the minimum information required for documentation. Contractor/Subcontractors may use these forms or comparable equivalents.

In addition, Subcontractors may be asked to prepare certain job-specific submittals (e.g., an asbestos work plan or lockout and tag out procedure) for review by Battelle.

1.1 Integrated Safety Management System

The Contractor must use a safety management system that conforms to Pacific Northwest National Laboratory's (PNNL) Integrated Safety Management (ISM) requirements. An effective ISM plan establishes a single system that integrates requirements into the work planning and execution process to protect the workers, public, and the environment. ISM provides the mechanisms for increasing worker involvement in work planning, including hazard and environmental impact identification, analysis, and control; work execution; and feedback/improvement processes.

ISM can be framed in the following logical progression of seven topics:

- Define the scope of work in a manner that effectively allocates resources to address safety, programmatic, and operational considerations.
- Analyze the hazards associated with the work.
- Develop/implement hazards controls, evaluating hazards per an agreed-upon set of safety standards and requirements. Administrative and engineering controls that mitigate hazards shall be tailored to the work being performed.
- Perform work under the conditions and requirements established and agreed-upon.
- Provide feedback and improvement on the adequacy of controls, opportunities for improving the planning and execution of the work.
- Clearly define roles and responsibilities for all levels within Battelle and its Contractors.
- Competence must be commensurate with responsibilities for all personnel possessing the experience, knowledge, skills, and abilities that are necessary to discharge their defined responsibilities.

Contractor program flexibility is understood and encouraged as long as program tenets adequately address the spirit and intent of the ISM provisions.

2.0 Program Policy

2.1 Purpose

This procedure provides requirements for identifying key aspects of contractor safety that provide all employees a safe and healthful workplace while also protecting the environment in compliance with Occupational Safety and Health Act (OSHA) and Washington Industrial Safety and Health Act (WISHA) standards. The provisions of this procedure apply to work activities associated with tasks performed by Battelle Contractors and Subcontractors.

2.2 Definitions

The following list identifies terms selected and defined for this procedure. The complete definitions can be found in Appendix A.

- Competent Person
- Personal Protection Equipment.

2.3 Requirements

The provisions for program policy at project locations include:

- responsibility
- contractor/subcontractor responsibilities
- general requirements
- safety requirements
- safety rights
- safety responsibilities
- safety bulletin boards
- adverse weather conditions

2.3.1 Responsibility

The Contractor has overall accountability for the safety of their project. The Contractor allocates the proper resources necessary to execute all safety-related tasks. The Contractor is responsible for implementing all required safety-related codes and contract/subcontract requirements.

The Contractor will be fully accountable for safety and health related activities within their purview, including the following activities:

- implementing this procedure (or Contractor’s own procedure when found acceptable)

- pre-planning work effectively to identify potential hazards and take appropriate steps to control/mitigate/eliminate these hazards
- orienting employees to the plan and Battelle-applicable requirements
- training employees in safe-work practices
- documenting all training on a Training Attendance Record
- providing each employee a place of employment which is as free as possible from recognized hazards that are likely to cause harm
- providing required personal protection equipment (PPE), making sure employees know how to use the equipment and enforcing its use in the field
- monitoring the workplace for unsafe conditions and taking steps to eliminate them
- taking immediate action to correct unsafe conditions, acts, and other deficiencies identified during inspections
- providing a Competent Person to oversee all activities
- providing apprentice craftsmen with appropriate field supervision, safety training and hands-on experience prior to assigning work activities

All employees shall be responsible for carrying out their assigned work in a safe manner to protect themselves and others from undue hazards and to prevent damage to property and the environment. All employees shall be responsible for:

- Actively complying with applicable safety standards and reporting promptly to their supervisors any condition which may lead to a violation of these standards or any other unsafe condition.
- Correcting unsafe conditions (within their ability and authority).
- Reporting emergencies and responding to warning signals which may be activated.
- Reporting all occupational injuries and illnesses immediately to their immediate supervisor.

2.3.2 Contractor/Subcontractor Responsibilities

The following summarizes the responsibilities of the Prime Contractor and any Subcontractors hired by the Contractor in the course of this project.

Contractor Responsibilities

- Immediately rectify any and all conditions that are found to be unsafe and/or unsanitary.
- Report any unsafe conditions to project personnel according to the Battelle contract.
- A follow-up report shall be issued detailing the action taken to rectify any and all inadequacies.
- Coordination of activities with subcontractors shall take place so work will proceed in accordance with applicable safety requirements.

- Project personnel and Subcontractors shall be notified of any recognized hazards, potential problem areas, and safety requirements.
- Coordination of all pertinent certifications, training, and recordkeeping shall take place and their accessibility for review made available.

Subcontractor Responsibilities

- Subcontractors shall retain full responsibility for the safety of their personnel.
- Review possible safety hazards, construction activities, etc., with their personnel.
- Make regular inspections of hand tools and equipment used in all phases of work activities.
- Immediately correct any safety deficiencies when identified and/or notified.
- Immediately inform the Contractor's safety representative of any and all unsafe conditions or activities.

Note: There must be an open and continuous line of communication between the Contractor and Subcontractor to discuss any unsafe acts or conditions that may arise during the project.

2.3.3 General Requirements

The Contractor shall take all reasonable precautions in the performance of work to protect the health and safety of employees, members of the public, environment, and Battelle-owned or operated facilities.

The contractor shall:

- Allocate sufficient resources to implement this safety program and specific contract requirements.
- Develop, implement, and/or adhere to job safety analyses (JSA) or other pre-job planning documents.
- Establish safety flow-down requirements in all subcontracts.
- Coordinate and plan pre-job planning with Subcontractors, field supervisors, 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.
- Designate (in writing) a Competent Person in the following areas (as necessary per the contract scope of work):
    - Ladders
    - Lead
    - Excavation/Trenching
    - Asbestos
    - Scaffolds
    - Demolition
    - Fall Protection

- Fire Protection
- Safety Monitor
- Aerial Lift Trainer
- Forklift Trainer/Evaluator
- Rigging Evaluator
- Silica
- Electrical (Assured Grounding Program)
- Steel Erection

2.3.4 Safety Requirements

Contractors working at Battelle-owned or operated facilities are expected to take actions that foster a safe working environment.

Each worker has the right, without fear of retaliation, to raise concerns about work related issues. Battelle will not tolerate retaliation against workers for raising concerns in good faith.

Supervisors must protect staff from harassment, retaliation, or disciplinary action that is based on staff having exercised their safety rights.

Workers are informed of their rights and responsibilities by appropriate means, including access to an appropriate DOE Occupational Safety and Health Protection poster in their workplace (see Section 6.0 below).

2.3.5 Safety Rights

Workers have these rights:

- To obtain their personal records on injury, illness, exposure, and medical documentation.
- To review their company's summary information on injury and illness. This information is available through their supervisor and the OSHA Form 300 summary, which is posted in each building during the month of February.
- To obtain and review their radiological exposure information. This information is available through PNNL Field Dosimetry.
- To be represented during regulatory workplace safety inspections (i.e., inspections by DOE or Washington State Department of Labor and Industries, Division of Occupational Safety and Health). Workers may contact their managers if they wish to request the name of their worker representative or participate in the workplace inspection as a worker representative.
- To have access to DOE worker protection publications, DOE-prescribed standards, PNNL's own protection standards, and their company's procedures applicable to the workplace. Workers should contact their supervisor for more information.
- To observe monitoring or measuring of hazardous agents to which the staff member is exposed and have access to the results of their exposure monitoring. Workers should contact their supervisor for more information.

- To be notified when monitoring results indicate they were overexposed to hazardous materials. Workers may contact their supervisor for more information.
- To request and receive results of inspections and accident investigations. Workers should contact their supervisor for more information.
- To stop work immediately, without fear of reprisal, when convinced a situation exists that places themselves, their coworkers, or the environment in danger.
- To address unsafe working conditions by preventing, avoiding, and reporting them.

2.3.6 Safety Responsibilities

Workers have these responsibilities:

- To conduct only those activities that the manager has approved.
- To use Battelle facilities, equipment, and tools only for the purposes for which they were designed.
- To stop work immediately without fear of retaliation and to notify your manager when you are convinced a situation exists that places you, coworkers, or the environment in danger.
- To follow technical work documents and consult Material Safety Data Sheets associated with the work being done.
- To observe requirements, procedures, instructions, signs, postings, and warning signals.
- To know emergency plans and procedures for your work area.
- To become familiar with potential hazards associated with your work and work area and the measures taken to control the hazards.
- To use the required and appropriate personal protective clothing and equipment.
- To report near-accidents or incidents to your manager before proceeding with the work.
- To report emergencies or work-related accidents, injuries, or illness promptly to your manager.
- To report unsafe conditions and hazards to your manager.
- To be aware of your current exposure status and the applicable control levels and limits. Workers should contact their supervisor for more information.
- To warn fellow staff members about hazards in your work area and point out the controls that are in place.
- To report noncompliance with ES&H requirements to your supervisor.
- To participate in required medical and biological monitoring programs. Workers may contact their supervisor for more information.

2.3.7 Safety Bulletin Boards

The contractor is responsible for installing and maintaining a safety bulletin board (when eight or more persons are working at a jobsite) at the location where the majority of employees report to work.

Mobile crews shall be advised of the location of the nearest bulletin board.

Employees 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
- DOE Occupational Safety and Health Complaint Form 5480.4
- Citations and notices as appropriate
- OSHA 300 form during February 1 to March 1
- Battelle-furnished safety bulletins and publications
- Your Rights as a Worker (poster)
- Washington State Industrial Notice for Employee's Form II P242-191-000.

Suggested items to be posted include:

- Safety & Health posters.
- Minutes of safety meetings.
- Information on accidents.
- Hazard communication information.
- Lessons Learned.

2.3.8 Adverse Weather Conditions

To keep workers safe, work or portions of work may be temporarily and incrementally shut down due to high winds, lightning, extreme heat, or other inclement weather as determined by PNNL. The Contractor shall issue the following warnings via radio system, public address announcement, or in person. The Contractor shall make sure that Subcontractor personnel are apprised of the warnings and take the required actions as stated below.

- Sustained winds greater than 15 mph – crane operation shall be closely evaluated for necessity.
- Sustained winds greater than 25 mph and/or gusts greater than 40 mph – all crane operations must cease and be secured. All loose outdoor materials shall be secured. Work on roofs and elevated surfaces (roof, scaffolds, aerial lift, etc) shall be scrutinized before continuing.

- Sustained winds greater than 50 mph – outdoor activities shall be curtailed and limited to those approved by Battelle and Contractor supervision.

Safety Guidance for Lightning/Thunderstorm Activity within 30 Miles of the Hanford Site

The Hanford Meteorological Station (373-2716) or the National Weather Service Forecast Office, Pendleton, Oregon (541 276-4493), can be used to obtain hazardous weather information. Contractor personnel shall not work on roofs or elevated surfaces during these threats. Personnel shall stay away from construction equipment, such as drill rigs, cranes, boom trucks, or aerial lifts. Employ the "30-30 Rule" to know when to seek a safer location. The "30-30 Rule" states that when you see lightning, count the time until you hear thunder. If this time is 30 seconds or less, go immediately to a safe location. These protective actions shall remain in place until Battelle or the Contractor cancels the warning. Again, the Hanford Meteorological Station or the National Weather Service should be used to verify the storm has dissipated or moved on past 30 miles.

2.4 References

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

WAC 296-155, Safety Standards for Construction Work

2.5 Records

Training Attendance Record

Competent Person Designation

2.6 Forms

Competent Person Designation

Training Attendance Record

2.7 Exhibits

Job Safety and Health Protection poster

Right to a Safe and Healthful Workplace poster

Worker Protection for DOE Contractor Employees poster

3.0 Environmental Protection Plan

3.1 Purpose

This section provides requirements for environmental protection and management of project waste from construction and demolition activities in compliance with Occupational Safety and Health Act (OSHA) and Washington Industrial Safety and Health Act (WISHA) standards. The provisions of this procedure apply to work activities associated with tasks performed by Battelle subcontractors.

3.2 Definitions

The following list identifies terms selected and defined for this section. Complete definitions can be found in Appendix A.

- excavation
- hazardous material
- cultural resource
- satellite accumulation area (SAA)
- containers
- secondary containment
- 90-day accumulation area
- waste minimization and pollution prevention
- asbestos

3.3 Requirements

Environmental protection and management program elements include:

- cultural and biological resource protection
- excavation
- erosion control
- dust control
- hazardous material storage
- waste accumulation and inspection
- waste disposal
- spill control and prevention
- liquid effluent management
- waste minimization and pollution prevention (P2) program

- equipment and waste transportation
- miscellaneous waste

3.3.1 Cultural and Biological Resource Protection

Battelle shall perform site reviews for State and federally protected wildlife, plant, and migratory bird species (e.g., bank swallows) prior to initiation of work activities that have the potential to disturb these species or their habitat whether native or man-made (e.g., equipment, facilities, or soil with vertical banks). The Battelle Construction Manager (CM) will convey to the contractor any restrictions that are to be implemented, resulting from the initial review, to protect these species on the site during the initial work activities and throughout the term of the project. In order to prevent disturbance of priority animal habitats and protected plant and animal species, the contractor shall comply with the following:

1. If any nesting birds (if not a nest, a pair of birds of the same species or a single bird that will not leave the area when disturbed) are encountered, or defensive behaviors (such as flying at workers or strident vocalizations) are observed, workers are advised to stop work and notify the Battelle CM.
2. Before disturbing native vegetation verify authorization to proceed with the Battelle CM.

3.3.2 Excavation

Excavation may include any operation in which earth, rock, or other material in the ground (below existing grade) is moved, removed, or otherwise displaced by means or use of any hand tools, mechanical equipment, or explosives. An approval from the Battelle POC is required prior to any excavation activities. The approval processes are necessary to prevent injury from accidental contact with utilities, to protect sensitive cultural and biological resources, and to meet U.S. Department of Energy and state law requirements.

Excavated earth (excluding stumps and wood) should be placed back into the original excavations or used as fill at the construction site. However, for work that will be conducted on or near the water, an approval from the Battelle POC is required before replacement of dredged materials. Approval from the Battelle POC is also required prior to disposal of excavated earth that cannot be used for fill.

3.3.3 Erosion Control

Erosion controls should be in place and approved by the Battelle POC prior to any land disturbing activities.

Battelle uses best management practices as described in the Washington State Department of Ecology Stormwater Management Manual for Eastern Washington and summarized as follows:

- Construction vehicle access and exit shall be limited to one route if possible, and access points shall be stabilized to minimize the tracking of sediments onto roads.
- Design, construct, and cut and fill slopes in a manner that minimizes erosion through terracing, reducing slope steepness, surface roughening, or other methods.

- Perform erosion inspection and sediment controls on a weekly schedule, prior to expected storm events and after each heavy rainfall event.
- Where appropriate, provide temporary or permanent modifications to surface terrain gradient (soil or crushed stone berms, sediment retention basins, etc.) in order to minimize the flow of stormwater into or out of excavated or otherwise disturbed areas.
- All erosion and sediment control measures should be maintained throughout the course of the project and removed at completion of project. Appropriate measures should be taken to return the area to its previous state. Maintenance should include, but not be limited, to the removal of accumulated sediment and repairs and/or replacement of storm damaged or otherwise deteriorated structures.
- All disturbed areas shall be temporarily or permanently stabilized as soon as practicable to minimize erosion from rain and wind. Methods of soil stabilization include mulching, using nets or plastic covers, sodding, and surface roughening.

3.3.4 Dust Control

Dust generated by construction operations needs to be minimized by water or other methods approved by the Battelle POC. Battelle-preferred best practices, consistent with the Washington State Department of Ecology Stormwater Management Manual for Eastern Washington, are provided below.

- Vegetate or mulch areas that will not receive vehicle traffic. Apply gravel or landscaping rock in areas where planting, mulching, or paving is impractical.
- Clear vegetation only from those areas where you will work right away.
- Apply water until surface is wet. Repeat as needed. Water applied to the construction site for dust control must not leave the site as surface runoff.
- Cover piles with wind-impervious fabric.
- Use of any chemical dust suppressant must be reviewed and approved by the Battelle POC. Follow the manufacturer's instructions and cautions regarding handling and application.

3.3.5 Hazardous Material Storage

Hazardous materials and chemical products at the project site should be managed in accordance with manufacturer instructions, safety and fire codes, and general safe practices to prevent accidental discharge to the environment. This includes closing containers when not in use, using secondary containment when possible, and storing materials inside or under shelter. Materials stored outside shall be stored in a manner to prevent discharge to a stormwater management device (e.g., dry well, catch basin) or to the ground or surface water.

3.3.6 Waste Accumulation and Inspection

In the event that a satellite accumulation area (SAA) or a 90-day accumulation area is needed to facilitate appropriate waste management, the Battelle POC shall be notified to implement Battelle procedures and requirements. Descriptions provided below are provided as Battelle-preferred best management practices

for the accumulation and management of dangerous wastes within a SAA or a 90-day accumulation area. The applicability of additional requirements is evaluated and addressed in project planning packages or other project specifications on a case-by-case basis.

SAA Requirements for Dangerous Waste

- The SAA shall be at, or near, the point of generation.
- Containers and liners used for accumulation shall be compatible with waste.
- Accumulation containers shall be clearly marked per applicable requirements.
- Containers shall be kept securely closed so that spillage will not occur if the container is tipped over unless waste is being added to the container.
- SAA containers must be kept secured at all times (e.g., with a locking device) or under constant control of the process operator.
- No more than 55 gallons of dangerous waste or 1 quart of acutely hazardous waste may be accumulated per waste stream at one time.
- When accumulation limits have been achieved or the generation of that waste stream is complete, whichever is earlier, containers shall be marked with accumulation date and moved to appropriate 90-day accumulation area within three calendar days.

90-Day Accumulation Area Requirements for Dangerous Waste

- Containers and liners shall be compatible with the type of waste that will be stored in them.
- Containers shall be in good condition and closed securely.
- Waste containers shall be labeled and marked in accordance with applicable requirements including the words "HAZARDOUS WASTE," the accumulation start date, and the primary risks. In the case of mixed or radioactive wastes, the containers shall be marked with the additional labeling of "CAUTION RADIOACTIVE MATERIAL."
- Incompatible wastes shall be separated by dike, berm, wall, or other device.
- Secondary containment must be provided for all 90-day accumulation areas.
- Waste shall be stored with a minimum of 30 inches between each aisle of container rows, and rows of containers shall be no more than two wide.

Inspection of Dangerous Waste

- Inspect all 90-day accumulation areas and containers weekly.
- SAAs shall be inspected, at the minimum, on a monthly basis.

Non-hazardous Waste Management

- Accumulate non-hazardous waste in containers, or as otherwise appropriate, to prevent nuisance, contamination, dispersal by wind or precipitation, or visual blight.

- Arrange for periodic collection of non-hazardous waste to prevent excessive accumulation of non-hazardous waste.
- See the Waste Minimization and Pollution Prevention section below for recyclable materials management.

3.3.7 Waste Disposal

Dangerous waste will be transferred to Battelle for subsequent management at project expense, unless other arrangements are authorized by Battelle in advance. All non-dangerous waste should be recycled, if possible, or sent to a Battelle-approved landfill. A copy of the landfill waste disposal record shall be provided to the Battelle POC for documentation purposes. No waste is to be disposed of on Battelle property unless authorized by Battelle in advance.

3.3.8 Spill Control

A spill kit should be available at the job site to absorb spilled materials and properly manage spill cleanup residues. At a minimum, the spill kit should contain an appropriately sized container with lid, a spill kit identification sign on the container, absorbent pads/pigs, absorbents, shovels, rags, gloves, and safety goggles.

In the event of a spill or leak, immediately report releases of any materials, such as oil, fuel, solvents, paints, coolants, acids, caustics, or equipment leaks, to the Battelle POC. Call 375-2400 if the Battelle POC is not immediately available. Contain spills as much as possible without compromising personnel safety.

Do not allow liquids, such as gasoline, diesel fuel, lubricating oil, or antifreeze, to enter the sanitary, process, or storm sewer systems, waterways, drainage ditches, or the ground. Use due caution when operating oil-bearing equipment near such features. Where necessary, implement appropriate control measures, including but not limited to, the use of physical barriers (plastic or tarps, berms, etc.), secondary containment, and/or absorbent materials to capture leaked or splattered contamination.

3.3.9 Liquid Effluent Management

Prior approval from the Battelle POC is needed for all liquid effluent discharged to the groundwater, sanitary sewer, process sewer, storm sewer or surface water. Battelle-preferred best management practices for common construction wastewater are summarized below.

Concrete or Asphalt Wastewater

- Concrete truck chutes, pumps, and internals shall be washed out only into formed areas awaiting installation of concrete or asphalt.
- Unused concrete remaining in the truck or in the pump shall be returned to the originating batch plant for recycling. Concrete remaining from smaller projects shall be reused, recycled, or disposed of in a dumpster.

- Hand tools, including, but not limited to, screeds, shovels, rakes, floats, trowels, and wheelbarrows, shall be washed off only into formed areas awaiting installation of concrete or asphalt.
- Equipment that cannot be easily moved, such as concrete pavers, shall only be washed in areas that do not directly drain to natural or constructed stormwater conveyances.
- When no formed areas are available, wash water and leftover product shall be contained in a lined container. Contained concrete shall be disposed of in a manner that does not violate groundwater or surface water quality standards.
- Discharge to a storm sewer, surface water, or sanitary sewer is prohibited.

Saw-cutting and Surfacing Operation

All material generated as part of saw-cutting or surfacing operation shall be collected and disposed of a Battelle-approved landfill. (Note: Saw-cutting and surfacing operations include, but are not limited to, sawing, coring, grinding, roughening, or hydro-demolition). A summary of Battelle-preferred best management practices are provided below:

- Slurry and cuttings should be vacuumed and collected during cutting and surfacing operations, when possible.
- Slurry and cuttings should not remain on permanent concrete or asphalt pavement overnight.
- Slurry and cuttings should not drain to any natural or constructed drainage conveyance including storm sewers, catch basins, or other underground injection control wells, trenches, or ditches.
- Process water that is generated during hydro-demolition, surface roughening, or similar operations should be collected and should not drain to any natural or constructed drainage conveyance.
- Collected slurry, cutting, or process water can also be placed in a “lined holding pond” for evaporation. The dried residual material can be discarded as non-regulated construction material.
- Cleaning waste material and demolition debris should be handled and disposed of in a manner that does not cause contamination to water.

3.3.10 Waste Minimization and Pollution Prevention (P2) Program

Waste minimization and pollution prevention opportunities and requirements should be evaluated and addressed on project specifications or job planning packages on a case-by-case basis. Recyclable items should be properly collected, packaged and transported to designated locations as directed by the Battelle POC. Typical recyclable items managed on Battelle sites are:

- aluminum
- cardboard
- scrap metal
- aerosol cans
- batteries
- scrap wood

- fluorescent tubes and lamps
- printed circuit boards
- used oil

Other recyclable items, such as asphalt and concrete from construction or demolition activities, are not routinely collected at Battelle sites. However, depending on project volume, requirements for recycling of these items will be addressed in the specification.

Non-recyclable construction debris will be sent to a Battelle-approved landfill, such as the City of Richland landfill in Richland, Washington, the Roosevelt Landfill located in Roosevelt, Washington, the Waste Management landfill located in Arlington, Oregon, or the Finley Buttes Regional Landfill located in Boardman, Oregon. Prior written approval shall be obtained from Battelle before using a landfill other than those listed. A copy of the landfill disposal shall be provided to the Battelle POC for documentation purposes.

3.3.11 Equipment and Waste Transportation

Prior to transporting operational equipment, drain, plug, and tag it with the appropriate label or tags. In the case of waste transport, use appropriate containment, such as covering open trucks with plastic or tarps. Vehicles shall have valid Department of Transportation registration, and the drivers shall have a valid commercial driver's license.

3.3.12 Miscellaneous Wastes

Asbestos

When applicable, a Notice of Intent (NOI) should be submitted to Benton County Air Authority for their review and approval at least 10 days before performing asbestos abatement work. Asbestos wastes should be placed in two sealed impermeable bags or containers and labeled with the warning:

DANGER
CONTAINS ASBESTOS FIBERS AVOID
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST
AVOID CREATING DUST

Asbestos waste must be sent to a Battelle-approved landfill, such as the City of Richland landfill in Richland, Washington (if non-friable and meeting City of Richland landfill waste acceptance criteria), the Waste Management landfill located on Graham Road in Richland, Washington, the Finley Buttes Regional Landfill located in Boardman, Oregon, the Roosevelt Landfill located in Roosevelt, Washington, or the Waste Management landfill located in Arlington, Oregon. Prior written approval shall be obtained from Battelle before using a landfill other than those listed. A copy of the landfill asbestos disposal shall be provided to the Battelle POC for documentation purposes.

Beryllium

Package beryllium, beryllium compounds, or beryllium-contaminated waste materials, including protective gloves, cleaning materials, equipment, waste, scrap, or debris, in sealed, impermeable containers and label with this warning:

DANGER
CONTAMINATED WITH BERYLLIUM
DO NOT REMOVE DUST BY BLOWING OR SHAKING
CANCER AND LUNG DISEASE HAZARD

Beryllium waste must be sent to a Battelle-approved landfill, such as the City of Richland landfill in Richland, Washington (if meeting City of Richland landfill waste acceptance criteria), the Waste Management landfill located on Graham Road in Richland, Washington, the Finley Buttes Regional Landfill located in Boardman, Oregon, the Roosevelt Landfill located in Roosevelt, Washington, or the Waste Management landfill located in Arlington, Oregon.

If any amount of beryllium in powder form is discovered, the Environmental Protection (EP) Regulatory Programs Subject Matter Expert (SME) must be contacted immediately.

PCB (Polychlorinated Biphenyls)

Package PCB, PCB compounds, or PCB-contaminated waste materials, including protective gloves, cleaning materials, equipment, waste, scrap, or debris, in sealed, impermeable containers and mark with a PCB warning label. PCB waste must be sent to a Battelle-approved landfill.

If PCB in the following compositions or concentrations is discovered, the EP Regulatory Programs SME must be contacted immediately:

- Solids at concentrations > 50 ppm
- Organic liquid PCBs at $\geq$ 2 ppm
- Inorganic liquid PCBs at $\geq$ .5 ppb

3.4 References

29 CFR 1926.59, Hazard Communication

40 CFR 261, Identification and Listing of Hazardous Waste

40 CFR 279, Standards for the Management of Used Oil

40 CFR 761, Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions

49 CFR 172, Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

49 CFR 173, Shippers-General Requirements for Shipments and Packaging

WAC 173-303, Dangerous Waste Regulations

WAC 173-226, Waste Discharge General Permit Program

Benton County Clean Air Authority, Regulation 1

16 USC 5A, Protection and Conservation of Wildlife

16 USC 7, Protection of Migratory Game and Insectivorous Birds

Stormwater Management Manual for Eastern Washington, Chapter 7 – Construction Stormwater Pollution Prevention, Washington Department of Ecology, September 2004, publication number 03-10-038C.

3.5 Records

None

3.6 Forms

None

4.0 Occupational Medicine

4.1 Purpose

The purpose of this section is to define the requirements for contractor occupational medicine and to ensure compliance with 10 CFR 851, *Worker Safety and Health Program*, Occupational Safety and Health Act (OSHA), or Washington Industrial Safety and Health Act (WISHA) requirements. The provisions of this procedure apply to work activities associated with tasks performed by Battelle and its Contractors and Subcontractors.

4.2 Definitions

None

4.3 Requirements

Contractors will establish and provide comprehensive occupational medicine services to workers who are enrolled in a medical or exposure monitoring program required by federal, state, or local regulation.

Occupational medical service providers are required to be under the direction of a graduate of a school of medicine or osteopathy who is licensed for the practice of medicine in the state in which the site is located. Other medical service personnel who provide occupational medical services must also be licensed, registered, or certified as required by federal or state law where employed.

The Contractor is responsible for assuring that their occupational medical provider maintains medical records associated with the program in a manner meeting requirements for the confidentiality of medical records.

The following health evaluations must be conducted when determined necessary by Battelle or the occupational medicine provider:

- Medical monitoring or qualification-based medical evaluations required by regulations and standards.
- Medical examinations to evaluate an employee's injuries and/or illnesses to determine work-relatedness, medical restrictions, and referral for definitive care or rehabilitation.
- A return-to-work evaluation for work-related injury or illness or any injury- or illness-related absence of five or more consecutive workdays.

4.4 References

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

4.5 Forms

PNNL Contractor Employee Job Task Analysis Form

4.6 Exhibits

Federal and State Medical Surveillance Requirements

5.0 Industrial Hygiene

5.1 Purpose

This section defines the requirements and responsibilities for recognizing, evaluating, and controlling employee exposures to chemical, physical, and biological agents encountered during construction activities.

The Industrial Hygiene (IH) program includes the following elements (as applicable):

- hearing conservation
- hazardous materials
- sanitation
- temperature extremes
- lighting and illumination
- ventilation
- ionizing radiation
- lasers
- contractor work site dust control
- Silica

5.2 Responsibility

The Contractor shall be responsible for reviewing the worksites for compliance with this section, and for providing assistance on industrial hygiene matters.

The Contractor shall be responsible for implementing an effective IH program that:

- 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.

Employees shall be responsible for:

- Complying with the provisions of this procedure.
- Using all prescribed engineering control devices and personal protective equipment.

- Reporting unsafe conditions or suspected exposures to harmful agents to their supervisor.

5.3 General Requirements

Identification of Health Hazards

The Contractor shall identify and document, as part of the JSA, existing and potential physical, chemical, and biological health hazards.

ALARA

In the pre-job planning process, all exposures or potential exposures to employees shall be controlled so that levels are maintained As Low As Reasonably Achievable (ALARA). ALARA is an ongoing program that promotes high levels of employee recognition and understanding about safe practices and principles.

The Contractor will make every attempt to substitute less hazardous substances for any carcinogenic material.

Control Measures

This program requires that controls be implemented to eliminate or reduce employee exposures to inhalation, ingestion, absorption, or contact with any material or substance at the concentration above those specified in the American Conference of Governmental Industrial Hygienist, "Threshold Limit Values for Chemical Substances and Physical Agents." Administrative and/or engineering controls shall be used first, if feasible. Personal protective equipment may be used in emergency situations for short-term exposures or where other methods of control have not proven feasible or available. These devices shall be used in the interim while other controls are being implemented. Gloves, splash protection coveralls, and other kinds of non-respiratory-type personal protective equipment may be routinely used.

Periodic Review

The employer shall perform periodic industrial hygiene surveys, inspections, evaluations, and surveillances of work activities. Employees shall have access to the results of these reviews.

Control of Hazardous Materials

Hazardous material exposures shall be maintained at ALARA levels wherever possible. Because of the broad definition of hazardous, a chemical shall not be used in any situation unless an individual has information indicating how the material can be used safely. See the Appendix A, **Error! Reference source not found.** for what constitutes a hazardous substance.

Bloodborne Pathogens

Employees who may reasonably be expected to be exposed to blood or other body fluids shall comply with OSHA/WISHA 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.” (Disposal of medical waste during first aid shall be in labeled red bags, and may be in the same manner as normal refuse.)

5.4 Programs

5.4.1 Hearing Conservation

5.4.1.1 Engineering Controls

Every feasible effort shall be made to “engineer out” noise exposures greater than or equal to an 8-hr time-weighted-average (TWA) sound level of 85 decibels (dBA) on the A-weighted scale. When controls are not feasible or fail to reduce noise to acceptable levels, hearing protection shall be required.

When work is to be performed in an environment that is suspected to exceed the allowable noise exposure as identified in the JSA, mandatory hearing protection requirements shall be implemented.

5.4.1.2 Noise Evaluation

The Contractor shall survey and evaluate suspected high noise areas and work efforts.

Employees may observe surveys and evaluations, and the results shall be made available to employees.

Engineering control measures will be recommended when employee exposures exceed 85 dBA as an 8-hr TWA, or over 115 dBA maximum, or if impulse noise exceeds the standard.

Maximum allowable noise exposure shall not exceed the threshold limit values shown in American Conference of Governmental Industrial Hygiene, TLVs® and BEIs®, Table 1 TLVs® for Noise.

When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. Exposure to different levels for various periods of time shall be computed according to the formula set:

F(e)=(T(1)divided by L(1))+(T(2)divided by L(2))+ ... + (T(n) divided by L(n)) where:

F(e) = The equivalent noise exposure factor.
T = The period of noise exposure at any essentially constant level.
L = The duration of the permissible noise exposure at the constant level (from Table D-2).

If the value of F(e) exceeds unity (1) the exposure exceeds permissible levels.

5.4.1.3 Hearing Conservation

Employees who are routinely exposed to noise levels in excess of 85 dBA (based on an 8-hr TWA) shall be included in a hearing conservation program meeting the requirements of OSHA 29 CFR 1910.95 or WAC 296-817.

Noise exposure shall be determined without regard to hearing protection.

Audiometric testing shall be performed in accordance with OSHA/WISHA requirements. The baseline audiogram must be conducted within six months of confirmation of an exposure equal to or exceeding the 85dB action level. Audiograms shall be performed annually. Audiometric test records shall be retained by the Contractor. Employees shall be given access to and notification of testing results. Annual in-depth training on hearing conservation shall be provided. The training shall include:

- Type of hearing protector required for each specific activity/area.
- Proper method of donning and fitting hearing protectors.
- Capabilities and limitations of hearing protectors.
- Care of hearing protectors.
- Effects of noise on hearing.
- Purpose of audiometric testing procedures.
- Explanation of audiometric testing procedures.
- Employee's right of access to records.

5.4.1.4 Hearing Protectors

The selection of the proper hearing protectors shall be based on the:

- Nature of the operation.
- Period of time for which hearing protectors must be worn.
- Activities of workers in the surrounding area.
- Fit of the hearing protector device to the employee.

The Contractor, prior to the commencement of work, shall determine the proper type of hearing protection.

Hearing protectors shall be inspected by the wearer and shall be replaced if not in proper working condition.

Supervisory personnel shall periodically monitor worksites where hearing protection is required to verify that hearing protectors are being worn.

Hearing protectors must reduce the decibel level to the internal ear to a level below an 8-hr TWA of 85 dBA. This attenuation is determined as follows:

- Identify the noise level at the ear (e.g., 95 dBA).
- Subtract the noise reduction rating (NRR) for the hearing protector from the noise level (e.g., 95 dBA – 30 NRR = 65 dBA).
- Add 7 e.g., 95 dBA – 30 NRR = 65 dBA + 7 = 72 dBA to the internal ear).

High noise areas shall be posted with appropriate warning signs at all entrances.

5.4.1.5 Lead

The General Industry Lead Standard (OSHA 29 CFR 1910/WISHA WAC 296-62-07521) or the Construction Lead Standard (OSHA 29 CFR 1926.62/WISHA WAC 296-155-175) will apply to all lead work performed by the Contractor. The Contractor shall be responsible for compliance with all requirements within the applicable Standards. These requirements include employee training, exposure assessment and monitoring, selection and use of respiratory protective equipment, medical surveillance, and application of methods for controlling the release of lead to the environment.

5.4.1.6 Asbestos

It is expected that either the General Industry Asbestos Standard (OSHA 29 CFR 1910.1001/ WAC 296-62, Part I-1) standards or the Construction Asbestos Standard (OSHA 29 CFR 1926.1101 / WAC 296-62, Part I-1) standards will apply to all asbestos work performed by the Contractor. The Contractor shall be responsible for compliance with all requirements within these Standards. These requirements include employee training, exposure assessment and monitoring, selection and use of respiratory protective equipment, medical surveillance, and application of methods for controlling the release of asbestos to the environment.

5.4.1.7 Carcinogen Control

Occupational exposure to chemical carcinogens shall be maintained at ALARA levels. The primary objective shall be to prohibit or reduce the use of known or suspected carcinogens in the workplace.

If hazardous materials containing carcinogenic components are used, control measures outlined in this section shall be included in a detailed JSA. Whenever any employee is exposed to formaldehyde, the requirements of 29 CFR 1910.1048 shall apply.

The JSA shall identify hazardous materials that contain greater than 0.1 percent by weight or volume of components that are known or suspect human carcinogens (as defined by OSHA, the American Conference of Governmental Industrial Hygienists [ACGIH], the National Toxicology Program [NTP], or the International Agency for Research on Cancer [IARC]).

Regulated (access controlled) areas shall be established where chemical carcinogens are used. A record shall be maintained of all personnel who enter the regulated areas.

Engineering controls shall be the primary method used to minimize exposure and to prevent the release of carcinogens into the work environment.

Signs warning of the presence of chemical carcinogens shall be posted at all entrances to regulated areas.

Identified employees shall be provided appropriate notification, monitoring results, and medical surveillance as required by the mandatory OSHA/WISHA requirements for each harmful agent.

Fifty percent of the permissible exposure limit (PEL) or the threshold limit value (TLV), whichever is most restrictive, shall be the “action level” (if a specific action level is not already established in applicable standards).

Carcinogens may be used only when no other practical substitute can be found.

All facilities that store or use carcinogens shall keep a current carcinogen inventory, including the following:

- carcinogen product name
- Safety Data Sheet (SDS)
- storage and use location
- volume on hand
- description of use

All employees who work with or are potentially exposed to chemical carcinogens shall be provided with documented use-specific training, including instruction on:

- Possible source of exposure, health effects.
- Handling procedures.
- Specific application of the chemical use.
- Potential hazardous conditions.
- Decontamination procedures, proper disposal.
- Emergency procedures, including spills.
- Medical surveillance requirements.

Job Safety Analysis-specific training can satisfy this requirement, and documentation may be the JSA sign-in sheet, providing that adequate detail is included on the JSA.

Employees shall wash thoroughly after using or handling products containing carcinogens. Eating, drinking, smoking, chewing, and food utensil storage is prohibited in work areas where carcinogenic materials are used or stored.

5.5 Sanitation

All work areas, shops and offices shall be kept clean to the extent the nature of the work allows. The floor of every workroom 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. Lunchroom receptacles shall be equipped with a solid, tight fitting cover.

All sweepings, wastes, refuse, and garbage shall be removed in a timely and sanitary manner.

Housekeeping shall be maintained on a daily basis. Cleaning and sweeping shall be done in a manner, which minimizes the contamination of the air with dust or particulate matter.

Drinking water and ice shall conform to the quality criteria established by local, state and federal regulations.

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 well-equipped toilets and wash stations (including eyewash stations and showers, where required) must be readily accessible to all employees. Those facilities shall be maintained in a sanitary manner at all times, and include soap, towels, and waste receptacles.

5.6 Temperature Extremes

This section describes the recommendations relating to heat stress and cold stress.

5.6.1 Heat Stress

Heat stress monitoring shall be measured by the ambient temperature and relative humidity or Wet Bulb Globe Temperatures (WBGT) index method when outdoor ambient or indoor work area temperatures exceed 85º F. The Hanford Meteorological Station (373-2716) provides WBGT readings during daylight hours.

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. Engineering controls, work time limits, work rates, and use of body cooling devices should be described in the JSA.

5.6.2 Working Conditions

Adequate amounts of cool drinking water (50º F to 60º F) shall be at each worksite in coolers designated only for drinking water purposes. When ambient temperatures exceed 85º F, water breaks should be taken frequently during the day to replenish water lost from perspiration.

Symptoms, such as hot, dry skin, extremely high body temperature, rapid pulse, unconsciousness, or lack of perspiration, suggest heat stroke and constitute a medical emergency.

Solar shielding may be provided (if possible) when workers are exposed to direct sunlight throughout the workday when the temperature exceeds 100º F.

5.6.3 Cold Stress

The ACGIH Cold Threshold Limit Value (TLV) is the prescribed standard for cold exposure. The Cold TLV requires that the air temperature, wind speed, and equivalent wind chill temperature be measured, calculated, and recorded at least every four hours when employees are exposed to temperatures below 30º F.

When work involves continuous employee exposure to an equivalent chill temperature (ECT) below 10º F, the following safe work practices shall be observed:

- Work is conducted using the "buddy system."
- Workers are instructed on symptoms of frostbite and hypothermia, and appropriate preventive and first aid measures.
- Heated, warming shelters are conveniently available.

Non-emergency work is curtailed when the ECT in the work area is below -25º F.

Workers who experience symptoms of cold exposure, such as hypothermia, are immediately moved to a warm area, and then examined by a physician as a follow-up measure.

5.7 Lighting and Illumination

General construction areas including active storage areas, loading platforms and field maintenance areas shall be lighted to a minimum of 3 foot-candles.

The minimum level of task lighting in indoor construction workplaces shall be an average of 5 foot-candles measured 30 in. above the floor.

General illumination for outdoor construction work areas shall be a minimum of 5 foot-candles. Auxiliary lighting shall be used when needed.

First aid stations and offices shall be lighted to a minimum of 30 foot-candles.

5.8 Ventilation

Local exhaust ventilation is a primary engineering control and is required to reduce concentrations of hazardous, irritating, and odoriferous air contaminants below allowable exposure limits (where feasible). The operability of such systems shall be evaluated prior to the start of the work.

5.9 Lasers

Only qualified and trained employees shall be assigned to install, adjust, and operate laser equipment. Use of non-construction laser equipment may require a laser use permit.

Proof of qualification of the laser equipment operator shall be in possession of the operator at all times.

Employees, when working in areas in which a potentially hazardous exposure to direct or reflected laser radiation exists, shall be provided with anti-laser eye protection devices.

Areas in which Class II and Class IIIa lasers are used shall be posted with standard laser warning placards.

Beam shutters or caps shall be used, or the laser turned off, when laser transmission is not actually required. When the laser is left unattended for a substantial period of time, such as during lunch hour, overnight, or at a change of shifts, the laser shall be turned off.

Only mechanical or electronic means shall be used as a detector for guiding the internal alignment of the laser.

The laser beam shall not be directed at employees.

When it is raining or snowing, or when there is dust or fog in the air, and it is impracticable to cease laser system operation, employees shall be kept out of range of the area of source and target during such weather conditions.

Laser equipment shall bear a conspicuously displayed label to indicate hazard classification. This label shall be prepared in accordance with 21 CFR 1040.10.

Only Class I, II, or IIIa laser equipment shall be used. Class IIIb and IV laser equipment shall not be used without the express written permission of the Battelle Laser Safety Officer.

Laser units shall be set up for operation above the heads of employees, when possible.

5.10 Contractor Work Site Dust Control

All contractor projects shall address dust control during pre-job planning.

Areas to be cleared for construction shall be limited to keep dust generation to a minimum.

Construction of permanent roadways and parking areas shall 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. Sufficient equipment shall be kept at the jobsite to control dust whenever a nuisance or hazard occurs.

5.11 Safety Showers and Eyewash Apparatus

Eyewash/shower apparatus shall be provided where there is significant potential for personnel exposure to injurious materials (e.g., corrosives, skin sensitizes, etc.)

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.

Employees involved in work that presents potential exposure shall test the closest eyewash/shower apparatus prior to the start of the job.

Eyewash/shower apparatus shall be functionally tested monthly to flush the line and to verify proper operation. A record shall be maintained to verify testing.

The potable water provided for a portable eyewash/shower apparatus shall be flushed or changed according to manufacturer's specifications.

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.

5.12 Welding Hazards

Contractors shall evaluate welding fumes and identify control measures using the Job Safety Analysis (JSA) process outlined in section 8.4. Welding fumes need to be assessed by type of metal along with a number of variables when determining control measures such as: weld type, welder setting, base and core/electrode metal, flux coating, work rate, body positioning, location, which all affect the fume generation and ability of fumes to enter the worker's breathing zone.

JSA's must include an explanation of these variables and control techniques to manage fume generation. Smoke eaters, UV screens, and work area delineation are all common control measures.

Special emphasis on welding fume constituents, such as manganese, chromium, nickel, cadmium, due to either extremely low exposures limits and recent declaration as carcinogenic and must be a point of emphasis when evaluating welding tasks. Various metals have independent standard that govern their use, for instance hexavalent chromium/nickel associated with stainless steel, manganese/iron oxide with mild steel, and zinc oxide fumes with galvanized steel. Other considerations associated with welding include hot work permitting, UV, noise, gases, (ozone, NOx, CO) and material coatings. Coatings shall be removed 4 inches on all sides of weld location.

The contractor shall be provided with a PNNL hot work permit detailing work requirements which may include fire retardant (FR) clothing, fire watch requirements, designated hot work areas, combustible protection, and special conditions.

Welding related exposures as tied to many variables, PNNL is requiring contractors to provided details of each welding task and when requested provide objective exposure data.

5.13 References

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

WAC 296-155, Safety Standards for Construction Work

6.0 Personal Protective Equipment

6.1 Purpose

The purpose of this procedure is to establish the responsibilities and requirements for Battelle Contractor use of Personal Protective Equipment (PPE) so as to comply with Occupational Safety and Health Act (OSHA) and Washington Industrial Safety and Health Act (WISHA) standards.

6.2 Definitions

ANSI American National Standards Institute. An organization that writes consensus standards that incorporate input from a diverse group of subject matter experts.

PPE Personal Protective Equipment is clothing or equipment that is intended to 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.

6.3 Requirements

6.3.1 Responsibility

The contractor shall:

- Perform an assessment identifying hazards or potential hazards and determine necessary PPE for activities to be performed,
- Adhere to prescribed PNNL postings and/or PNNL pre-job planning documentation requiring use of PPE,
- Provide adequate PPE for all its employees ,
- Properly maintain, use and store PPE, and
- Remove damaged and/or defective equipment from service.

6.3.2 General Requirements

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

- 29 Code of Federal Regulations (CFR) 1926, Subpart E; Personal Protective and Life Saving Equipment
- 29 Code of Federal Regulations (CFR) 1926, Subpart I; Personal Protective Equipment
- 10 Code of Federal Regulations (CFR) 835, Occupational Radiation Protection
- Washington Administrative Code (WAC) 296-800-160, Personal Protective Equipment
- Applicable American Standards Institute (ANSI) Standards

Personal protective equipment 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. Contractors shall provide PPE to its employees in accordance with OSHA/WISHA requirements. PPE will be specified in hazard assessment documentation (as appropriate) based on the activity and associated hazards. Examples of applicable hazard assessment documentation include:

- Job Safety Analysis
- Fall Protection Work Plan
- Confined Space Permit
- Welding, Cutting and Heating Permit
- Electrical Energized Work Permit
- Blind Penetration Permit
- Biological Work Permit
- Chemical Process Permit
- Radiological Work Permit

6.3.3 Procedure

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

6.3.3.1 Foot Protection

Occupations in which there is a danger of foot injuries due to falling and rolling objects, or objects piercing the sole, and/or where feet are exposed to thermal burns from open flames, welding, cutting or grinding, and electrical, employees shall wear protective footwear which comply with American Society for Testing and Materials (ASTM) F2413-05 Standard Requirements for Protective Footwear.

Substantial footwear made of leather or equally firm material shall be worn by all employees within construction areas or laboratory areas where chemical spills may occur. Open-toed sandals, slippers, or other similar shoes shall not be worn. Exceptions may be approved for special or unique situations.

6.3.3.2 Hand Protection

Employees exposed to hazards that could injure their hands shall use appropriate hand protection. Examples of these hazards include:

- Absorbing harmful substances (see Table 6.1).
- Severe cuts, lacerations or abrasions.
- Punctures.
- Chemical burns and/or thermal burns.
- Harmful temperature extremes.

Employees shall choose hand protection that performs relative to the:

- Task
- Conditions present
- Duration of use
- Potential hazards

Table 6.1. Suggested Gloves When Working With Chemicals

The following table provides guidance for selecting the appropriate glove to be worn in situations involving chemical hazards. This table is not intended to be all-inclusive. If you have any questions about the appropriate type of glove required for your work activity, contact your supervisor or a Battelle Safety and Health Representative.

Chemical Hazard	Butyl	Neoprene	Nitrile	Polyvinyl-chloride	Polyvinyl-alcohol	Latex	Poly-ethylene	Vitan
Acids, dilute	X	X	X	X		X		X
Alcohol	X	X	X	X		X	X	X
Alkali bases, dilute	X	X	X	X		X		X
Aromatics					X			X
Chlorinated hydrocarbons	X		X		X			X
Expoxy resins	X	X	X	X				X
Esters	X							
Hydrocarbons	X	X	X		X			X
Ketones	X							
Lacquer thinners	X	X	X		X			X
Oils, grease	X	X	X	X	X			X
Petroleum distillates	X	X	X		X		X	X
PCBs								X

X indicates appropriate for use.
"Blank" indicates not appropriate for use.

Note: Very little data are available for protection against mixtures of chemicals. One permeating chemical may pull another with it through the material much faster than expected. PPE materials with the broadest range of chemical resistance test results should be used when chemical mixtures are involved.

6.3.3.3 Respiratory Protection

Contractors will provide respiratory protection equipment when required by pre-job planning documentation. A written respiratory protection program shall be required in accordance with OSHA 1910.134, Respiratory Protection and/or WISHA 296-842, Respirators, as applicable. Further details regarding respiratory protection are in Section 7 below.

6.3.3.4 Head Protection

Head protection meeting the requirements of ANSI Z89.1, Protective Headwear for Industrial Workers, shall be worn by all personnel working in, visiting, or passing through construction areas and other locations where head protection requirements are posted or specified in pre-job planning documentation.

All persons exposed to overhead hazards shall wear nonmetallic hard hats.

Before using a hard hat, inspect the:

- Suspension system for firm fit of mounting points.
- Shell for cracks, dents, signs of wear and damage.
- Hard hat for excessive dirt, grease, and/or chemicals.

Hard hats that are defective shall be removed from service.

6.3.3.5 Eye and Face Protection

Employees exposed to hazards that could injure their eyes and/or face must use appropriate protective equipment. Examples of these hazards include:

- flying particles
- molten metal
- liquid chemicals
- acids or caustic liquids
- chemical gases or vapors
- any light that could injure the eyes such as lasers, ultraviolet, or infrared light
- objects that puncture

Employees exposed to hazards from flying objects must use eye protection with side protection.

Additional eye and face protection (goggles, face shields, etc.) may be required for certain work activities, such as grinding, flying particles, handling chemicals, etc.

Safety glasses (or other appropriate safety eye protection) shall be worn under face shields and welding hoods/helmets.

Eye protection for employees who wear prescription lenses must:

- Incorporate the prescription into the design of the eye protection, **or**
- Be large enough to be worn over the prescription lenses without disturbing them.

PPE used to protect the eyes and face must meet the applicable ANSI (American National Standards Institute) standard. Most commercially available PPE is marked as meeting ANSI standard Z87.1-1989 requirements.

All personnel working in, visiting, or passing through construction areas and other locations where safety glass requirements are posted or indicated in the pre-job planning documentation shall wear safety glasses meeting the requirements of ANSI Z87.1,

6.3.3.6 Hearing Protection

The contractor will take steps to eliminate and minimize high levels of noise. When it is not feasible to reduce noise levels to less than 85 dBA, hearing protection shall be furnished and worn (see Table 6.2).

Table 6.2. Suggested Types of Hearing Protection

Two main types of hearing protection devices are used to protect workers' hearing from noise in the workplace: 1) earplugs that are inserted into the ear canal and 2) earmuffs that are worn over the head to cover the outer ear. The ability of the hearing protection device to attenuate noise is expressed as a Noise Reduction Rating (NRR). The higher the NRR, the more protection the device provides. The following table lists suggested hearing protection to be used for work activities that involve physical hazards. If you have any questions about the appropriate type of hearing protection required for your work activity, contact your supervisor or a Battelle Safety and Health Representative.

Hazard Category	Product	
	Minimum Exposure	More Severe Exposure
Physical - Noise Select hearing protection with an NRR adequate to reduce the wearer's exposure to below the 85-dB level	Earmuffs (use when frequent removal and replacement of hearing protection is necessary) Earplugs (fit into and seal the ear canal; generally considered "disposable") Earcaps (small, soft pods, pads, or flexible tips that seal at or near the entrances of the ear canal with a minimal degree of insertion)	Earplugs and earmuffs

6.4 References

29 CFR 1910, Occupational Safety and Health Standards

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 1926, Subpart I; Personal Protective Equipment

10 Code of Federal Regulations (CFR) 835, Occupational Radiation Protection

ANSI Z87.1, Occupational and Educational Personal Eye and Face Protection Devices

ANSI Z89.1, Protective Headwear for Industrial Workers

ASTM F2413-05 Standard Requirements for Protective Footwear.

WAC 296-155, Safety Standards for Construction Work

WAC 296-155, Part C; Personal Protective and Life Saving Equipment

6.5 Records

None

6.6 Forms

None

7.0 Respiratory Protection

7.1 Purpose

This section identifies a key aspect of the Industrial Hygiene (IH) program, and establishes the requirements and practices for the purchase, issue, control, and use of respirators.

7.2 Responsibility

The Contractor is responsible for a program that includes the following elements:

- assigned protection factors
- program administration
- medical examination
- training
- fit testing
- exposure assessment
- selection of respirators
- respirator issue, control, and use
- cleaning, maintenance, and storage
- emergency/IDLH (immediately dangerous to life and health) use
- compressor use
- voluntary respiratory use

7.3 Application

This section applies to all work activities and personnel under the control of the Contractor and its Subcontractors.

7.4 General Requirements

Respiratory protection will be used only in those instances when engineering or administrative controls are ineffective, impractical, or are in the process of being installed. Employees will be medically cleared, fit tested, and trained prior to using respiratory protection equipment.

7.4.1 Assigned Protection Factors

Differences in assigned protection factors for respirators exist between the various standards and guidelines. To resolve differences in protection factors, this program establishes WAC 296-842 as the overall basis for assigned protection factors for both radiological and chemical hazards. In addition, in

situations involving hazards for which substance-specific standards apply (such as asbestos and lead), the protection factors listed in the applicable substance-specific WISHA standard will be used.

When radiological and non-radiological hazards exist that require respiratory protection, project safety and supervision will collaborate on selecting the appropriate respiratory protection that will provide protection against the combined hazards.

7.4.2 Program Administration

The Contractor's program administrator will serve as the initial point of contact for program administration and issue resolution on projects.

As necessary (for work demanding respiratory protection), the Contractor will appoint a suitably trained respiratory protection program administrator who will perform the following:

- oversee the implementation of practice requirements
- provide problem resolution
- conduct required evaluations of program effectiveness

7.4.3 Medical Examination

The Contractor shall:

- Verify that employees receive an initial medical evaluation or examination prior to wearing a respirator, reviewed by a physician or other licensed health care professional (PLHCP). A WISHA-approved questionnaire may be used for the evaluation.
- For each employee who may wear a respirator, the PLHCP will provide a written recommendation regarding the employee's ability to use a respirator.

  Note: A medical clearance is acceptable for all types of respirators unless a specific medical limitation has been designated.
- Provide additional medical evaluations if:

– The employee reports medical signs or symptoms related to the ability to use a respirator, or

– A change occurs in workplace conditions

7.4.4 Training

The Contractor shall:

- Enroll employees into initial respirator training courses as follows:

– employees who may wear respirators

– employees who issue respirators

– employees who supervise respirator wearers

- Enroll the employee into annual refresher training (assuming that the employee has a continued need to issue or wear a respirator or to supervise respirator wearers).
- Document training and maintain records. (Subcontractors and Sub-tier Contractors maintain records onsite.)

7.4.5 Fit Testing

Use only WISHA-accepted fit-test protocols when fit-testing for respirators.

Prior to the use of respirators in a hazardous atmosphere, respirator wearers will receive a fit test annually for each style and type of respirator that will be used. If an employee needs to wear a respirator they have not been fit tested for, arrange for additional fit testing through the fit test station prior to use of the respirator.

Do not allow any worker to obtain a fit test who has facial hair that interferes with proper respirator fit.

Respirator wearers will shave the morning of the fit test and maintain facial hair in a manner that does not interfere with respirator fit.

7.4.6 Exposure Assessment

The Contractor shall:

- Plan and implement a qualitative and quantitative exposure assessment for the purpose of identifying and quantifying airborne contaminants to determine and validate the level of respiratory protection.
- Qualitatively estimate and, as appropriate, quantitatively measure the airborne concentrations of chemical or particulate contaminants, before selecting a respiratory protection device.
- Consider using qualitative hazard analyses, hazard surveys, historical data, objective data, or quantitative source/area/personal monitoring to document the basis for selecting respiratory protection.
- When respirators are specified for a type of activity, validate their adequacy by initial and periodic personal/area monitoring, as appropriate.
- If historical data are not available and monitoring is not performed, the decision logic used to select the respiratory protection will be documented on the JSA.
- Use JSAs, qualitative exposure assessments, work permits, work packages, site-specific safety and health plans, or other appropriate systems to document hazards, specify respiratory protection, and establish job-based exposure monitoring to be conducted.

7.4.7 Respirator Issue, Control, and Use

As necessary, the Contractor shall:

- Establish a controlled distribution point for the proper storage, issue, and return of respiratory protection equipment for the project.
- Designate a project respirator issuer to control the custody and integrity of respirators.
- Inform the respirator issuer of the types and quantities of respiratory protection equipment required for the project.
- In special circumstances where modified issue and control measures are required to accommodate unusual situations, develop supplemental procedures for issue and control.
- Verify that work permits, work packages, or other work control documents clearly identify the types of respiratory protection equipment to be used for worksites and activities, and that respirator issuers have full and convenient access to these documents.
- Verify that respirator wearers have current medical clearance, training, and fit testing appropriate for the types and styles of respirators to be issued for the project.

7.4.8 Cleaning, Maintenance, and Storage

Respirator users will be provided respirators which are clean, sanitary, and in good working order. Cleaning and disinfection of respirators will be conducted according to WISHA standards.

Respirators and associated respiratory protection equipment will be stored in a controlled distribution area. Equipment will be stored in a manner that will protect it against physical and chemical agents such as sunlight, heat, cold, extreme cold, excessive moisture, or damaging chemicals. Equipment will be stored in a manner to prevent distortion of the face piece or elastomeric parts.

7.5 Voluntary Respiratory Use Policy

Employees may wish to use respiratory protection equipment for their own comfort or sense of well-being, even when there is no recognized hazard or over exposure based on the project exposure assessment process. In these cases, not all of the occupational safety requirements apply (i.e. fit testing is not required). In order to voluntarily use respiratory protective equipment in this way, the following criteria must be met:

- There is no recognized hazard or potential for over exposure
- The respiratory equipment must be NIOSH certified
- The respirator must be cleaned, stored and maintained as specified in the cleaning, maintenance, and storage section above.
- The respiratory equipment does not itself present a hazard to the user.
- The employee is medically cleared to use a respirator (Exception: filtering face pieces do not require a medical clearance for voluntary use)
- The employee is given a copy of Appendix D to Sec. 1910.134 (Mandatory) Information for Employees Using Respirators When Not Required Under the Standard

Note: Voluntary respirator users must seek a medical clearance from their occupational medical provider.

7.5.1 Information for Employees Voluntarily Using Respirators

- Read and all instruction provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations
- Choose respirators certified for use to protect against the contaminant of concern. The National Institute for Occupational Safety and Health certifies respirators. If a respirator isn't certified by NIOSH, there is no guarantee that it meets minimum design and performance standards for workplace use.
- Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes, smoke, or oxygen deficiency.
- Keep track of your respirator so that you do not mistakenly use someone else's respirator.

7.6 References

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

WAC 296-155, Safety Standards for Construction Work

7.7 Records

Document	Record Submittal Responsibility	Record Retention Responsibility
Respirator Training Certificate (or similar)	Contractor	Contractor
Fit-Test Card	Contractor	Contractor
Respirator Medical Examination	Contractor	Contractor

8.0 Pre-job Planning

8.1 Purpose

This section provides requirements for establishing a method for identifying, controlling, and documenting hazards associated with contractor work activities and communicating this information to all affected workers in compliance with Occupational Safety and Health Act (OSHA) and Washington Industrial Safety and Health Act (WISHA), and applicable environmental and radiological codes and standards. The provisions of this procedure apply to work activities associated with tasks performed by Battelle Subcontractors.

8.2 Definitions

Graded Approach:
A methodology incorporated into the work planning and control process that determines the rigor for implementing these work planning and control attributes based on the importance/significance and associated consequences of the activity.

Job Safety Analysis (JSA):
The written articulation of controls by the contractor who is responsible for identifying and implementing specified hazard controls prior to performing work. Review of the contractor's safety documentation is conducted to verify that the contractor's safety management system conforms to the Contract requirements.

The expectations associated with the completion and content of these plans and checklists set the basis for the interviews and document reviews conducted as part of this assignment.

Acquisition Hazard Assessment (AHA):
A broad hazard-screening tool that includes a review of the work that will be performed and identifies the hazards associated with the work and the work location. The results of the AHA are used to determine the need for additional, more detailed hazard assessment, serve as a precursor documenting that further controls (i.e. training, permits, or assessment) are deemed necessary, and serve as a baseline hazard assessment where further analysis is not indicated.

8.3 General Requirements

The Contractor is responsible for understanding the scope of work in sufficient detail to plan work, identify hazards associated with the work, and develop necessary schedules, priorities, and work instructions.

Work activities need to be understood to a level of detail in order to ensure acceptable results given the complexity of the work, the significance of the work, the hazards associated with the work, and worker knowledge and experience. The quality of work-planning activities must be sufficient in order to ensure safe and reliable performance of work. Work-planning procedures should provide clear guidance on how to apply the graded approach in a manner that ensures thorough planning and worker safety, but allows

appropriate flexibility to accomplish work without imposing overly conservative or unnecessary restrictions, costs, or burdens.

The Contractor shall inform non-Battelle staff of the hazards and prescribed safety measures that must be in place prior to the performance of their duties.

The Contractor is prohibited from performing on-site work without authorization from the Battelle Contract Representative.

8.4 Hazard Assessment and Control Process

This section applies to all Contractor activities performed at Battelle locations.

8.4.1 Hazard Recognition and Control Process

Prior to the initiation of any on-site work, the Contractor will collaborate with Battelle staff to ensure facility requirements are discussed and addressed. or an Acquisition Hazard Assessment (AHA) form by the Battelle Technical Oversight Administrator (TOR). An acceptable equivalent document must be approved by the Battelle TOR and Construction Safety Specialist as specified in the Statement of Work (SOW). The equivalent document must contain the following information:

- Summarizing the job scope.
- Providing a description of each activity or phase.
- Identifying potential hazards associated with the activities being performed.
- Specifying safety measures applied to eliminate or control the hazard.
- Designating appropriate protective devices and/or equipment.
- Selecting a mechanism to evaluate the adequacy of those controls.

All non-Battelle and Battelle staff involved in the work shall review the Job Safety Analysis documentation or AHA prior to starting work. If the work scope, site conditions, or hazards change the contractor shall revise Job Safety Analysis in accordance with section 8.4.2 to capture the additional hazards if applicable. All affected non-Battelle and Battelle staff involved in the work being performed shall review the revisedJSA prior to continuing work.

8.4.2 Job Safety Analysis Process

All construction activities performed at Battelle require a Job Safety Analysis. The JSA shall be completed by each contractor and/or subcontractor for their anticipated work tasks. The Contractor’s JSA will include the following information:

- job scope and description of activities
- listing of each activity or phase
- hazards associated with the activities being performed
- specific safety measures applied to eliminate or control the hazard
- appropriate protective devices and/or equipment specifically designated

Contractor JSAs must be developed in sufficient detail to preclude confusion and misunderstanding. Consideration will be given to hazards related to human factors, fatigue, heat/cold stress, restricted work space, restrictive personnel protective equipment (PPE), elevated work, and repetitive motion.

The contractor shall submit their JSA to the Battelle Construction Safety Specialist for review and concurrence.

A walk-down of the actual construction site will be done before start of work with Battelle staff. The JSA will be developed using the known or potential hazards list identified on the JSA form along with, site conditions, facility hazards (beryllium, asbestos, lead, magnet fields, IOPS, etc)Required training and permits must be completed for the items on the known or potential hazards list identified on the JSA form.

All contractor and sub-contractor and Battelle staff involved in the work shall review the JSA and sign the Pre-job Safety Planning Signoff sheet. The plan of the day (POD) will be given to all affected personnel before starting work. The POD shall cover the day's activities along with the associated hazards, coordination between subcontractors, special weather advisories, work scope changes, and unique activities for the day (i.e., crane lifts, EWPs, confined space, excavation, fall protection, hot work, roof access).

The original JSA shall be reviewed, revised, and re-approved if the work scope, site conditions, or hazards change. Contractors must be mindful of red line drawing changes that could impact work scope and create additional unplanned hazards. Field changes to the JSA (i.e., red line, pen/ink changes) are acceptable. All affected contractor, sub-contractor , and Battelle staff involved in the work scope must be briefed to the work scope change, hazards, mitigations, and sign-off on the updated JSA.

The Contractor JSA shall be placed in a yellow box and conspicuously located on the jobsite and made available to all Battelle, non-Battelle staff and visitors.

8.5 References

10 CFR 835, Occupational Radiation Protection

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

WAC 296-24, General Industry Safety Standards

WAC 296-155, Safety Standards for Construction Work

8.6 Records

Job Safety Analysis

Pre-job Safety Planning Signoff

Acquisition Hazard Assessment Form

8.7 Forms

Job Safety Analysis

Pre-job Safety Planning Signoff

9.0 Safety Orientations

9.1 Purpose

This section defines the requirements, responsibilities, and system for orienting Contractor employees to the safety plan and CESH Manual, and to instruct employees on job-specific requirements.

Note: Contractors may submit their own new hire orientation form for Battelle approval.

9.2 Responsibility

Contractor is responsible for:

- Orienting their employees and subcontractor employees to this Manual (or their own when deemed acceptable by Battelle) and completing the Orientation Checklist.
- Prior to individual employees beginning work activities.

  Note: Escorted personnel, including vendors, engineers and infrequent visitors, can be exempt from orientation provided they are escorted and kept out of hazardous areas.
- Verifying that each employee and lower-tier employee has reviewed the applicable/required procedures and signed the Orientation Record.
- Verifying that employees have the required training to perform their designated task.
- The checklist and signature sheet being available at the jobsite.
- Employees being responsible for understanding and complying with the safety plan and job-specific requirements.

9.3 General Requirements

Employees shall be oriented as identified on the Orientation Checklist and to procedures the Contractor identifies that are applicable to the project. These procedures must be checked on the Orientation Checklist.

Topics to be covered during the orientation (as a minimum) include:

- Employer rights and responsibilities.
- Disciplinary procedures.
- Alcohol and Drug Abuse policies.
- Access to exposure monitoring data/records.
- Location of JSAs and company safety program.
- Emergency signals, response, and notification requirements for the area.

- Location of fire extinguishers, pull box alarms, emergency evacuation routes, and first aid facilities.
- How to report injuries.
- How to report unsafe conditions.
- The use and care of personal protective equipment.
- Identification of hazards gases, chemicals and materials; instruction on the hazards of these products and their safe use.
- Instruct employees regarding smoking around Battelle facilities. Additionally, Contractors are encouraged to establish designated smoking areas for their facilities. The designated smoking area provides a healthier workplace for the employee where “passive smoke” effects are minimized and the rights of smokers are respected.
- Location of nearest medical aid station.
- Location of nearest telephone.

The employees, after understanding the procedures identified in the Orientation Checklist, sign the Orientation Record.

9.4 References

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

WAC 296-155, Safety Standards for Construction Work

9.5 Records

Document	Record Submittal Responsibility	Record Retention Responsibility
Orientation Checklist	Contractor	Contractor
Orientation Record	Contractor	Contractor

9.6 Forms

Orientation Checklist

Orientation Record

10.0 Safety Meetings and Inspections

10.1 Purpose

This section defines the system for conducting safety and health meetings and inspections that will facilitate compliance with the Occupational Safety and Health Act/Washington Industrial Safety and Health Act (OSHA/WISHA).

10.2 Responsibility

The Contractor shall be responsible for:

- Daily and weekly safety briefings.
- Daily safety and health inspections of the jobsites, documenting the results, and correcting noted deficiencies.

  Note: In-frequent contractors shall be a point emphasis for daily jobsite inspections.
- Weekly safety and health inspection of the jobsite with at least one employee.
- Correcting unsafe conditions and acts as soon as possible.
- Responding to employee concerns.

Employees shall be responsible for the following:

- Attending daily safety briefings.
- Attending safety and health meetings at least weekly.
- Reporting unsafe acts/conditions and concerns.

10.3 General Requirements

Supervisors and managers shall exercise their personal leadership in the conduct of operations under their control to afford all practicable protection to employees, Battelle and DOE property, and the environment. The Contractor shall provide for the correction of unsafe conditions and the continual observance of good safety practices.

Safety and health meetings shall address the following items:

- Safety, health, and job-related issues/concerns related to the particular operation.
- Accident investigations conducted since the last meeting to determine if the cause of the unsafe acts or conditions were properly identified and corrected.
- Safety and Health inspection findings since the last meeting.
- Safety Inspection Report items issued to the Contractor by Battelle or DOE personnel since the last meeting.

Minutes of safety and health meetings shall be taken and attendance will be documented on the Safety Meeting Sign-in Roster. (Meeting minutes are retained by the employer for the duration of the job.)

10.4 References

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

WAC 296-155, Safety Standards for Construction Work

10.5 Records

Document	Record Submittal Responsibility	Record Retention Responsibility
Contractor Supervisor Safety Inspection Checklist	N/A	Contractor
Weekly Safety Meeting	N/A	Contractor

10.6 Forms

Construction Supervisor Safety Inspection Checklist

Safety Meeting Sign-in Roster

Weekly Safety Meeting Agenda

11.0 Hazard Communication

11.1 Purpose

The purpose of this section is to ensure that the hazards of all hazardous materials produced, imported, or used are transmitted to the affected employees. Required components of a Hazard Communication Program include the method of hazard determination, Safety Data Sheets (SDS), labels and other forms of warning, employee information training, and a written Hazard Communication Program defining the above.

11.2 Responsibility

The Contractor shall be responsible for the following activities:

- Developing, promoting, updating, and administering the Hazard Communication Program.
- Determining the hazards of materials used in the workplace, making MSDSs available to employees, labeling containers, and providing information and training to employees on hazardous materials.
- Maintaining a list of hazardous materials and MSDSs to be used on the project.
- Developing work practice requirements for hazardous materials identified in the JSA.
- Labeling secondary and subsequent hazardous material containers.

11.3 General Requirements

The Hazard Communication Program shall comply with the applicable statutory requirements of:

- 29 CFR 1910, Subpart Z, Hazard Communications
- WAC 296-800-170, Employer Chemical Hazard Communication

Employees and contract personnel shall be provided with an overview of the Hazard Communication Program during the hiring process.

Users of hazardous materials shall receive specific training for those materials they use prior to initial use, and periodically thereafter. Specific training shall include the location of MSDS and inventory lists in the workplace, and the methods employees may use to access this information.

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.

A copy of the written Hazard Communication Program and a list (inventory) of hazardous materials shall be kept in the work area.

Note: The list (inventory) may be a book of SDSs, appropriately labeled and periodically updated to reflect the workplace inventory.

Employees shall have ready access to review and copy SDSs for hazardous materials they work with.

Areas where physical and/or biologic hazards are known to exist shall be clearly designated as such (with signs, placards, etc.) along with control requirements (ventilation, hearing protection, safety glasses, etc.).

11.4 Procedure

11.4.1 Hazard Determination

SDSs supplied by the material manufacturers, vendors, and/or client shall be the principal source of health hazard information. It is the responsibility of the Contractor to provide an SDS that meets the requirements of WAC 296-839-30005

Copies of SDSs received shall be legible.

When an SDS appears inadequate, or is not available, or the composition of the material is unknown or questionable, the manufacturer, vendor, and/or client shall be contacted for more details prior to use of the material.

Examples of qualities that make a material “hazardous” include but are not limited to the following:

- flammable, combustible, and/or explosive
- corrosive (acids/caustics)
- irritating/damaging to the eyes and/or skin on contact
- any human known or suspected carcinogen

11.4.2 Labels and Other Forms of Warning

The Contractor shall comply with the following label/warning requirements:

- Each secondary and subsequent container of hazardous materials in the workplace shall be labeled, tagged, or marked with the identity of the hazardous material contained therein, and show hazard warnings appropriate for employee protection.
- Labels shall be legible, in English (plus other languages if appropriate), and prominently displayed on the container.
- The identity of the hazardous material may be any chemical or common name that is indicated on the SDS and will permit cross-reference to be made among the list of hazardous materials, the label, and the SDS.

- Portable containers into which hazardous chemicals are transferred need no label if all of the following conditions are met:

  – The contents of the portable container are for the immediate use of the person making the transfer.

  – The container is used only by,and remains under the control of the person making the transfer.

  – The unlabeled portable container is used only within the work shift during which it was originally filled.

A label shall be used to identify containers that do not meet the conditions noted above.

Labels on incoming containers shall not be destroyed, removed or defaced.

11.4.3 Employee Information and Training

Employees shall undergo Hazard Communication training at the time of hire and prior to commencing work on the project. Minimum requirements of the training are:

- Signs and symptoms of overexposure.
- Methods and observations that may be used to detect and identify hazardous chemicals, such as odor, visual presence, etc.
- Physical and health hazards of materials used.
- Location of SDSs and the format in which they are maintained.
- How to use SDSs.
- Methods of protection from material hazards.

Prior to using any newly introduce hazardous material or product, supervisors shall obtain a copy of the appropriate SDS and review it with their employees.

11.5 References

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

WAC 296-155, Safety Standards for Construction Work

11.6 Records

Document	Record Submittal Responsibility	Record Retention Responsibility
Training Completion Record	Contractor	Contractor

12.0 Event Investigating and Reporting

12.1 Purpose

This section describes a mechanism for investigating, reporting, and analyzing accidents that occur during construction activities.

12.2 Responsibilities

Contractor and Subcontractor employees are responsible for immediately reporting all injuries, illnesses, occupational exposure to toxic substances, motor vehicle incidents, property damage, and near misses to their immediate supervisor. Supervisors are immediately required to make notification to the Battelle Point of Contact.

Contractor key supervisory personnel are immediately required to make notification to the Battelle Point of Contact (POC). The Battelle POC shall notify the PNNL Operations Center at 375-2400. For on-site emergencies (police, fire, rescue, and hazmat) call 375-2400.

When a contractor employee is involved in a serious event or accident, the Contractor shall implement the following actions: I. Secure the event scene from disturbance and unauthorized entry pending arrival of Battelle Representatives. II. Keep equipment or articles involved in the event from being operated, moved, or otherwise altered or repaired. III. To verify all necessary questions about the accident investigation/event have been answered the Battelle Project Manager and Battelle Worker Safety and Health Representative are responsible for releasing the event scene.

Contractors are responsible for notifying OSHA/L&I DOSH when such notifications are required by the regulations.

Contractors are responsible for participating in the accident investigation and reporting process. At a minimum, the contractor shall support completion of the Battelle Supervisor's Occupational Injury and Illness Report or an equivalent accident investigations form provided by the contractor.

If work extends beyond fourteen (14) days the contractor shall provide a monthly safety report summarizing all injuries, illnesses, non-injury events, and man-hours worked to the Battelle Contract Representative.

12.3 Recordkeeping Requirements

Daily records of all first aid treatments not otherwise reportable shall be maintained on prescribed forms and furnished to the Battelle Contract Representative upon request.

All records of exposure and accident experience incidental to the work (this includes exposure and accident experience of both the Contractor and its Subcontractors) shall be maintained. As a minimum, these records shall include exposure work-hours and a log of occupational injuries and illnesses (OSHA/L&I DOSH forms).

All records of employee exposure to toxic materials and harmful physical agents shall be maintained. The Contractor shall immediately notify Battelle of any excessive exposure and the hazard control measures that will be taken to control the exposure.

Access to the project's Worker Compensation Claims Report that details the compensable accidents experienced on the project by the Contractor and its Subcontractors will be provided to Battelle upon request.

13.0 Housekeeping

13.1 Purpose

This section establishes the requirements for housekeeping.

13.2 Responsibility

The Contractor shall enforce this section. Employees are responsible for complying with this section.

13.3 General Requirements

Housekeeping activities shall comply with applicable OSHA/WISHA requirements.

During the course of construction, alteration, repair or demolition of buildings and structures, continuous clean-up of the work area shall be performed, including removal of all rubble, scrap, boxes, crates, and excess material to trash disposal areas.

At the end of each work shift, a general clean-up of all work areas shall be performed.

Note: Once a week the contractor shall perform clean-up that includes; removal of debris from inside buildings, general organization of materials and barricades, sweeping of floors, roll-up of cords, adjustment of lights, trash removal, walk around exterior of building to ensure barricades, and debris are picked up.

All floors and walkways shall be maintained in good condition.

Every floor, working surface, and passageway shall be kept free from protruding nails, splinters, loose boards, or openings.

Cleaning and sweeping shall be performed in such a manner as to minimize the contamination of the air with dust.

Hoses and electrical conductors across aisles or passageways shall be covered or suspended overhead so that there is no tripping hazard. Where mechanical handling equipment is used, sufficient safe clearances shall be allowed for aisles, at loading docks, through doorways, and wherever turns or passages must be made.

Storage of material shall not create a hazard. Bags, containers, and bundles of construction materials and other equipment shall be stored in tiers, stacked, blocked or interlocked. They shall be limited in height (in general <5 ft) so that they are stable and secure against falling, sliding, or collapse.

Free access shall be maintained at all times to all exits, fire alarm boxes, fire extinguishing equipment, and any other emergency equipment. Free access means clear of all obstructions.

All lunchrooms, washrooms, and restrooms shall be kept in a clean and sanitary condition. Garbage cans in lunchrooms and restrooms shall be equipped with fitted covers, and the contents disposed of regularly.

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.

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

13.4 References

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

WAC 296-155, Safety Standards for Construction Work

14.0 Chronic Beryllium Disease Prevention Program

14.1 Background Information

The purpose of Battelle's Chronic Beryllium Disease Prevention Program (CBDPP) is to protect workers from health effects related to beryllium exposure. Battelle's approach to protecting workers is by controlling exposures to beryllium. This is done by identifying and minimizing beryllium hazards to levels as low as practical within the scope of essential work. Battelle's program to protect workers who come into contact with beryllium or beryllium-contaminated materials complies with the DOE CDBPP, 10 CFR 850.

Inhaling beryllium (Be) in the form of dust, mists, or welding fumes can cause chronic beryllium disease, a lung disorder resulting from the body's immune response to beryllium in the lung. Chronic beryllium disease is generally preceded by beryllium sensitization, which may develop months or years after exposure. Beryllium sensitization indicates that exposure has occurred and that the body's immune system has responded to that exposure. There is evidence that skin exposure to beryllium may also produce sensitization. Beryllium sensitization is measured by the beryllium lymphocyte proliferation test (BeLPT), a blood test.

Beryllium is classified as a carcinogen by the International Agency for Research on Cancer, the American Conference of Governmental Industrial Hygienists, and the National Institute of Occupational Safety and Health. Skin irritation may result from direct contact with soluble beryllium compounds, and healing is impaired in beryllium-contaminated wounds. Metallic beryllium powders are a moderate fire hazard, and hazardous concentrations may be released by heating metallic beryllium above 650°C or by heating beryllium oxide above 1540°C.

14.2 Applicability

The Battelle PNNL CBDPP applies to current Battelle workers, Contractors, and Subcontractors whose work potentially involves beryllium. It covers both present and past beryllium exposures resulting from U.S. Department of Energy (DOE) operations. The medical provisions also apply to employees of Battelle Contractors and Subcontractors who may have been exposed to beryllium at a DOE facility in the past. All contractors and subcontractors must conduct beryllium work in compliance with the provisions of Battelle's CBDPP.

Laboratory operations that meet the definition of laboratory use of hazardous chemicals in 29 CFR 1910.1450, *Occupational Exposure to Hazardous Chemicals in Laboratories*, are specifically exempted from the Battelle CBDPP. It also exempts work with beryllium articles, unless those articles are being processed in such a way as to generate airborne beryllium, (e.g., welding, machining, etc.). All portions of the DOE CBDPP (10 CFR 850) apply to Battelle.

Battelle Beryllium Tasks and Potential Exposures

All current beryllium tasks at Battelle involve either laboratory use of beryllium or work with beryllium articles. Battelle will assess and manage the potential for exposure from these tasks. Battelle also manages DOE facilities where beryllium has been used in the past, and has employees who have been previously

exposed to beryllium. Since areas of legacy contamination may pose a potential exposure risk to employees, work in these areas will also be actively assessed and managed by internal Battelle procedures.

14.3 Program Elements

14.3.1 Baseline Beryllium Inventory and Facilities List

Battelle has established an inventory of locations with beryllium-related activities and areas with potential beryllium legacy contamination, and updates the information contained in the baseline beryllium inventory at least annually to reflect sampling results, significant changes in existing activities, introduction of new beryllium activities, and termination of activities.

Battelle has conducted statistical surface sampling in facilities with evidence of past beryllium use to determine whether beryllium is still present, and if so, the extent and degree of beryllium contamination. Beryllium contamination is removed using prescribed methods to prevent resuspension of dust in accordance with Battelle's policy to decontaminate beryllium-contaminated areas normally occupied by staff to less than the DOE public release limit of 0.2 µg/100 cm^2.

Current activities are reported at Battelle's internal Beryllium website and surface sample results are reported on the PNNL Beryllium Explorer website. The PNNL Chemical Management System website is used to identify locations where beryllium is currently being stored in laboratories.

14.3.2 Hazard Assessment

Battelle uses a risk-based approach to assessing beryllium exposure hazards. Work in contaminated, or potentially contaminated areas, is assessed in the job planning package or alternative hazard analysis processes. Battelle Worker Safety and Health (WS&H) field-deployed staff perform hazard assessments, which include analysis of existing conditions, exposure data, medical surveillance trends, and the exposure potential of planned activities, as required, to determine the potential for worker exposure to airborne and/or surface beryllium and to confirm the necessary controls are identified to minimize the exposure risk, minimize the number of workers involved, and prevent or mitigate exposures.

The hazard assessment describes the activity performed; identifies the beryllium exposure hazards; specifies the required controls (engineering, administrative, and personal protective equipment [PPE]) commensurate with the hazard; and identifies sampling, training, and medical surveillance requirements. If sufficient information is not available to determine potential beryllium exposure levels for a work activity, conservative controls are established until the activity is characterized. WS&H staff will prescribe the appropriate postings and labels, protective equipment, work controls, and conduct exposure monitoring.

14.3.3 Exposure Monitoring

Exposure monitoring will be conducted under the cognizance of the Battelle WS&H Beryllium Subject Matter Expert (Be SME) and performed using nationally recognized exposure assessment methodologies. Only accredited industrial hygiene laboratories will be used for analytical data production. Exposure

monitoring and sample analysis must comply with the requirements of PNNL's CBDPP, 10 CFR 850.24 and 10 CFR 851. Battelle uses both surface sampling and airborne beryllium monitoring to assess exposure. Surface sampling and air sampling detection limits must be adequate to assess compliance with the public release limit and the action level. Development of sampling plans will be based on reviews of the work to be performed, the areas where work is performed, and results of prior sampling.

Battelle observes an internal airborne beryllium investigation level of 0.02 $\mu g/m^3$. Any air samples that exceed the investigation level require additional sampling and evaluation of work controls. Exposures exceeding the DOE action level of 0.2 $\mu g/m^3$ will trigger the control measures for a Regulated Area that are specified in 10 CFR 850.23(b)

Monitoring results will be reported in writing to monitored employees within 10 working days of receipt of laboratory results. The results are also captured in the case file in the DataPipe system.

14.3.4 Exposure Risk Reduction and Minimization

The worker exposure minimization goal at Battelle is as low as practicable. A standard hierarchy of IH controls (engineering controls, administrative controls, and PPE—in that order) is integrated into Battelle's work control processes in a manner to minimize both the number of workers exposed and the potential opportunities for exposure.

Exposure to airborne beryllium in Battelle facilities is low, with the majority of the sample results below reporting limits of the accredited laboratory's analysis protocols. For those activities with detectable airborne beryllium, airborne beryllium exposures are to be abated, controlled, or otherwise mitigated in a manner that provides assurance that workers are adequately protected.

If exposure levels meet or exceed the action level, a review of beryllium work practices and controls will be conducted by the Be SME and appropriate modifications made to reduce exposures to as low as practicable. Exposure reduction and minimization plans for exposures meeting or exceeding the action level will be developed by Battelle and submitted to PNSO for approval.

14.3.5 Access Control and Signage

Postings for areas with potential or existing beryllium contamination will follow the requirements of the Battelle CBDPP and 10 CFR 850. Battelle recognizes and controls the following types of beryllium areas:

- **Beryllium Contamination Area (BCA)** – an area where baseline facility characterization, hazard assessment, and/or sampling has indicated the presence of beryllium contamination at or greater than 0.2 $\mu g/100\ cm^2$ on surfaces or above the background beryllium concentration in soil of 1.25 ppm (as appropriate for the sampling method used).
    - BCA – accessible: beryllium contamination is present on surfaces that can be touched, contacted, or disturbed as a part of normal, routine activities in a work area. This would include, but is not limited to, surfaces of furniture or equipment, walls and facility structure surfaces below 8 feet, and easily opened (i.e., without the need to dismantle) enclosures or equipment cabinets.

- BCA – inaccessible: beryllium contamination is located on surfaces that are not normally touched, contacted, or disturbed as part of normal, routine activities in a work area.

- BCA – Elevated spaces: beryllium contamination is located on surfaces above 6 feet in elevation above the floor.

- **Additional Beryllium Sampling Required in Uncharacterized Spaces** – applied in facilities with legacy beryllium contamination which have not been completely characterized.

- **Regulated Area** – an area that is established for work activities that have the potential to generate airborne beryllium at or above the action level (0.2 $\mu g/m^3$ as an 8-hour TWA).

Regulated Areas and BCAs must be demarcated and controlled to adequately alert workers to the applicable boundaries, and access must be limited to authorized persons. The establishment of Regulated Areas in Battelle facilities is not currently anticipated, but will be implemented in accordance with the requirements of the Battelle CBDPP. Regulated Areas and BCAs must be posted and records of all individuals who enter Regulated Areas must be maintained.

14.3.6 Protective Clothing and Equipment

Battelle has established a protective clothing and equipment program that complies with the requirements of 29 CFR 1910.132, *Personal Protective Equipment General Requirement*s. At a minimum, PPE is required when dispersible forms of beryllium may contact the worker's skin, enter breaks in the skin, or contact the eyes, including where airborne concentrations of beryllium are at or above the action level or surface contamination levels of beryllium are at or above 3 $\mu g/100\ cm^2$. Battelle has established the policy that PPE will be used whenever surface contamination levels are at or above the DOE public release limit of 0.2 $\mu g/100\ cm^2$.

The types of PPE to be used are determined by a hazard assessment and are suitable to protect against inhalation, skin contact (including penetration of openings in the skin), and eye contact. WS&H staff determines specific PPE requirements based on the hazard assessment for each beryllium activity, and the required PPE is documented in the appropriate JPP or other work control documents. Activities with the potential for airborne beryllium at or exceeding the action level require the use of clean, disposable PPE.

Gloves must be worn when handling beryllium, beryllium material, beryllium compounds, or beryllium-contaminated equipment, materials, or waste. In the event that conditions exist in which the handling of beryllium items with gloves may present issues with the design of the experiment (e.g., metallurgy samples, cleanliness), WS&H staff will determine the conditions for handling during the hazard assessment process. Protective clothing and equipment will be made available to any beryllium-associated worker who requests it, regardless of measured exposure levels. It is Battelle's policy to use disposable PPE for work in designated beryllium areas.

14.3.7 Respiratory Protection

Battelle has established a respiratory protection program that complies with the requirements of 29 CFR 1910.134, *Respiratory Protection*, and provides workers with NIOSH-approved respirators (or respirators that DOE has accepted under the DOE Respiratory Protection Acceptance Program if NIOSH-approved

respirators do not exist for a specific task). All workers who use respiratory protection must be enrolled in the respiratory protection program.

Respirators are provided to workers who are exposed to airborne concentrations of beryllium that have the potential to meet or exceed the action level. In addition, respirators are provided to any beryllium-associated worker who requests to use a respirator for protection against airborne beryllium, regardless of measured exposure levels. Respirator use is required when:

- Potential or actual exposures are at or above the action level.
- There is potential for acute worker exposure (short-term exposure at high levels).
- There is reasonable potential for failure of a critical control system.
- It is expected that new or modified activities may exceed the action level (until sampling results demonstrate that the activity is being adequately controlled).

Respiratory protective equipment to be used for each beryllium activity is determined by a hazard assessment by WS&H staff and is documented in the appropriate JPP, or other work control documents.

14.3.8 Release of Beryllium Contaminated Material

Battelle's policy on surface contamination is intended to prevent beryllium exposure and uncontrolled contamination resulting from the release of equipment/items with potential surface contamination. Battelle will not release materials or equipment known to be contaminated with beryllium to the general public, even if cleaned below the DOE public release limit in 10 CFR 851.31. Items from BCAs and Regulated Areas are evaluated by WS&H staff prior to being considered for release.

Beryllium-contaminated materials that have been cleaned below the public release criteria of 10 CFR 850.31 may be transferred to another DOE facility, provided they are enclosed or placed in sealed bags or containers, impermeable to particulate contamination and appropriate labels are affixed to the material or equipment. Materials with contamination levels below the housekeeping limit of 10 CFR 850.30, but above the public release limit, can only be transferred to another DOE facility performing work with beryllium. Any such equipment or materials must be labeled in accordance with 10 CFR 850.38 and enclosed or placed in sealed bags or containers, impermeable to particulate contamination.

14.3.9 Housekeeping

Surface sampling is used to monitor the effectiveness of controls, evaluate housekeeping efforts, identify beryllium-contaminated surfaces, and verify the effectiveness of cleaning and decontamination efforts. Accessible surfaces in designated beryllium areas will be kept free of excess accumulation of beryllium contamination or administratively controlled to minimize exposure to beryllium. Contaminated surfaces will be cleaned by using certified HEPA filter-equipped vacuums specifically designated for beryllium use or wet-cleaning methods to clean floors or other surfaces. Battelle has established a policy that a specific work plan must be prepared and approved for change-out of HEPA filters on HEPA-equipped vacuums used for beryllium activities. Wet-cleaning methods include low-pressure water streams, mobile wet scrubber units equipped with HEPA filtration, wet floor mops, and wet wipes, sponges, and cloths. All equipment used for cleaning and decontamination must be labeled, controlled, and prohibited from use outside of designated beryllium areas and for non-hazardous materials unless it has been evaluated

and approved by WS&H staff. Dry-sweeping methods, dry-cleaning methods, and use of compressed air are prohibited.

Surfaces contaminated with beryllium dusts and waste in operational areas of Battelle facilities should not exceed a removable contamination level of 3 µg/100 cm^2 excluding the interior of installed closed systems such as enclosures, glove boxes, chambers, or ventilation systems. Surfaces in occupied areas of facilities, or unoccupied areas where work is anticipated, with contamination levels above the public release limit of 0.2 µg/100 cm^2 will be decontaminated. A decontamination plan will be developed prior to conducting decontamination.

14.3.10 Waste Disposal

Work should be planned to minimize the generation of beryllium-contaminated waste and beryllium-contaminated items that are disposed of as waste. Wastes generated from BCAs and Regulated Areas are defined as beryllium-contaminated waste.

All beryllium-contaminated waste and equipment disposed of as waste are sealed in containers that are impermeable to particulate contamination (e.g., plastic bags, plastic wrap, other containers) to prevent the release of beryllium dust during handling and transportation. The bags, wraps, and containers are clearly labeled in accordance with 10 CFR 850.38.

14.3.11 Medical Surveillance, Consent, and Removal from Potential Exposure

The Contractor shall comply with the occupational medical provisions of 10 CFR 850.34, 850.35 and 850.36.

14.3.12 Training

Battelle provides training on beryllium hazards and controls for contractors and subcontractors that is dependent on potential exposure to beryllium.

The training provided for beryllium-associated workers is in accordance with 29 CFR 1910.1200, *Hazard Communication*. Beryllium-associated workers must complete this training at the time of initial assignment and at least every 2 years thereafter. The beryllium-associated worker training includes:

- The contents of this CBDPP
- Potential health risks to beryllium worker family members and others who may come into contact with beryllium on beryllium workers, their personal clothing, or other personal items as a result of beryllium control failure at a DOE facility.

General awareness-level training on beryllium hazards and controls is required for all persons working at Battelle. This training is provided at the time of initial assignment and at least every 2 years thereafter. Retraining or additional training is required when:

- New or significantly changed beryllium activities introduce hazards or required controls on which a worker was not previously trained.

- There have been changes to a facility that could impact beryllium activities.
- There is reason to believe that a beryllium worker lacks the proficiency, knowledge, or understanding needed to work safely with beryllium.

14.3.13 Recordkeeping

Battelle will maintain exposure monitoring, inventory, and hazard assessment records, and will protect the confidentiality of records in accordance with the requirements specified in 10 CFR 850.39. Battelle will implement the requirements for submission of worker data into the Beryllium-Affected Worker Registry (BAWR). The Contractor will provide the required information for the BAWR submission to Battelle upon request.

14.3.14 Performance Feedback

CBDPP assessments will be conducted by Battelle WS&H Division in conjunction with other safety and health self-assessments. Results will be provided to affected line managers, safety and health staff, workers, the occupational medical contractor, and made available to labor organizations on request.

15.0 Demolition

15.1 Purpose

This section establishes the requirements for demolition work that complies with WAC 296-155, Part S.

15.2 Responsibility

The Contractor shall be responsible for protecting the health and safety of their staff members performing demolition work.

15.3 General Requirements

15.3.1 Preparation

Prior to the start of demolition work, an engineering survey shall be made, by a competent person, of the structure to determine structural integrity and the possibility of unplanned collapse of any portion of the structure. Any adjacent structure where employees may be exposed shall also be similarly checked.

A copy of the survey report and demolition plans shall be kept at the job site for the duration of the demolition operation. The original report and plans shall be kept by the Contractor.

All devices or equipment used during demolition work shall be constructed, installed, inspected, maintained and operated in accordance with applicable Federal or State regulations and manufacturer's instruction.

Safety codes, standards, rules, regulations, and ordinances governing any and all phases of demolition work shall be observed at all times.

Demolition shall be conducted under competent supervision and safe working conditions.

Exceptional care will be taken for all demotion work within a damaged structure. This includes installing shoring and bracing to maintain structural integrity.

All utilities (electric, gas, water, steam, sewer, and other service) shall be deactivated under a PNNL internal process of modification to the facility or under a project specific plan that identifies all energy sources are air gapped with no intent of reconnection. All air gapped utilities shall be shut off, capped, or otherwise controlled, outside the building line before demolition work is started. All affected utility companies shall be notified in advance.

If it is necessary to provide utilities during demolition, such utilities shall be properly located and protected.

Surveys shall be conducted for the presence of asbestos, hazardous materials, hazardous chemicals, gases, explosives, flammable materials, or similarly dangerous substances at the work site. When the presence of any such substance is apparent or suspected, testing and removal or purging shall be performed and the

hazard eliminated before demolition is started. Removal of identified substances shall be in accordance with Battelle requirements and WAC 296-62 and 296-65.

All structural openings shall be used and protected in accordance with the requirements of the Floor Openings, Open Sides, and Ramps section below and WAC 296-155-775.

Any openings cut in a floor for the disposal of materials shall be no larger in size than 25 percent of the aggregate of the total floor area, unless the lateral supports of the removed flooring remain in place. Floors weakened or otherwise made unsafe by demolition shall be shored to safely carry the intended imposed workloads.

When debris is dropped without the use of chutes, the area onto which the material is dropped shall be completely enclosed with barricades. Warning of the hazard of falling materials shall be posted at each level. Debris removal from the lower level shall not be permitted until debris handling ceases above.

Except for necessary preparatory work, demolition shall begin at the top of the structure and proceed downward.

No work shall be permitted that will expose persons working on a lower level to danger.

Employee entrances to multistory structures being demolished shall be completely protected by sidewalk sheds or canopies, or both, providing protection from the face of the building for a minimum of eight feet. All such canopies shall be at least two feet wider than the building entrances or openings (one foot wider on each side thereof), and shall be capable of sustaining a load of one hundred fifty pounds per square foot.

Dust control in the demolition area shall be performed according to the requirements of the project's Environmental Protection Plan.

All planking, scaffolding, and ladders used for demolition work shall by installed and used in accordance with the Scaffold and Ladder sections of this Manual.

Aerial lifts used for demolition work shall be used in accordance with the Aerial Lifts section of this Manual.

15.3.2 Work Area Access

Only designated access points and ways shall be used. Other access ways shall be entirely closed off at all times.

All access points and ways will be inspected and maintained in a clean, safe condition.

All ladders shall be secured in position.

Proper illumination shall be maintained in all access points, ways, and work areas.

15.3.3 Use of Chutes

No material shall be dropped to any point lying outside the exterior walls of the structure unless the area is effectively protected.

All materials chutes shall be installed and used per WAC 269-155-785.

A substantial gate shall be installed in each chute at or near the discharge end. A competent employee shall be assigned to control the operation of the gate, and the backing and loading of trucks.

15.3.4 Removal of Walls, Masonry Sections, and Chimneys

Masonry walls, or other sections of masonry, shall not be permitted to fall upon the floors of the building in such mass as to exceed the safe carrying capacities of the floors.

No wall section more than one story in height shall be permitted to stand alone without lateral bracing, unless such wall was originally designed and constructed to stand without such lateral support, and is in a condition safe enough to be self-supporting.

All walls shall be left in a stable condition at the end of each shift.

In buildings of “skeleton-steel” construction, the steel framing may be left in place during the demolition of masonry. Where this is done, all steel beams, girders, and similar structural supports shall be cleared of all loose material as the masonry demolition progresses downward.

Walls serving as retaining walls to support earth, adjoining structures, or debris shall not be demolished until such earth has been properly braced, adjoining structures have been properly underpinned or debris pile rendered safe.

15.3.5 Manual Removal of Floors

Openings cut in a floor shall extend the full span of the arch between supports.

Before demolishing any floor arch, debris and other material shall be removed from such arch and other adjacent floor area.

When floor arches are being removed, employees shall not be allowed in the area directly underneath, and such an area shall be barricaded to prevent access to it.

Demolition of floor arches shall not be started until they, and the surrounding floor area for a distance of 20 feet, have been cleared of debris and any other unnecessary materials.

15.3.6 Removal of Walls, Floors, and Material with Equipment

Mechanical equipment shall not be used on floors or working surfaces unless such floors or surfaces are of sufficient strength to support the imposed load.

Floor openings shall have curbs or stop-logs to prevent equipment from running over the edge.

Mechanical equipment used shall meet the requirements specified in this Manual and WAC 296-155, Parts L and M.

15.3.7 Debris and Material Storage

The storage of waste material and debris on any floor shall not exceed the allowable floor loads.

In buildings having wooden floor construction, the flooring boards may be removed from not more than one floor above grade to provide storage space for debris, provided falling material is not permitted to endanger the stability of the structure.

When wood floor beams serve to brace interior walls or free-standing exterior walls, such beams shall be left in place until other equivalent support can be installed to replace them.

Floor arches, to an elevation of not more than 25 feet above grade, may be removed to provide storage area for debris provided that such removal does not endanger the stability of the structure.

Storage space into which material is dumped shall be blocked off, except for openings necessary for the removal of material. Such openings shall be kept closed at all times when material is not being removed.

15.3.8 Removal of Steel Construction

Hoisting equipment used shall meet the requirements specified in this Manual and WAC 296-155, Parts L and M.

Steel construction shall be dismantled column length by column length, and tier by tier (columns may be in two-story lengths).

Do not overstress structural members being dismantled.

15.3.9 Mechanical Demolition

No workers shall be permitted in any area that can be adversely affected by demolition operations when balling or clamming is being performed. Only those workers necessary for the performance of the operations shall be permitted in this area at any other time.

The weight of the demolition ball shall not exceed 50 percent of the crane's rated load, based on the length of the boom and the maximum angle of operation at which the demolition ball will be used, or it shall not exceed 25 percent of the nominal breaking strength of the line by which it is suspended, whichever results in a lesser value.

The crane boom and loadline shall be as short as possible.

The ball shall be attached to the loadline with a swivel-type connection to prevent twisting of the loadline, and shall be attached by positive means in such manner that the weight cannot become accidentally disconnected.

When pulling over walls or portions thereof, all steel members affected shall have been previously cut free.

All roof cornices or other such ornamental stonework shall be removed prior to pulling walls over.

During demolition, continuing inspections by a competent person shall be made as the work progresses to detect hazards resulting from weakened or deteriorated floors, or walls, or loosened material. No employee shall be permitted to work where such hazards exist until they are corrected by shoring, bracing, or other effective means.

15.3.10 Use of Explosives for Demolition

Demolition using explosives shall comply with WAC 296-52.

15.4 References

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

WAC 296-155, Safety Standards for Construction Work

16.0 Excavation

16.1 Purpose

To define the responsibilities and requirements for protecting personnel engaged in excavation, trenching and shoring.

16.2 Responsibility

The Contractor shall be responsible for the following:

- Compliance with the procedure, including employee training.
- Monitoring excavation, trenching and shoring operations.
- Designating a Competent Person, who has had the training to act in this position, providing the competent person the authority to effectively discharge his/her duties.
- Reviewing activities that have a potential to damage utilities in or near excavations such as; gas, electrical, or other hazardous energy sources as defined by PNNL's lock and tag program requirements. Potential damage includes activities such as; backfill & bedding operations, pipe placement using equipment, removing debris (i.e. concrete) that could fall on to utilities, or other potential tasks which could damage a utility.

The Competent Person(s) shall be responsible for the following:

- Defining requirements and control measures.
- Performing daily inspections for compliance.
- Stopping work when non-compliances or problems/concerns are identified from inspections.
- Evaluate daily activities that have the potential to damage utilities in or near excavations during backfilling and bedding, pipe placement, debris removal, or other such activities.

Employees shall be responsible for complying with the provisions of this procedure.

16.3 General Requirements

Excavation, trenching, and shoring shall be conducted in accordance with the following statutory requirements:

- 29 CFR 1926, Subpart P; Excavations
- WAC 296-155, Subpart N, Excavations, Trenching and Shoring

Employees in excavations shall be protected from cave-ins by an adequate protective system (sloping, shoring, or shields) in accordance with the provisions of 29 CFR 1926 and WAC 296-155.

16.3.1 Inspections

Daily inspections of excavations, adjacent areas, and protective systems shall be conducted by a designated competent person to identify evidence of a situation that could result in possible cave-ins, for indications of failure of protective systems, and for hazardous atmospheres, hazardous conditions, or activities that could damage existing utilities The competent person(s) shall be documented on a Competent Person Designation form. See section 16.2 for roles and responsibilities of competent person.

Inspections shall also be conducted after every rainstorm, changing work activities (i.e. going from excavating to backfill operations), or other potential hazard-increasing occurrence.

Inspections shall be performed and documented using the Daily Excavations/Trenches Safety Inspection Checklist and Inspection Log.

Note: These inspections are required when employee exposure can be reasonably anticipated (i.e.; 4 ft or more in depth and occupied by employees) or changing work activities that have the potential to damage nearby utilities.

When inspection reveals evidence of a situation that could result in a possible cave-in, indications of protective system failure, hazardous atmospheres, or other hazardous conditions, employees shall be removed from the hazardous area until the necessary precautions have been taken.

Employees shall not work in excavations where water is accumulating or has accumulated unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation.

Employees exposed to mobile equipment or vehicular traffic shall be provided with and shall wear warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

When the configuration of an excavation is such that the excavation is deemed to be a confined space, the provisions of the applicable confined space entry program apply.

Adequate barriers for physical protection shall be provided at all excavations. All wells, pits, shafts, etc., shall be barricaded or covered.

When mobile equipment is used or allowed next to excavations or trenches, stop logs or barricades shall be installed. Such devices shall not be required for equipment conducting the actual excavating or backfilling operations.

Special precautions for excavation/trenching around electrical utilities:

- Each underground electrical interface with new construction shall be independently reviewed on a case-by-case basis using the PNNL excavation permit and excavation review board process
- If it can be determined from installation as-builts that the energized cable is protected by a rigid steel conduit raceway or concrete encasement, then de-energizing the cable is not required and excavation with hand tools such as shovels, pry bars, picks or air lances is acceptable.

- If it is determined from installation as-builts that the energized cable is protected by a PVC conduit raceway, then de-energizing the cable is not required.

  Note: De-energizing underground lines when excavating near or around them is always the safest and preferred method to mitigate electrical hazards during excavation.

- If actual installation details are indeterminate, or the service is a direct buried cable not protected by rigid steel raceway, concrete encasement, or PVC, then the cable shall be de-energized.

  Exception: If it is determined that the system cannot be de-energized due to the adverse effects on necessary operation or life safety systems, then justification to hand excavate must be provided. Such justification requires concurrence of the Battelle Construction Manager.

- Minimum safety precautions during hand excavations of an energized direct buried cable shall include:

– The excavation worker shall wear protective insulated gloves, rated for the voltage potential and meeting the specifications of ANSI/ASTM D120-1984.

– A qualified standby person shall be in attendance during excavation. The standby person shall be CPR certified, first-aid trained, and trained in emergency electrical practices.

– The suspected cable location shall be periodically verified using a hand-held inductance meter.

Note: Unknown underground utilities shall use the same precautions as hand digging around energized direct buried cables.

– Minimum safety precautions during hand excavations of an energized cable protected by PVC conduit shall include:

  The excavation worker shall wear protective insulated gloves, rated for the voltage potential and meeting the specifications of ANSI/ASTM D120-1984.

  A qualified standby person shall be in attendance during excavation. The standby person shall be CPR certified, first-aid trained, and trained in emergency electrical practices.

Hand excavation around unprotected, energized electrical utilities is defined as the removal of surface and subsurface materials, including sand, gravel, soil, and rocks by direct labor methods where the only acceptable hand assist tool is a common hand shovel. The use of requiring hand-held picks and pry bars is expressly prohibited in situations requiring hand excavation. The use of a hand shovel to stab the soil in an effort to loosen or penetrate excavation material with anything greater than normal foot pressure is prohibited. The only acceptable aid to a hand excavation operation is an air-assisted dielectric soil pick, (e.g., air lance). The air lance is permitted to loosen compacted soil and/or expose a buried utility where soil conditions are sufficiently compacted, rocky or the presence of an underground utility is suspected and not yet physically verified.

16.4 Procedure

16.4.1 Preparation

Prior to excavation, permits (internal and external, when required by contract) shall be obtained from authorized organizations and included with pre-job planning documents where applicable. In addition, the necessary drawings, specification, and restrictions applicable to the excavation shall also be obtained.

Reference drawings and documents shall be checked in detail to determine location of all known underground obstructions, pipes, power lines, phone lines, foundations, etc. These locations shall be marked at the worksite in a conspicuous manner.

Utilities and facilities shall be de-activated, de-energized and/or interrupted, as required, and the source locked and tagged in accordance with the Lockout/Tagout Program. Coordination for this activity will be done through the Battelle Construction Manager.

Just prior to excavation, the excavation crew shall be briefed as to any special requirements or obstructions in the excavation area. The excavation permit and a Survey Scanning Report (when required) shall be at the excavation site during excavation as a reference for the excavation crew.

A spotter is used, when required, to assist the equipment operator during excavation.

All surface items to be protected shall be made visible to the equipment operator by high-viz tape or by a 7-ft bicycle flag mounted above the object

The equipment operator shall be made aware of these protected items prior to operating equipment such as cranes, trucks, backhoes, or loaders.

A stairway, ladder, ramp or other safe means of access/egress shall be located at personnel points where there is a break in elevation of 19 inches or more in trenches so as to require no more than 25 ft of lateral travel for employees.

16.4.2 Hand Excavation

All known underground obstructions shall be exposed by hand excavation beginning at a distance of 5 ft from the obstruction.

Note: Machines may be used to remove the soil from excavation, but shall not be used to dig undisturbed soil unless utility can be seen by the operator and a smooth face bucket is used. Always dig parallel to the utility never across the top.

In work areas where the exact location of underground electrical power lines in unknown, the contractor must perform GPR scanning and potholing to determine location of underground electrical line before allowing the use of jack hammers, bars, or other hand tools which may contact and damage an electrical line. Employee shall wear class 00 insulated voltage rated gloves. Penetrating solid concrete material requires a blind penetration permit.

If obstructions shown on the drawings and/or permits are not found in the location indicated, or if obstructions are encountered that are not shown, the work in that area shall be stopped and the Battelle Construction Manager shall be contacted.

Machine Excavation: machine excavation, when permitted, shall take place after compliance with the above procedures. The following requirements apply:

Battelle Construction Manager shall be notified of damage to utilities or facilities and of any abnormal conditions encountered.

Equipment (i.e. bucket) shall be kept at least 5 ft horizontally from exposed underground utilities. Unless approved by the Battelle Construction Manager, Battelle Utility Owner, Battelle Safety.

16.4.3 Protective Systems

Excavations and protective systems shall be designed so that cave-ins and slides are avoided and safe conditions shall be maintained for employees working in and around the excavation.

Whenever practical and feasible, the sides of excavations and trenches shall be sloped at an angle not steeper than 1-1/2 horizontal to 1 vertical (see Excavation Detail Sketch).

When sloping is not practical or feasible, the sides of excavations and trenches may be vertical if they are provided with support systems (shoring or shielding).

Support system shall be required in trenches more than 4 ft/WISHA or 5ft/OSHA deep under the following circumstances:

- The slopes are steeper than 1-1/2 horizontal to 1 vertical.
- The slopes are at least 1-1/2 horizontal to 1 vertical but do not extend to the bottom of the trench.

Support systems shall be installed and removed in a manner that protects employees from cave-ins and structural collapses and from being struck by members of the support system.

Excavation of material to a level no greater than 2 ft below the bottom of the members of a support system shall be permitted only if the system is designed to resist the forces calculated for the full depth of the trench and there are no indications, while

Shoring shall support the vertical portion of a trench and shall extend above the bottom of the slope at least 18 in to prevent material from sliding into the trench. The surface of the slope shall be cleared of boulders, stumps, or other hard masses of earth.

A support system may not be required under the following circumstances:

- The trench is less than 4 ft (WISHA)/5ft (OSHA) deep.
- The trench is less than 20 ft deep and the slopes are at least 1-1/2 horizontal to 1 vertical and extend to the bottom of the trench.

Timber cross-brace or trench jacks shall be placed in a true horizontal position, vertically spaced, and secured to prevent sliding, falling, or kick outs. Wales shall be placed with the greater dimension horizontal.

The sides of an excavation next to a previously backfilled area shall be sloped at least one and one-half horizontal to one vertical, particularly when the separation is less than the depth of the excavation.

When employees or equipment must cross over an excavation 6ft in depth, a walkway or bridge with standard guardrails shall be provided.

Engineering-approved portable trench boxes or sliding trench shields may be used instead of a shoring system or slope. They shall protect as well as, or better than, the shoring required for the trench and are used in accordance with the manufacturer's recommendations.

Materials used for support systems shall be in good, serviceable condition. Sheeting and four-by-4 in timber cross-braces shall be Douglas Fir, No. 2, or better. Wales and 6-by-6 in timber cross-braces shall be Douglas Fir, No. 1, or better

When employees are required to enter and excavation, excavated material shall be kept back at least 2 ft from the edge of the excavation.

Mudsills (wales installed at the toe of the trench side, having the same size and cross bracing spacing as the wales directly above them) may be used in place of embedding the uprights.

Sloping or shoring designs for trenches and excavations deeper than 20 ft shall have Registered Professional Engineering approval prior to placement.

Shoring, bracing, or underpinning shall be provided to stabilize adjoining structures, which may be endangered by an excavation. Among others, these structures would include the following:

- buildings and walls
- concrete encased raceways, piping, etc.
- storage tanks
- power poles

16.5 References

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

WAC 296-155, Safety Standards for Construction Work

16.6 Records

Document	Record Submittal Responsibility	Record Retention Responsibility
Competent Person Designation	Contractor	Construction Management
Shoring Designs	Contractor	Construction Management
Daily Excavation/Trenches Safety Inspection Log	NA	Contractor

16.7 Form

Daily Excavations/Trenches Safety Inspection Checklist and Inspection Log

16.8 Exhibit

Excavation Detail Sketch

17.0 Floor Openings, Open Sides, and Ramps

17.1 Purpose

This section defines protective measures to be implemented on Battelle work sites that involve temporary conditions of floor openings and open sided work surfaces where there exists danger of employees or materials falling into or off of working surfaces.

17.2 Responsibility

The Contractor shall be responsible for compliance with this section.

Employees shall be responsible for complying with the provisions of this section.

17.3 General Requirements

Floor openings, open sided surfaces and ramps shall comply with the following statutory requirements:

- 29 CFR 1910, Subpart D, Walking-Working Surfaces
- 29 CFR 1926, Subpart M, Floor and Wall Openings
- WAC 296-155, Part K, Floor Openings, Wall Openings and Stairways

17.3.1 Floor Openings

Floor openings shall be guarded by a standard railing and toe boards on all exposed sides except at entrances to stairways.

Hatchways and chute openings shall be guarded by one of the following:

- Hinged covers of standard strength and construction and a standard railing with only one exposed side.
- A removable standard railing with toe board on no more than two sides of the opening and fixed standard railings with toe boards on all other exposed sides. The removable railing shall be kept in place when the opening is not in use and shall be hinged or mounted to be conveniently replaceable.

Pits and trap door floor openings shall be guarded by floor opening covers of standard strength and construction. While the cover is not in place, the pit or trap openings shall be protected on all exposed sides by removable standard railings.

Manhole floor openings shall be guarded by standard covers, which need not be hinged in place. While the cover is not in place, standard railings shall protect the manhole opening.

All floor-opening covers shall be capable of supporting the maximum potential load but never less than 200 pounds (with a safety factor of four).

The cover shall be recessed to conform to the level of the surrounding floor or to be flush with the perimeter of the opening.

The cover shall be secured by fastening devices to prevent unintentional removal.

If it becomes necessary to remove the cover, a monitor shall remain at the opening until the cover is replaced. The monitor shall advise persons entering the area of the hazard shall prevent exposure to the fall hazard and shall perform no other duties.

Floor opening covers shall be clearly marked, “HOLE” OR “FLOOR OPENING COVER.”

Floor holes into which persons can accidentally walk, shall be guarded by either a standard railing with standard toe boards on all exposed sides, or a floor hole cover of standard strength and construction that is secured against accidental displacement. While the cover is not in place a standard railing shall protect the floor hole.

17.3.2 Open Sided Surfaces

Every open sided floor or platform or surface 4 ft or more above adjacent floor or ground level shall be guarded by a standard railing on all open sides except where there is an entrance to a ramp, stairway, or fixed ladder. The railing shall be provided with a standard toe-board beneath the open sides wherever persons can pass, there is moving machinery, or there is equipment with which falling materials could create a hazard.

Runways shall be guarded by standard railing on all open sides 4 ft or more above floor or ground level. Wherever tools, machine parts, or materials are likely to be used on the runway, a toe-board shall be provided on each exposed side.

Where employees entering runways become exposed to machinery, electrical equipment or other dangers that are not a falling hazard, additional guarding shall be provided.

Regardless of height, open sided surfaces, walkways, platforms, runways above or adjacent to dangerous equipment shall be guarded with a standard railing and toe-board.

17.3.3 Ramps

Ramps (runways) shall be a minimum of 18 inches in width.

Ramps shall be secured so that they cannot be accidentally displaced.

Ramps shall be provided with standard railing when located 4 ft above the ground or floor level.

Ramp specifications: Ramps (runways) and walkways shall not be inclined more than twenty degrees from horizontal and when inclined shall be cleated or otherwise treated to prevent a slipping hazard on the walking surface.

17.3.4 Fall Protection

Where guardrails cannot be provided and the potential for fall injuries exist, employees shall be protected in accordance with an acceptable fall plan.

17.4 References

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

WAC 296-155, Safety Standards for Construction Work

18.0 Signs and Barricades

18.1 Purpose

This section establishes requirements for the use of signs, signals, and barricades.

18.2 Responsibility

The Contractor shall be responsible for compliance with the provisions of this section.

Employees shall be responsible for complying with the provisions of this section.

18.3 General Requirements

Prior to commencing construction activities, the construction work shall have signs, signals, and barricades in the work area in accordance with the following statutory requirements:

- 29 CFR 1926, Subpart G; Signs, Signals, and Barricades.
- WAC 296-155, Part E.

Whenever appropriate, traffic control shall be instituted in accordance with the provisions of the U.S. Department of Transportation, Federal Highway Administration's Manual on Uniform Traffic Control Devices for Streets and Highways.

Signs, signals, and/or barricades shall be visible at all times when the work is being performed and shall be promptly removed or covered when the hazard no longer exists.

18.4 Procedure

18.4.1 Construction Activities

Caution signs and appropriate physical barricades shall be used to warn against potential hazards or to caution against unsafe practices.

Caution signs shall be yellow with black lettering.

Danger signs shall be used where an immediate hazard exists.

Danger signs shall be red with black lettering.

Where specific hazards exist (e.g., overhead hazards, noise, chemical exposure, radiation), signs shall be posted to warn of such hazards.

Accident Prevention Tags: Accident prevention (Danger – Do Not Use) tags shall be used as a temporary means of warning employees of an existing hazard such as defective tools, equipment, etc.

Configuration-Control Tags and Locks: Special tags and locks (never a green or red lock -these are used only for energy-isolation lockouts) may be used as configuration control for situations in which the change in configuration of a system or equipment could have a negative effect on equipment, facilities, or operations (e.g., opening or closing a valve, energizing or de-energizing a piece of equipment).

18.4.2 Traffic Control

Adequate warning, delineation, and routing by means of proper pavement marking, signing, and other devices that will give the motorist positive direction in advancing through the work area must be used.

When construction activities are adjacent to the roadway, warning signs shall be erected on the approach in both directions.

All signs intended for hazard warning during hours of darkness shall be reflectorized and illuminated.

A certified flag person shall be used at worksites to intermittently stop traffic as necessitated by work progress or to maintain continuous reduced-speed traffic past a worksite to help protect the work crew.

A flagger shall possess the following minimum qualifications:

- Each flagger shall have in their possession a valid certification of completion of an approved flagging course.
- Signaling directions by flaggers shall conform to the Manual on Uniform Traffic Control Devices for Streets and Highways, as amended by the Washington State Department of Transportation.
- Good physical condition, including sight and hearing.
- Mental alertness.
- Courteous but firm manner.
- Sense of responsibility for safety of public and crew.

18.5 References

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

WAC 296-155, Safety Standards for Construction Work

ANSI Z535.1/2535.2, Specifications for Accident Prevention Tags

19.0 Confined Space Entry

19.1 Purpose

This section establishes the requirements for confined space work that complies with WAC 296-809.

19.2 Responsibility

The Contractor shall be responsible for protecting the health and safety of their staff members performing confined space entries.

19.3 General Requirements

19.3.1 Identifying Confined Spaces

Employers/supervisors perform the following activities:

- Survey each work area to identify confined spaces.

  A confined space is defined as a space that meets all of these criteria:

  – is large enough and configured such that an individual can bodily enter and perform assigned work, and

  – has limited or restricted means of entry or exit (e.g., tanks, vessels, silos, storage bins, hoppers, vaults, and pits), and

  – is not designed for continuous human occupancy.

- An initial hazard evaluation is performed and documented to assess potential and existing hazards inherent in the confined space. Classify the space as a permit required confined space or non-permit confined space.
- Document the initial hazard evaluation on the Confined Space Hazard Identification form or equivalent documentation.
- Control any confined space that does not have an initial hazard evaluation, as a permit required confined space until a hazard evaluation is performed and documented.
- Label or post permit required confined spaces with a danger sign at potential entry points, stating “DANGER: CONFINED SPACE - Contact Safety & Health Representative before Entering” or using similar language.
- If the space dimensions or configuration do not permit the conventional attachment of signs, use other effective means to inform employees of the space location and hazards.
- A permit required confined space with more than one entry must be labeled with a sign at all access points.

Employers/Supervisors will perform the following activities:

- Comply with the requirements of the Confined Space Entry form and other applicable permits.
- Determine that employees have received confined space training and are qualified to fulfill assigned duties.
- Obtain available information on the specific confined space from Battelle.
- Notify employees of required site-specific arrangements for a confined space entry, and provide additional information as follows:

– Identify hazards and conditions that form the basis for classifying the particular confined space as a permit required confined space.

– Notify employees of required precautions and procedures required by the space owner when employees are working in, or near, a permit required confined space.

– Identify the means to coordinate entry operations when multi-contractor employees will be working in, or near, a permit required confined space.

– Conduct and document a debriefing with employees at the conclusion of entry operations to determine whether unanticipated hazards were encountered or created during the work.

– Coordinate entry operations with other workforces.

– At the conclusion of the confined space operation, inform Battelle of unanticipated hazards and work conditions. Provide the Battelle Contract Representative the canceled permit and other records associated with the entry.

19.4 Classifying Confined Spaces

Before any work is performed in a confined space, the employer/supervisor must identify, evaluate, and plan methods to control potential hazards of the space by performing the following:

- Review existing hazard evaluations, if available.
- Identify the hazards associated with the work to be performed in the confined space.
- Classify the space as a permit required confined space or a non-permit confined space.
- Control all non-permit confined spaces.
- Based on the results of the hazard evaluation, a permit required confined space may temporarily be reclassified as a non-permit confined space under the following conditions:
- If the permit-required space poses no actual or potential atmospheric hazards and if all engulfment, entrapment and serious safety hazards within the space are eliminated without entry into the space. The space may remain classified as a non-permit-required confined space for as long as the hazards remain eliminated.
- If it is necessary to enter the permit-required space to eliminate hazards, such entry shall be performed under permit-required confined space procedures. If testing and inspection during that entry demonstrate that the hazards within the permit-required space have been eliminated, the

permit-required space may be reclassified as a non-permit-required confined space for as long as the hazards remain eliminated.

Note: Control of atmospheric hazards through forced air ventilation does not constitute elimination of the hazards.

- The Contractor has documented the basis for determining that all the hazards in the space have been eliminated through a certification containing the date, space location, and the signature of the Contractor. The certification must be made available to all entrants. In addition to the above certification, routine work control documents must address the control methods for any other safety and health hazards that may be encountered during the entry.
- When the permit-required confined space cannot be reclassified as non-permit-required confined space, work is conducted in accordance with the Confined Space Entry form, which specifies control measures, and work practices to minimize exposures and maintain health and safety of staff members.

19.4.1 Working on Telecommunication or Electrical Equipment in Manholes or Underground Vaults

When telecommunication or electrical service work is performed in manholes or underground vaults, special requirements apply regardless of the classification status of the confined space (permitted on non-permitted).

Before telecommunication or electrical service work is performed in a manhole or underground vault, employers/supervisors must identify, evaluate, and plan methods to control potential hazards of the space by following these steps:

- Guard the manhole or street opening.

  Note: When covers of manholes or vaults are removed, the opening must be promptly guarded by a railing, temporary cover, or other temporary barrier to prevent an accidental fall through the opening and to protect staff working in the manhole from foreign objects entering the manhole.
- Test the space for oxygen levels and combustible gas with a properly calibrated and maintained combustible gas indicator.

  Note: If an open flame is to be used in the space, combustible gas monitoring must be performed immediately prior to use of the flame. Storage of fuels is not permitted in the space unless it is in actual use.
- Establish forced air ventilation before entry into space and continue for the duration of the job. Mechanical forced air ventilation must be in operation at all times when workers are required to be in the manhole or vault.

  Note: The air should be tempered when necessary and care should be taken so that workers will not be subjected to excessive air velocities. If the forced air ventilation is discontinued during the course of the work (for example, during shift change or lunch breaks) the oxygen and combustible gas measurements must be repeated to verify adequate breathing air quality.

- Provide ladders for entry and exit if manhole is more than 4 ft deep.
- Provide first-aid trained staff during entry to render emergency first aid when there is electrical power exposure potential in the space.

  Note: See the Electrical Safety section for further electrical safety requirements.
- If the space has been classified as a permit-required confined space for the purpose of this entry, conduct the work in accordance with the Confined Space Entry form, which specifies control measures and work practices to minimize exposures and maintain health and safety of staff members.

19.4.2 Non-Permit Confined Spaces

Before entry, verify and document on the Confined Space Hazard Identification form that the planned work or changes in the space configuration will not introduce permit required space hazards.

Review the initial hazard evaluation, if available and update as necessary.

Appropriately manage all hazards associated with work activities in non-permit confined spaces.

Re-evaluate and, as necessary, reclassify non-permit confined spaces to permit required confined space when changes in the use or configuration of the non-permit confined space increase the hazards to which employees may be exposed.

Use documented engineering controls, or posting/labeling, to prevent inadvertent entry into non-permit confined spaces.

19.4.3 Preparing for Entry into Permit Required Confined Spaces

For each permit-required confined space entry, a job-specific briefing must be held for all employees involved in the entry to cover the known or anticipated hazards associated with the space and the work and the techniques for controlling these hazards.

Designate an appropriately trained entry supervisor to authorize, oversee, and terminate entry operations.

Assign at least one trained attendant to remain outside the permit space for the duration of the entry.

The entry supervisor conducts the job-specific briefing for the entrants and the attendants based on the completed entry permit. Topics that must be included are:

- Work to be performed
- Anticipated hazards, including signs, symptoms, and consequences of exposure to the hazards
- Hazard control measures
- Verification that entrants and attendants have appropriate training.
- Emergency rescue procedures.

The entrants and attendants read and sign the permit. Signing the permit indicates that the signatories have been briefed on the hazards and the techniques used to control the hazards and that they will comply with these techniques and control measures.

19.4.4 Multi-Employer Entries

Confined space entries involving employees of more than one Contractor or Sub-contractor working in a space simultaneously will be coordinated so all work is conducted safely.

The following activities will occur:

- Personnel involved in the confined space entry have been informed of hazards that may be introduced by other workforces.
- Entry is authorized by issuance of a single permit signed by a representative from each organization.
- Workers participating in a multi-employer entry attend a single pre-job briefing.

19.4.5 Contractor Activity Interface

During contractor related work activities, control and classification of temporary or newly constructed confined spaces is the responsibility of the Battelle Contract Representative. Confined spaces will be classified prior to entry as part of the hazard evaluation and work planning process.

When the construction phase ends, the completed confined space will be turned over to Battelle.

19.4.5.1 Making Entries into Permit Required Confined Spaces

Work in a permit-required confined space must be conducted in compliance with the Confined Space Entry form.

Designate qualified and trained entry team members to perform duties described in Attachment 01 below.

If a single attendant is assigned to monitor multiple spaces, determine the means or procedure the attendant can use to respond to an emergency affecting each of the spaces without compromising other assigned duties, and document on the permit.

The initial testing and evaluation of atmospheric hazards will occur before entry, and as often as necessary during re-entry to maintain acceptable conditions.

Determine what engineered controls, personal protective equipment, and atmospheric monitoring requirements are needed for chemical and physical hazards.

Provide rescue equipment, harnesses, lifelines, lifting devices, supplemental lighting, communication devices, personal protective equipment, ladders, ventilation equipment, or other special equipment as specified on the Confined Space Entry form. Provide for entrant rescue and retrieval, considering both the size and configuration of the space, the size of entrants and rescue personnel.

19.4.5.2 Permit System

Entries into permit required confined spaces are administratively controlled by a Confined Space Entry form. The permit system includes the hazard assessment, entry permit, and supporting documentation. The permit designates a specific operation, location, work package, and time period.

The duration of the permit may not exceed the time required to complete the assigned task or job as identified on the permit. If planned work will continue for more than 1 work shift, the permit may be approved for subsequent re-entries provided that the following conditions are met:

- No new hazards are identified or introduced into the space.
- There are no changes in work scope or permit-prescribed work controls.
- Pre-entry testing is performed and acceptable entry conditions exist.
- Re-entries are authorized and documented on the permit.

Before entry, verify that all authorizing signatures are recorded on the permit.

Document all confined space entries/egresses on the Confined Space Entry Log.

Restrict entry to those listed on the log, unless they are entering as members of the rescue team.

Terminate entry and cancel the permit when entry operations covered by the permit are complete or if conditions occur in or near the space that are not allowed by the permit. When entry operations are complete, do the following:

- Verify that all entrants have exited the space, remove any temporary barricades, and return the space to service as applicable.
- Cancel the permit by completing and signing the Permit Cancellation section on the permit itself.
- Note on the permit any unusual conditions encountered during the entry operation.

19.4.6 Unusual Conditions

Any of the following may be unusual conditions and, as such, require a review of the entry procedures, if observed:

- an unauthorized entry into a permit space
- detection of a permit space hazard not covered by a permit
- occurrence of an injury or near miss during entry
- change in the use or configuration of a permit space
- detection of a condition prohibited by the permit
- when the employer or employee has reason to believe entry procedures do not protect entrants

Obtain assistance from Battelle for conducting a review of permits that report unusual conditions, or when entry operations have been canceled because of conditions not allowed by the permit.

Submit canceled permits with the work package records. Maintain a copy for the project or facility records for annual review.

19.4.7 Atmospheric Testing For Permit Required Confined Spaces

For permit spaces with potential atmospheric hazards, perform atmospheric testing before employee entry and throughout the duration of the entry to maintain acceptable entry condition.

Note: Atmospheric testing will be performed by a qualified person.

Provide atmospheric testing equipment that is calibrated, maintained, and operated in accordance with the manufacturer's operating manual.

Record instrument calibration data and all initial and subsequent atmospheric test results on the permit. Calibration and maintenance records will be maintained with the data collected representative of the levels of contaminants being measured.

Perform atmospheric monitoring, as prescribed by the permit, to determine whether acceptable entry conditions are being maintained during entry operations. Test for the following conditions in this sequence:

1. Oxygen content between 19.5 percent and 23.5 percent.
2. Flammable gases and vapors (not to exceed 10 percent of the lower flammable limit).
3. Toxic air contaminants, as specified on the permit.

Test multiple levels of the space to determine any stratified layers that may be present. If there are areas that cannot be tested from outside the space, then test as the entry progresses. Use extension apparatus or other means to test the atmosphere at least 1.2 meters (4 ft) to the front and sides of the entrant.

If the space configuration limits effective atmospheric testing (as may occur with large spaces or spaces that cannot be isolated, such as sewer system entries), provide entrants with personal monitoring devices that they have been trained to use. Conduct pre-entry testing to the extent possible before authorizing entry, and continuously monitor conditions in areas where employees are working.

When portable mechanical ventilation is used, conduct atmospheric testing first with the ventilation off, then with the ventilation on.

If testing indicates the presence of a hazardous atmosphere in the confined space, prohibit entry until appropriate controls have been implemented, and implement monitoring strategies.

19.4.8 Applying Hazard Controls

Assign controls commensurate with the risk and dependent on the hazards and whether the hazards will be eliminated before entry or controlled before and during entry. Implement hazard control/reduction, whenever feasible, by:

- Redesigning tasks to make personnel entry into confined spaces unnecessary.

- Using accepted engineering control measures.
- Applying administrative controls and work practices.
- Prescribing personal protective equipment.

When prescribing recommendations for controls or work practices, consider additional hazards that the control itself may introduce. Prescribed protective measures will not interfere with the ventilation requirements for the space, means of entrance or egress for the occupants, or rescue methods.

Based on the pre-entry hazard evaluation, apply the hazard controls and work practices described in Attachment 02, as applicable.

19.4.9 Emergency Response and Rescue for Permit Required Confined Space

Emergency and rescue planning, procedures, and escape routes will be designed for the characteristics of the space. Consider effective response times in determining rescue measures. When working on the Hanford Site, the Hanford Fire Department is the emergency rescue team.

Attendants will have at least one of the following at the work location:

- telephone
- two-way radio
- cellular phone
- other suitable means of summoning the emergency rescue team

The attendant will maintain constant communication with confined space occupants by voice, signal, or other means as specified on the permit.

The emergency rescue team will be available for response. If the emergency rescue team is unavailable or becomes unavailable for response, reschedule or suspend the entry.

For non-entry rescue from a permit space, determine appropriate retrieval systems or methods to summon the emergency rescue team. If the use of retrieval equipment increases the overall risk of entry or would not contribute to the rescue of the entrants, then define alternate rescue methods, document them on the permit, and communicate them to employees.

When required by the permit, each authorized entrant will use a full body harness with retrieval line attached at the center of the entrant’s back near shoulder level or above the entrant’s head. Wristlets may be used in lieu of the full body harness if you can demonstrate that the use of the full body harness is not feasible or creates a greater hazard and that the use of wristlets is the most effective and safe alternative.

Attach the other end of the retrieval line to a mechanical device or fixed point outside the permit space such that the rescue can begin as soon as the rescuer becomes aware that rescue is necessary. Dedicate a mechanical device to retrieve personnel from vertical type confined spaces more than 1.5 meters (5 ft) deep.

The entry attendants and authorized entrants will be trained in the proper use of the retrieval equipment.

Note: Attendants do not enter a space to attempt a rescue.

Inspect required harnesses, retrieval lines, and mechanical lifting devices so they will be immediately available at the work location during permit space entries.

Damaged equipment shall be tagged out-of-service and removed from use.

When a non-entry rescue begins, contact the emergency rescue team in case an additional emergency response or rescue is needed. If retrieval or rescue requires entry into the space, the attendant will summon the designated rescue team, and stand by (the attendant is not to enter the permit space).

Inform the rescue team of all hazards associated with the confined space.

Summon the emergency rescue team under any of the following circumstances:

- Rescuers are required to enter the confined space.
- The rescue involves retrieval of an injured person.
- The attendant needs help in retrieving the confined space occupants.
- Medical assistance is required.

In the event of a chemical exposure, communicate hazard information from the MSDS or other sources to the medical providers.

19.5 Training/Qualifications

The following conditions shall be met:

- Attendants, entrants, supervisors, atmospheric testing personnel, and other entry team members are provided initial confined space training before performing their assigned duties for confined space entries.
- Employees are aware of the safety requirements and availability of this program.

Entry team members are appropriately informed of the following:

- There is a change in assigned duties.
- A change in permit space operations introduces a new hazard for which the employee has not been trained.
- Inadequacies in the employee’s knowledge or use of this program or entry procedures have been identified.
- Changes in program requirements are communicated to entry team members.

Employees have completed any additional training requirements specified by the permit.

In addition to the initial confined space training course required for all entry team members as required, the designated atmospheric testing person is trained on the proper use, application, and limitations of the instrumentation to be used, including the following:

- Field calibration and performance checks of the instruments.
- Anticipated hazardous contaminants.
- Instrument operation.
- Knowledge of alarm set points and actions required when an alarm occurs.
- Related documentation requirements.

19.6 References

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

WAC 296-155, Safety Standards for Construction Work

19.7 Records

Document	Record Submittal Responsibility	Record Retention Responsibility
Confined Space Entry	Contractor (also Battelle for any of its employees who must enter)	Contractor (site), Battelle as necessary
Training/Qualifications	Contractor	Contractor

19.8 Attachments

Attachment 01, Entry Team Duties (See below.)

Attachment 02, Hazard Controls/Work Practices (See below.)

Attachment 01: Entry Team Duties

Entry Supervisor

Recognize the hazards that may be encountered during entry and the mode, signs, symptoms, and consequences of exposure.

Before signing the permit to authorize entry, verify completion of pre-entry activities, completion of the permit, and required signatures have been obtained. Post completed permit at the entrance of the confined space so that authorized entrants may confirm completion of pre-entry preparations.

Before entry into a permit space, notify the designated rescue team of the planned entry, location of the space, anticipated hazards, and any special considerations for rescue from the space. Verify availability of rescue service, and that the means to summon them are operable.

Perform a pre-job briefing with all entry team members to review the work scope, hazards associated with the entry, and details of the permit requirements.

If the duties of entry supervisor are transferred from one individual to another during the course of entry, record the name of the current entry supervisor on the permit.

Entry operations will remain consistent with the terms of the entry permit.

Take appropriate measures to remove unauthorized personnel who are in or near the space.

Cancel the entry authorization and terminate entry whenever entry conditions are not acceptable.

When entry procedures are complete, close out entry operations and cancel the permit.

Document problems encountered during an entry operation the permit.

Note: An entry supervisor may also serve as standby attendant or entrant as long as they are trained and equipped to perform each role.

Attendant

Recognize the hazards that may be encountered during entry and the mode, signs, symptoms, and consequences of exposure.

Do not perform other tasks that could prevent, limit, or interfere with implementation of assigned duties as attendant.

Remain stationed outside the permit required confined space during entry operations until relieved by another attendant, documenting any change of duty on the permit.

Monitor any conditions or changes that could occur in or around the confined space that could adversely affect the entrants.

Order entrants to evacuate the space immediately when any of the following conditions are observed:

- A condition that is not allowed on the permit (such as interruption of ventilation).
- Activation of an alarm on the atmospheric testing equipment.
- Effects of hazard exposure on behavior of entrants or an uncontrolled hazard in the space.
- A situation outside the space that could affect the safety of the entrants.
- The need of the attendant to leave the workstation and another qualified attendant is not available as a replacement.
- Inability of the attendant to safely and effectively perform all required duties.
- Unavailability of the emergency rescue team to perform a rescue.

Perform non-entry rescue as specified on the permit. Summon emergency/rescue services when required.

Maintain an entry log to identify and track the entry/egress of each authorized entrant.

Restrict access during entry operations to authorized entrants only. If there is an attempted unauthorized entry, notify the entry supervisor.

Authorized Entrants

Recognize the potential hazards that may be encountered during entry, including the mode, signs, and symptoms of exposure.

Review the requirements of the Confined Space Entry form and sign the entry log for each entry/egress.

Understand and implement required measures for work control as defined in the permit. Safely use all required equipment necessary for safe conduct of work in the space.

Communicate with the attendant to facilitate the monitoring of entrant status and conditions in the space.

Alert the attendant and exit the space when a warning sign, symptom of exposure, or prohibited condition is identified.

Exit the space when the order is given to evacuate, on recognition of warning signs/symptoms, or when prohibited conditions are detected or alarms activated.

Attachment 02: Hazard Controls/Work Practices

Isolation/Tagout Requirements

Evaluate energy sources/materials, including equipment not connected to an energy source but having unguarded movable parts. Consider outside sources that could introduce a hazardous substance into the space.

If determined to be potentially hazardous to the entrants, isolate in accordance with the Battelle Lockout/Tag out Program. Examples of hazardous energy include electrical, mechanical, hydraulic, pneumatic, chemical, and thermal energies, in addition to potential energies, such as compressed gases, springs, or suspended objects.

Acceptable means of isolation include blanking or blinding, misaligning or removing sections of lines, pipes, or ducts, a double-block-and-bleed system;, lockout/tag out of all sources of energy, or blocking or disconnecting all mechanical linkages.

Purging/Flushing/Ventilation Requirements

Before entry, confined spaces will be emptied or otherwise purged of flammable, injurious, or incapacitating substances, as feasible.

If safe levels cannot be achieved, implement additional ventilation or other engineering controls to reduce contaminants to the lowest level feasible, and provide adequate personal protective equipment.

Do not introduce pure oxygen into the space for purposes of ventilation or to improve the breathing air quality.

If flammable gases, vapors, or combustible dusts are present, any ventilating equipment used must be approved for use in the specific hazardous location.

Test the atmosphere before and during ventilation of the space to verify acceptable entry conditions.

If the ventilation system shuts down, entrants shall leave the space and not re-enter until approved by Battelle.

Provide and maintain continuous ventilation or local exhaust ventilation of the confined space during welding, painting, and other operations that generate air contaminants. If ventilation is not possible or feasible, develop alternate protective measures.

The ventilation arrangement for the space will preclude the entry of atmospheric contaminants into the ventilation intake and the exhaust of contaminants into adjacent work areas.

Welding, Cutting, and Heating

Welding and cutting performed in a confined space requires a Hot Work Permit.

Fall Protection and Retrieval

Components making up both systems consist of personal protective gear (harness), connecting devices (retracting lifelines, retrieval devices), and approved anchorages (tripod).

Emergency retrieval equipment is specifically intended to lift injured personnel from a vertical, confined space.

Material hoists must be separate and approved for use as part of the anchorage system.

Devices such as a combination retractable lifeline/retrieval device can meet both fall protection and emergency rescue functions.

Excavations and Trenches

Confined entry procedures may be applicable for certain excavations and trenches. Evaluate each situation separately to determine whether the requirements for confined space entry apply to the anticipated work.

Personal Protective Equipment

Personal protective equipment selection, as determined by project safety, will be appropriate for the conditions and configuration of the confined space, based on results of the hazard evaluation.

Confined space entrants, whose work requires respiratory protection, will be fit tested, trained, and medically cleared.

Requirements for Equipment and Tools

In confined spaces, ground fault circuit interrupters will be used with all power tools and electrical lighting.

If flammable liquids, gases, or vapors are present, use only tools, lighting, communications equipment, and other electrical equipment that are approved for use in the specific hazardous location.

Illumination Requirements

All lighting used in spaces containing, or having the potential to contain, flammable vapors or explosive dusts will be approved for use in hazardous atmospheres. This requirement also applies to low-voltage lighting such as droplights.

Install temporary lighting in accordance with National Electric Code requirements.

Lighting will be sufficient for entrants to see clearly, avoid potential hazards, and exit the space quickly in an emergency.

External Hazards

When entrance barriers are removed from below-grade confined spaces, guard the opening with a railing, temporary cover, or barrier to prevent persons or objects from falling into the space.

20.0 Electrical Work Safety

20.1 Purpose

The purpose of this section is to define the requirements for electrical safety and to ensure compliance with National Fire Protection Association (NFPA) 70E (2015), Standard for Electrical Safety Requirements for Employee Workplaces and U.S. Department of Energy; Occupational Safety and Health Act; and Washington Industrial Safety and Health Act requirements. The provisions of this section apply to Subcontractors or vendors who perform work on or near exposed, electrical equipment for Battelle.

20.2 Definitions

De-Energized: Equipment or systems where electrical or mechanical energy has been released by disconnecting power, discharging all capacitors, short-circuiting and grounding all high-capacitance elements, releasing or physically restraining springs, and relieving or blocking all other sources of stored energy.

Diagnostics and Testing: Diagnostic and testing includes work performed on or near live parts related to tasks such as electrical testing, troubleshooting, or voltage and current measurement. It may require the use of portable test instruments, but no other tools can be used on energized parts. Note: Repairing, replacing, or removing energized exposed components is considered energized work, not diagnostic and testing.

Electrical Hazard: A dangerous condition in which inadvertent or unintentional contact or equipment failure can result in shock, arc flash burn, thermal burn, or blast.

Electrical Installation: Work that involves installing power circuits, installing permanent wiring, attaching new electrical equipment to a facility's permanent electrical wiring, or modifying electrical equipment that is attached to a facility's permanent wiring (i.e., situations where a modification permit is needed). It does not include installing cord and plug connected equipment.

Energized: Equipment or systems electrically connected to an energy source. All electrical equipment is considered to be energized until proven otherwise (using a meter).

Qualified Electrical Worker: A person who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training on the hazards involved. Such a person is familiar with the proper use of precautionary techniques, personal protective equipment, insulating and shielding materials, insulated tools, and test equipment. A person may be considered qualified with respect to a certain equipment but still be unqualified for others.

Safe Condition Check: The comprehensive inspection or test of the isolating boundary performed for or by the controlling organization to confirm that the isolating boundary is controlled to prevent exposure from all sources of hazardous energy and material.

Safe-to-Work Check: The inspection or test that an authorized worker performs to confirm that no hazardous energy exists where servicing or maintenance will be performed. For electrical energy, this

involves the use of test equipment (Only contact type such as voltmeters, etc.) by the qualified electrical worker performing the work.

20.3 Requirements

The electrical work safety requirements address:

- training
- underground or temporary electrical installations
- Approach boundaries
- shock analysis
- flash hazard analysis
- working on or near exposed energized electrical parts within the limited approach boundary
- working on or near exposed energized electrical parts within the restricted and prohibited approach boundary
- electrical work permit process
- testing and troubleshooting on live, energized parts
- de-energizing live parts
- Personal Protective Equipment (PPE)
- Insulated /nonconductive equipment use
- Measuring and Testing Instruments
- Use of ground fault circuit interrupter (GFCI)
- Flexible cords and cables
- blind penetrations
- national electrical code compliance
- work affecting electrical utilities operations
- specific activities/requirements

20.3.1 Training

Contractor or Subcontractor employees receive basic instruction on electrical safety as part of their orientation. This instruction is covered in the PNNL Laboratory Orientation (Course 2400) when work is to be performed on Battelle sites.

Contractor or Subcontractor employees who face a higher-than-normal risk of contact with electrically energized parts (technicians, vendors, craftsmen) must be trained to understand electrical hazards associated with work related activities in accordance with NFPA 70E (2015), Standard for Electrical Safety Requirements for Employee Workplaces. Such training must be deemed acceptable to Battelle

and supplemented by PNNL electrical safety training as appropriate. Electrical qualification is documented using the Activity Specific Electrical Worker Qualification form. Retraining shall be performed at intervals not to exceed three years.

Note: Such persons shall also be familiar with Battelle procedural requirements, emergency procedures, personal protection equipment (PPE), arc flash, test equipment, insulating materials, and tools. A person can be considered qualified with respect to certain equipment and methods, but still be unqualified for others.

The Contractor or Subcontractor shall be responsible for providing apprentice electricians with appropriate electrical safety training prior to assigning work assignments that involve electrical hazards. When working under the supervision of a Journeymen Electrician, it is the responsibility of the Journeymen Electrician to assign work that is appropriate for the apprentice's experience, skill level, and training. Battelle doesn't allow apprentice electricians to perform work on energized electrical conductors or circuit parts that are not placed in an electrically safe work condition.

20.3.2 Underground or Temporary Electrical Installations

Underground electrical installations shall meet the requirements of the version of NFPA 70 currently accepted at PNNL. Temporary installations shall meet the general requirements of the version of NFPA 70 currently accepted at PNNL. Installations shall be inspected by PNNL's third party NEC inspector prior to being energized. PNNL may require underground electrical services to be marked above ground with danger buried electrical.

20.3.3 Shock Analysis

A shock hazard analysis shall determine the voltage to which personnel will be exposed, boundary requirements, and the PPE necessary in order to minimize the possibility of electric shock to personnel.

Limited Approach Boundary – Working Near (refer to Table 20.1): This boundary establishes the distance around exposed energized parts that only a qualified person may enter. If an unqualified person must enter the limited approach space to perform a minor task, like an inspection, then a qualified person must escort and advise this person of the potential hazards and ensure that the unqualified person is under his/her direct supervision.

To enter the limited approach boundaries, the qualified person must:

- Verify that a shock hazard analysis and flash hazard analysis is performed and the approach boundaries are clearly defined, and the required PPE (if applicable) are prescribed.
- Understand and follow the requirements established in the PNNL Electrical Work Permit (EWP).

Restricted Approach Boundary (refer to Table 20.1): This boundary establishes the distance around exposed, energized parts that only a qualified person may enter. To enter the restricted approach boundary, the qualified person must:

- Meet the requirements of entering the Limited Approach Boundary

Table 20.1. Approach Boundaries to Live Parts

Nominal System Voltage Range	Limited Approach Boundary		Restricted Approach (includes inadvertent movement adder)
Phase-to-Phase	**Exposed Movable Conductors**	**Exposed Fixed Circuit Parts**	
50 V to 150 V	10 ft 0 in.	3 ft 6in.	AVOID CONTACT
151 V to 750 V	10 ft 0 in.	3 ft 6 in.	1 ft 0 in.
Over 751 V, not over 15kV	10 ft 0 in.	5 ft 0 in.	2 ft 2 in.
15.1 kV to 36 kV	10 ft 0 in.	6 ft 0 in.	2 ft 7 in.
36.1 kV to 46 kV	10 ft 0 in.	8 ft 0 in.	2 ft 9 in.

20.3.4 Arc Flash Hazard Analysis

An electrical arc flash analysis shall be conducted in order to protect personnel from the possibility of being injured by an arc flash event. The analysis shall determine the flash protection boundary and the personal protective equipment that workers must wear when they are within the flash protection boundary.

Note: If the flash analysis determines the incident energy to be 40 cal/cm^2 or greater the work must not be performed unless an electrically safe work condition has been established (equipment de-energized). The electrical work permit (EWP) will specifically address the method on establishing the electrically safe work condition.

Note: For AC systems, see the flash protection boundary below or contact Construction Safety for assistance.

Note: NFPA 70E Table 130(C)(15)(A)(a) can be used in lieu of the flash hazard analysis to determine the type of activity, equipment condition, and a need for PPE to perform the task. Then Table 130.7(C)(15)(A)(b) maybe used to determine the hazard PPE categories for the task. Work on DC systems above 50V will require PNNL electrical safety evaluation and approval.

20.3.5 Working within the Limited Approach Boundary of Exposed Energized Electrical Parts

Qualified electrical workers, the Battelle EWP author, and a Battelle construction safety or delegate will determine the electrical hazards during a site visit.

Since each job may differ in electrical hazards, the required PPE may vary according to the electrical hazards present. PPE may include arc-rated clothing, an arc flash face shield, insulated gloves with leather

protectors, insulated tools, voltage-rated rubber blankets, or insulated shielding (see the EWP for required PPE for the specific task).

Before conducting work, follow these safety practices:

- Provide suitable working clearance for the equipment (i.e., 36 inches in front of equipment, 30 inches wide, and 6 feet high).
- Locate the disconnect that de-energizes equipment before starting work.
- Confirm that lighting is adequate.
- Do not reach blindly into areas that might contain exposed live parts where an electrical hazard exists.
- Secure doors and hinged panels to prevent swinging into the worker.
- Restrict access with barricades, or attendants to isolate the work area and warn others of the exposed energized electrical circuits.
- Use voltage rated tools when required

Verify that the pre-job safety documentation is consistent with the scope of work. Use signs (designed in accordance with NFPA 70E) to isolate the work area and warn others of the exposed energized electrical circuits. Electrical safety warning signs are worded:

DANGER

ELECTRICAL HAZARDS

AUTHORIZED PERSONNEL ONLY

Before starting each shift a Battelle Electrical Qualified Worker conducts a pre-job safety briefing for participants involved with the work to be performed. The pre-job meeting shall be documented using the Pre-job Safety Planning Signoff Sheet. The Battelle Electrical Qualified Worker gives the briefing again for the oncoming shift workers if the job continues through a shift change. If you receive any electrical shock (other than static if clearly known) during your work performance, stop work and report to your immediate supervisor. Due to potential risks associated with electrical shocks, Battelle requires employees to be evaluated by a trained medical provider prior to returning to work.

20.3.6 Working within the Restricted Approach Boundary of Exposed Energized Electrical Parts

In addition to the requirements in safe practices for work within the limited approach boundary found above. The following applies when working within the restricted approach boundary:

Do not wear or carry any conductive accessories (such as rings, watches bracelets, metal frame glasses, or metal hats) in clothing pockets where they may make contact with exposed, energized parts. Clothing made of flammable materials, such as acetate, nylon, polyester, polypropylene, and spandex, shall not be worn. The two-person rule is required for work on energized components/safe-to-work checks, (systems with an incident energy of greater than 1.2 Cal/Cm^2), the second person observes the worker to ensure

that clearances are maintained and performs electrical emergency rescue if required. The backup person must be CPR certified, trained in first aid, and trained in methods of release of victims from contact with exposed energized electrical conductors/circuit parts.

Note: Unless specified otherwise in the EWP, all equipment and circuits to be worked on or to be near shall be de-energized and locked out and tagged out before initiation of work.

20.3.7 Electrical Work Permit Process

An Electrical Work Permit (EWP) is required when working within the limited and restricted approach boundaries. Working on energized parts must be considered a last resort after all other opportunities for establishing an electrically safe work condition have been exhausted. After consulting with electrical qualified workers and a Battelle Electrical Safety Engineer or delegate (e.g., Battelle S&H Representative), ensure that measures have been taken to de-energize all electrical sources and that there is no feasible alternative to completing work on the energized equipment that is within the approach boundaries. The compelling reason for justifying energized work shall be identified on the EWP.

- Construction activity involving energized work requires completion of an Electrical Work Permit.
- EWPs may be approved up to six months.
- Include the completed permit with other pre-job safety planning documents.
- Have a copy of the completed permit available at the jobsite.

20.3.8 Diagnostic Testing, and Commissioning on Live, Energized Parts

Diagnostic, testing, and commissioning on live, energized parts is allowed when a EWP for diagnostic and testing is developed and approved. The work may require the use of portable test instruments, but no other tools (i.e. jumper install or lifting of conductors) can be utilized to help diagnose the problem while the system(s) are energized. Once the problem is discovered and identified during the diagnostic phase the repair and replacement of the components shall be performed with the system de-energized and managed under PNNL's lock and tag program requirements.

Electrical parts and components (see Table 20.2) are ther than low risk equipment shall be de-energized and locked and tagged out to the maximum extent feasible before they are work on (Refer to the Lockout/ Tag out Program for further guidance).
The following steps must be used to verify the correct energy isolation point.

Note: The Qualified Electrical Worker verifies that the equipment is properly de-energized, isolated, and locked and tagged out before applying their Authorized Worker lock and tag.

Step 1: If the circuit is in service, use an approved voltage-rated instrument to verify that the correct energy isolation point has been identified as follows:

- Verify the presence of power and then de-energize while observing the voltage decrease ("watch the meter fall"). This test can be completed at a less hazardous location, if necessary. If contact with the test point cannot be verified visually, shields or barriers may be removed to allow visual

confirmation. Verification of the correct isolation point (safe condition check) is required only once (not for each phase).

- When the energy isolation for a component must be confirmed on the device being manipulated, verifying the presence of energy before isolation and verifying the absence of energy after isolation is acceptable in lieu of watching the voltage decrease to zero on the meter.
- If a method other than those described above is used to verify the energy isolation point, the method must be identified on LOTO written instruction form.
- If the circuit is not in service but can be safely energized and energization does not create any safety concerns then energize the system or equipment and proceed as above for a circuit that is in service.

If the system or equipment source is unknown, the source must be verified and positively identified before work can proceed.

Guards, shields, and other non-energized parts may be removed with insulated tools to expose conductors in order to obtain voltage readings to verify the correct energy isolation point (safe condition check) and safe-to-work checks.

Where isolating elements are visible, verify that all blades of the disconnecting devices are fully open or that drawout-type circuit breakers are withdrawn to the fully disconnected position.

Step 2: Lock and tagout the equipment or system following the Controlling Organization written instructions

Step 3: Complete a safe-to-work check by using an approved voltage-rated test meter to test each phase conductor or circuit component both phase-to-phase and phase-to-ground. Test before touching. Retest equipment for absence of voltage when circuit conditions change or when the job location has been left unattended.

Table 20.2. Threshold for Low Risk Equipment

Equipment	Voltage/Capacity Values (voltage is line-to-ground or line-to-line, whichever is greater)
Low	Voltage <50 V or Energy, <10 J stored in a capacitor **or** Output current < 5 mA

Note: Lockout/tagout is not required for cord and plug equipment when the cord and plug is in line of sight, within arm's reach, and under exclusive control of the qualified person performing the work.

Note: Electrical equipment that is considered low risk is not required to be de-energized and/or locked or tagged out. It's recommended to de-energize this equipment before working on it when practical. Energized parts that are considered minimal risk need not be de-energized if there is no increased exposure to electrical burns or to explosion due to electric arcs.

Note: If de-energizing requires lifting or cutting neutrals or grounding electrode conductors, perform the following:

- Treat all disconnected/cut neutrals and grounding electrode conductors in the affected circuit as energized until zero energy is verified and any lifted, cut, or otherwise disconnected neutrals and

grounding electrode conductors are insulated (i.e., wire nut, electrical tape, or other approved insulating material is installed). Note that some grounding electrode conductors are bare. They cannot be insulated, but must be treated as energized until zero energy is verified. Wear PPE as required in this section while performing zero energy checks and establishing safe work conditions (i.e., insulating cut/disconnected neutrals).

- PPE is required when removing and reconnecting these wires due to the potential for changing electrical conditions in previously de-energized circuits via ungrounded or shared neutrals. PPE for this task can be downgraded to shock protection only if an arc flash analysis has been conducted.

20.3.9 Personal Protective Equipment

When Contractor and Subcontractor employees are working within the arc flash protection boundary, they must be qualified and shall wear arc rated protective clothing and other protective equipment. Clothing selection is based on the available arc incident energy level. Contractor and Subcontractor employees may be required to wear protective equipment for the head, face, neck, chin, hands, and arms whenever there is exposure to electric arcs or flashes. Inspect PPE before each use. PPE found to be damaged or contaminated with grease or oil shall not be used. Follow manufacturer's instructions for care and maintenance.

Contractor and Subcontractor employees must be trained to the manufacturer's instructions, characteristics, and PPE ratings. Document PPE training received by using the Training Attendance Record or an equivalent form.

20.3.10 Insulated/ Nonconductive Equipment Use

A qualified worker shall inspect the insulated equipment to be used before each use to verify the item is in satisfactory condition and has been tested as required. Inspect gloves for holes by air testing before use.

Note: Rubber protective equipment is inspected, cleaned, and tested at 6 month intervals. Hot sticks are tested at least every 12 months and date stamped at that time. A recommended alternative is to use disposable, voltage-rated (500 volts) protective equipment.

Inspect voltage-rated tools for defects and surface contamination, such as moisture, before each use. Do not rely on insulated tools alone for complete protection. Store and use equipment according to the manufacturer's recommendations.

Contractor and Subcontractor employees are briefed on the use of insulating rubber gloves. The Checklist for Insulating Rubber Gloves exhibit provides a checklist for users of insulating rubber gloves, as well as a basic outline for initial briefings and on-the-job-training.

20.3.11 Measuring and Testing Instruments

Only qualified personnel, who are trained on the operation and limitation of the equipment, shall use electrical measuring and test equipment. Verify test equipment is listed by a Nationally Recognized Testing Laboratory (NRTL) . Visually inspect electrical test equipment before use for a broken case, worn

test leads, and frayed or broken wires. Also check for a 600 volt or 1000 volt CAT III or CAT IV rating. Identify defective test equipment by tagging it out of service, and repair or dispose of it properly. Use electrical test equipment only for intended applications. Check electrical test equipment for proper operation immediately before and after use when verifying that circuits are placed in an electrically safe work condition. When performing zero-energy checks, make sure that stored electrical or mechanical energy cannot re-energize the circuit.

20.3.12 Use of Ground Fault Circuit Interrupter (GFCI's)

Use GFCIs on 120-volt circuits as specified below:

- in damp or wet (standing water) work areas outdoors
- for temporary power (e.g., extension cords) during construction, remodeling, maintenance, repair or similar activities
- when using portable, electric hand tools with cord/plug connectors

20.3.12.1 Ground Fault Circuit Interrupter (GFCI) Testing

Test GFCI breakers prior to use or per manufacturer's instructions. Users test portable GFCIs using 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.

Tripped GFCI outlets/circuit breakers shall be reset only once. If tripped during rest, they may not be re-set again until it has been determined the cause of tripping.

Do not reset or operate facility circuit breakers. Contact the construction manager or delegate.

20.3.13 Flexible Cords and Cables

Use NRTL flexible cords suitable for the conditions and the location of use. Flexible cord sets used with grounding-type equipment must contain an equipment grounding conductor.

Protect flexible cords and cables from damage. Extension cord sets are not to be used as a substitute for the permanent wiring of a building.

Note: Cords and cables may be damaged by foot traffic, vehicles, sharp edges, pinching, or improper storage.

Note: Extension cords are an acceptable means of extending power provided they do not contribute to overload, are protected from damage, and are removed when not in use. Daisy chaining extension cords are not allowed on PNNL project sites.

Discard damaged cord sets. Cord sets that have breaks in the insulation may be repaired by a qualified person so that the insulation is equal, or better than, the original insulation. Do not repair cords smaller than number 12 American Wire Gage.

20.3.14 Entering a Space

Do not reach blindly into areas that may contain energized parts.

Do not enter a space or perform functions, such as connecting or disconnecting cords, actuating circuit breakers or switches, or any other operation that may require being close to exposed energized parts, if lighting is not adequate or an obstruction prevents adequate observation of the work.

20.3.15 Blind Penetrations

20.3.15.1 Class I Penetrations

Class I penetrations are penetrations into hollow walls, ceiling, or floors where the absence of utilities or other hazards has been determined, or two inches or less into solid material.

Managers assigning workers to perform Class I penetrations must consider the location and type of work to be performed and provide oversight as necessary.

Workers performing Class I penetrations must evaluate the location of intended penetrations to identify potential hazards due to presence of hidden utilities (e.g., electrical, gas, steam) or hazardous materials (i.e., potential asbestos-containing materials). The worker evaluates the hazards, with assistance, if needed, by examining the material to be penetrated and checking behind walls, under floors, or above false ceilings to attempt to locate hidden utilities or other hazards that could be contacted during the penetration.

Upon completion of the evaluation, workers must implement the following controls:

- Use existing penetrations/holes when possible.
- Use self-tapping nylon wall anchors where appropriate for the application (e.g., anchoring light loads on sheetrock walls).
- Use non-conductive manual tools (e.g., star drills, screwdrivers, wooden handle punches, or similar tools with non-conductive handles) when feasible to make penetrations.
- Limit depth of penetration to the thickness of the external surface of hollow cavities or no more than 2 inches into solid materials when using power tools by use of short drill bit, depth gage, or other means. **Exception**: Use of self-tapping nylon wall anchors is exempt from this requirement.
- Use tools equipped with a GFCI,where electric power tools are needed. Test GFCIs before use.
- Battery-powered tools can only be used in hollow cavities.
- Visually inspect or probe (tools with nonconductive handles) completed penetrations before inserting screws, toggle bolts, etc. that might contact hazards.

- Scanning is not required for penetrations of less than 2 inches in solid materials. However, regardless of depth, electric power tools are required to be protected by grounded metal contact/power cut-off circuitry ("white box" attachment or integral circuitry).
- The minimum PPE required for a Class I penetration is:
  - Safety glasses with side shield, leather gloves, and substantial footwear.
  - Wear rubber outer boots over foot protection when using electric cord connected power tools with water coolant or in a wet environment.
  - Wear Class 00, 500-volt rated insulated gloves and leather protectors when penetrating solid materials (does not apply to hollow cavities).

Note: When a hollow cavity must be penetrated beyond the thickness of the exterior surface, a check for hazards (e.g., utilities, asbestos) must be made after penetration of the outside surface by looking into the hole with a flashlight, borescope, or probing with a nonconductive or insulated tool such as a screwdriver or wooden handle punch. Stop work and notify your supervisor if this check reveals potential asbestos-containing materials or other hidden objects not anticipated. Take steps as necessary to move or remove fiberglass insulation or other non-hazardous materials that may obscure hazards. The absence of hazards in the area to be penetrated must be verified before proceeding. **Exception**: Use of nylon wall anchors is exempt from this requirement.

A Class II Penetration Permit is required when penetrating solid materials beyond a depth of 2 inches or in hollow structures where the absence of utilities or other hazards cannot be determined as described above. Contact the Construction Manager or TOR for this form.

20.3.15.2 Stopping Work – Class I Penetration

If any unusual conditions are encountered while performing a penetration, the operation must be stopped and the responsible manager/delegate must be informed.

Note: Examples of unusual conditions are evidence of metal shavings, electrical or insulating material, or other unexpected materials, or an unusual sound such as that caused by contact of a drill bit with a metal object; lighting or other equipment unexpectedly turning off, or a GFCI or breaker trip.

20.3.15.3 Class II Penetrations

A Class II Penetrations must be completed for work requiring cutting, drilling, or otherwise penetrating deeper than 2 inches into solid material or through hollow structures (walls, floors, roofs, etc.) where the absence of utilities or other hazards has not been determined.)

The following steps must be followed for Class II penetrations.

- The immediate manager or delegate for staff performing the work, with assistance from knowledgeable personnel, must evaluate the hazards and document this assessment on the Class II Penetration Permit.
- Review historical records, engineering drawings, and plans that pertain to the area/location of the planned penetration.

- Consult with the Battelle construction manager, or other knowledgeable personnel, to assist in identifying potential hidden hazards.
- Visually inspect the proposed location of the penetration for evidence of hidden utilities in or behind walls, above false ceilings, and under sub-floor systems.
- Obtain a utility location with nondestructive testing devices (e.g., penetrating ionizing radiation, and ground-penetrating radar; magnetic and inductive devices) and mark the penetration point. If the responsible line manager or delegate has knowledge that a structure, wall, floor, or other surface does not contain electrical, gas, or other hazards, a Class II penetration may be authorized without a scan.
- If it is suspected that hidden hazards exist at the point of penetration, relocate the work if possible. If penetration cannot be relocated to a site free of obstructions, then de-energize and lock and tag utilities in the location of the penetration.
- If the penetration is to be made into a solid load-bearing wall or floor or if it cannot be relocated to avoid suspected reinforcing bar, consult a structural engineer prior to performing the penetration to make sure that the penetration does not unacceptably reduce load-bearing capacity of wall.
- Class II penetration permits must be reviewed and approved by the building manager/delegate, line manager responsible for staff performing the penetration, and the safety and health representative.
- Post the permit at the job site.

Workers must implement the following controls:

- Wear PPE and follow requirements specified by the Class II Penetration Permit.
- AC power tools must be protected by grounded metal contact/power cut-off circuitry ("white box" attachment or integral circuitry). If the power tool with ground-sensing capability detects metal objects, stop work immediately and notify your manager. DC power tools must not be used for class II penetrations.

  Note: The work cannot be restarted until the penetration is relocated or the grounded metal object is identified by removing the concrete material. Only qualified electrical workers with appropriate PPE can expose embedded material.
- After identifying the grounded metal object, the responsible line manager/delegate determines the appropriate method to proceed.

  Note: If the embedded object appears to be conduit, conductors, or presents other hazards to workers, stop work, isolate the area, warn other workers and notify the Battelle construction manager. Do not proceed.
- If the material is rebar or other structural material and the penetration cannot be relocated, consult a structural engineer for approval to remove it. A smaller diameter core may be required in order for power tools with ground-sensing capability to continue operation, or multiple pilot holes may be drilled to check that additional embedded metal objects do not exist in the penetration path.

Once absence of additional metallic objects has been verified, power tools with ground-sensing capability can be removed and penetration completed.

20.3.15.4 Stopping Work - Class II Penetrations

If any unusual conditions are encountered while performing a penetration, the operation must be stopped and the responsible manager/delegate must be informed.

Note: Examples of unusual conditions are evidence of metal shavings, electrical or insulating material, loss of water during core drilling, or other unexpected materials; or an unusual sound such as that caused by contact of a drill bit with a metal object; lighting or other equipment unexpectedly turning off; GFCI or breaker trip.

In addition, work must be stopped if any of the following conditions occur before or during the penetration:

- Penetration area boundaries have changed.
- Additional penetration work beyond the scope of the original work is required.

20.3.16 National Electrical Code Compliance

Electrical installations and modifications shall be inspected by a certified and qualified electrical inspector in accordance with contract requirements.

20.3.17 Work Affecting Electrical Utilities Operations

When work takes place within a horizontal distance 20 feet of the center line of the nearest voltage line, notify the electrical utility owner for an onsite meeting to establish conditions to safely complete the operations. If the vehicle is in transit with its structure lowered, the clearance may be reduced to 4 feet. If the voltage is higher than 50 kilovolts, increase the clearance by 0.1 meter for every 10 kilovolts over that voltage. For other reduced clearances, consult the appropriate Battelle Safety and Health Representative.

In addition to the requirements above, notify utilities if you intend to:

- Move any equipment taller than 14 feet under overhead power lines.
- Operate equipment within 20 horizontal feet from overhead high voltage (over 600 volts) power lines. If a vehicle is in transit with its structure lowered, the clearance may be reduced to 1.22 meters.
- Perform any operations near power lines during bad weather or hazardous conditions (rain, range fires, dust or wind storms, etc.).

20.3.18 Working Near Conduits (Flexible, PVC, EMT, Rigid and MC)

Flexible Metal Conduits (FMCs) & Flexible Non-metallic Conduits (FNCs) are meant to be used in relatively short runs and for ease of raceway installation and in locations where the equipment is subject to vibration (motors, fans, etc.). This type of raceway per NFP 70 Article 348.12 (for Flexible Metal

Conduits) and Article (356.12) (for non-metallic Conduits) cannot be used where they may be subject to physical damage. Therefore, care shall be taken when working near these types of conduits and around energized electrical equipment in general. Specifically, when working (electrical or non-electrical tasks) near these types of conduits the following precautions shall be taken:

- Evaluate your work activity against types of conduits found in your work area. Some conduits have a higher rate to become damaged in the work area. Safety precautions will depend on the nature of the work and types of conduit found within your work area. Planning your work will be essential for working around and near conduits safely. Remember hazards are identified and evaluated for every task, every time. Make certain work activities will not interfere or impede on conduits. If conduits are located in your work area:
    - All employees receive basic awareness for working around conduits and electrical components.
    - Machinery and equipment shall not operate within 5 feet of conduit or must be de-energized. Follow PNNL lock and tag program process.
    - When necessary shield conduit against physical damage or de-energize conduit when subject to damage by portable power tools, hand tool, or other activities that may cause damage. (e.g Sawzall, drill, shovel, hammer)
    - Report any broken conduits, removed faceplates, open ended wires that could potentially expose employees to energized parts.
    - Never attempt to move a permanently installed equipment and/or electrically connected equipment via a flexible conduit without properly de-energizing and if necessary, disconnecting it from the power source.
    - Flexible conduits are not meant to be treated like a cord used in cord & plug equipment. (Typically cord and plug equipment can be relocated while connected to a power source)
    - Prior to moving light fixtures wired by metal clad cable, PNNL's approval is required.

20.3.19 Working on Flexible metal/non-metallic conduits (performing electrical work):

When working on equipment connected to an electrical power source via a metallic or non-metallic flexible conduit, always perform the following:

- Ensure electrical power is controlled per PNNL's Lockout and Tagout Program
- Ensure no damage exists to the conduit system (i.e. flexible conduits are not broken, or pulled out of connectors, couplings and connectors are tight, covers are in place, knockouts are covered)
    - Contact electrical inspector or PNNL Electrical Authority Having Jurisdiction (AHJ) for assistance with electrical code applicability and implementation of the following; Use of such conduit is approved and appropriate for that location per NFPA 70, Articles 348 and 356.
    - Determine whether it is appropriate to use the conduit itself as an equipment grounding conductor (EGC)
    - Determine raceway itself can be used as an equipment grounding conductor, verify proper continuity is maintained after installation and or modification.

- Determine raceway cannot be used as an EGC, a separate EGC must be included as part of the circuit conductors and routed with the current carrying conductors within the same raceway.

20.4 References

NFPA 70E (2015), Standard for Electrical Safety in the

Workplace NFPA 70, National Electrical Code

WAC 296-24, Part L, Electrical

29 CFR 1926, Safety and Health Regulations for Construction

29 CFR 1910, Occupational Safety and Health Standards

20.5 Forms

Activity Specific Electrical Worker Qualification form, Course 2024

Pre-job Safety Planning Signoff

Electrical Work Permit

20.6 Exhibits

Checklist for Insulating Rubber Gloves

21.0 Lockout and Tag out

21.1 Purpose

This Lockout/Tag out information applies to Contractor and Subcontractor employees working in Battelle-owned, operated, or leased facilities. All employees must comply with facility-specific requirements. The Lockout/Tagout program applies to the installation, servicing, and maintenance of machines, equipment, and systems in which the unexpected release of hazardous energy or startup of the machines, equipment, and systems could cause injury to personnel. When it is determined there is no potential for release of hazardous energy during such service and maintenance activities, no lockout/tag out is required by this program.

Lockout/tag out involves the installation of a lock and tag (or locks and tags) so that work can be performed safely. A lock and tag is placed on each isolating point so the device and the equipment or system that is isolated and/or controlled cannot be operated until the lock and tag is removed. Contractor employees must use the correct personal protective equipment for hazardous energy while the lockout/tag out boundary is being established and lock and tag installed.

There are two important roles involved in lockout/tag out, the Controlling Organization and the authorized worker.

- The Controlling Organization is the Battelle organization, or an individual delegated by the organization, who is responsible for the operation of the building, utility, facility, system, or equipment associated with the work to be performed. For example, Building Managers are assigned responsibility for several categories of key operating systems or equipment. In those instances, the Building Managers are considered to be the Controlling Organization. A researcher who has been assigned responsibility for laboratory equipment is considered to be the Controlling Organization for that equipment. In the event that multiple organizations are involved in the need for lockout/tagout, a single organization needs to assume Controlling Organization lockout/tagout responsibility. Individuals assuming Controlling Organization responsibilities **MUST** be Battelle staff members and authorized workers.
- The authorized worker is the individual who actually conducts the work and, for their personal safety, places their individually assigned lock and tag prior to initiating the work activity.

The information provided in this procedure addresses the roles of authorized workers, Controlling Organizations, and their delegates in the lockout/tag out process. The Controlling Organization's role is described throughout this procedure. The authorized worker's role is described throughout this procedure and in the Authorized Worker Requirements exhibit.

Whenever outside utility service personnel are to be engaged in activities covered by the scope of the Lockout/Tag out program, Battelle's Controlling Organization and the outside utility must hold a pre-job meeting to inform each other of their respective Lockout/Tag out procedures. Both parties must agree on the procedures that are to be followed and inform their respective workers of any changes to normal procedures.

Lockout/Tag out does not address the use of cord and plug for control of electrical energy and work on energized equipment. For this Manual, a cord and plug connected piece of electrical equipment is any electrical equipment for which exposure to the hazards of electrical energy or unexpected start-up of the equipment is controlled by the unplugging of the equipment from the energy source, and by the plug being under the exclusive control of the employee performing the servicing or maintenance. For information on the use of cord and plug where the hazard is controlled by unplugging the equipment from the energy source and keeping the plug within arm's reach and line of sight of the authorized worker performing the servicing or maintenance, contact Battelle Construction Safety. Work on equipment where the servicing or maintenance requires the equipment to be energized (e.g., troubleshooting activities, voltage or current checks) is also covered in Section 20, Electrical Work Safety. Regardless of activity type, potential hazards are identified and assessed. Assessments involve examination of objective evidence and estimation of the degree of risk associated with hazards. When the significance of risk has been completely assessed, controls are assigned to the hazards. A graded approach is used, in which the controls are commensurate with the risk presented by the hazard. Contractor and Battelle staffs help determine the feasibility and effectiveness of proposed controls and select the best controls. The prescribed controls are documented in appropriate work control documents.

21.2 Definitions

See Appendix A for the complete definition of terms used in this procedure.

21.3 Planning for Lockout and Tagout

Installation, servicing, and maintenance of machines, equipment, and systems must be performed, and there is a potential for unexpected release of hazardous energy or the start-up of the machines, equipment, or systems could cause injury to personnel. This potential is identified during previous planning, hazard analysis or recognition of concern during the performance of work.

PNNL staff working off site must meet these lockout and tagout (LOTO) requirements at a minimum (in addition to other local requirements).

Note: Refer to hazard-specific work controls or contact the safety and health representative if there are questions.

Contractors shall utilize the Isolation/Outage Request Form to identify facility systems, utilities, or services that meet the requirements for hazardous energy isolation for lockout and tagout. This request allows the Controlling Organization to review the work scope, evaluate the hazards, and determine how the lock and tag will be performed.

21.3.1 General Requirements

These requirements do not apply to the following:

- When it is determined that there is no potential for the release of hazardous energy.
- Equipment and/or facility have been deactivated under a PNNL internal process of modification

to the facility or under a project specific plan and all energy sources are air gapped with no intent of reconnection, and LOTO is no longer required.

- Greenfield Construction activities, where infrastructure systems (e.g., mechanical, electrical, piping) are built toward the energy source and LOTO is not required until there is an ability to connect the system to the energy source.
- Leased facility owners or their contractors working on leased-facility equipment.
- The use of locks and tags for configuration control. See section 18.0 Signs and Barricades for configuration control methods.
- Emergency situations (e.g., freeing an individual from an energized electrical component, rescue of an individual from confined space) when alternative protective controls are in place and followed.

The following are exceptions apply to this procedure:

- Installation and removal of compressed gas cylinders.
- Work on equipment where the servicing or maintenance requires the equipment to be energized (e.g., troubleshooting activities, voltage checks, current checks, hot-tap of a pressurized system).
- Work on electrical equipment when it can be conclusively demonstrated that de-energizing introduces additional or increased hazards, or when it is infeasible due to equipment design or operational limitations, should be conducted in accordance with section 20.0 Electrical Work Safety

21.3.2 Required Procedure

<u>Evaluate the Potential for Unexpected Release of Hazardous Energy</u>

Performed By: **Knowledgeable LOTO-trained worker**

1. Based on training and LOTO requirements, evaluate the scope of work to determine if there is a potential for the unexpected release of hazardous energy and if LOTO is needed. Only a worker that is knowledgeable about all the hazards associated with the system and PNNL LOTO training (692) shall make this determination.
2. See the Lockout and Tagout Hazards Analysis Process exhibit to determine if LOTO is required. If lockout is not possible, follow the Alternative Means of Isolating Hazardous Energy from Specific Equipment exhibit.
3. Provide recommendation to the controlling organization.

<u>Determine If and How LOTO will be Performed</u>

Performed By: **Controlling Organization**

1. Evaluate the scope of work and the potential for unexpected release of hazardous energy, and determine if and how the LOTO will be performed. The options include:
   - Authorized Worker **LOTO with Verbal Authorization** – Controlling Organization determines the eight criteria can be met and provides verbal authorization for the Authorized Worker to perform the LOTO. Refer to the Eight Criteria for Proceeding with Verbal Authorization of Lockout-Tagout. No

controlling organization LOTO will be used. Refer to Section 21.4.

- **Authorized Worker LOTO with Written Instructions** – Controlling organization issues written instructions for the Authorized Worker to perform the LOTO. Refer to Section 21.5.
- **Controlling organization "Danger - Do Not Operate" LOTO** – Controlling organization issues written instruction and requires the use of Controlling Organization LOTO. Refer to Section 21.6.

2. Lockout and tagout devices will be used in accordance with the requirements described in the Locks, Tags, and Other Devices for Hazardous Energy Control exhibit.

3. If lockout is not possible, follow the Alternative Means of Isolating Hazardous Energy from Specific Equipment exhibit.

21.4 Perform Authorized Worker Lockout and Tagout with Verbal Authorization

21.4.1 Applicability

The controlling organization has determined that the lockout and tagout (LOTO) may be performed by the authorized workers without written instructions or controlling organization "Danger - Do Not Operate" LOTO. The LOTO must meet the Eight Criteria for Proceeding with Verbal Authorization Only.

All of the following eight criteria must be met to perform a lockout and tagout (LOTO) without having specific written instructions for the authorized worker to follow. If the work activity does not meet all of these criteria, then written instructions are required.

- The machine or equipment has no potential for stored or residual energy or re-accumulation of stored energy after shutdown that could endanger staff.
- The machine or equipment has a single energy source that can be readily identified and isolated.
- The isolation and locking out of that energy source will completely de-energize and deactivate the machine or equipment.
- The machine or equipment is isolated from that energy source and locked out during servicing or maintenance.
- A single lockout device will achieve a locked-out condition.
- The lockout device is under the exclusive control of the authorized worker performing the servicing or maintenance (i.e., the key to the lockout device is in the possession of the authorized worker).

- The servicing or maintenance does not create hazards for other staff.
- No accidents have resulted from unexpected activation or re-energization of the machine or equipment during servicing or maintenance.

Note: Should an accident occur or a deficiency be identified that involves the failure to control hazardous energy, the controlling organization suspends the use of the above criteria related to that equipment Such suspension will be lifted only after corrections agreed to by the controlling organization and the LOTO subject matter expert are completed.If an authorized worker representative will be used to avoid exposing multiple workers to a hazard (e.g., a high radiation area, confined space, flash protection boundary), follow the Perform Authorized Worker Lockout-Tagout with Written Instructions or Perform Controlling Organization Lockout-Tagout (Section 21.6).

21.4.2 Required Procedure -

Authorize LOTO with Verbal Authorization

Performed By: **Controlling Organization**

1. Consider reviewing the Eight Criteria for Proceeding with verbal authorization (word) exhibit with the authorized workers.
2. Review the following with the authorized workers: 1) equipment shutdown and isolation responsibilities, 2) energy isolation point, 3) system isolation check, 4) safe-to-work check
3. Identify a staff member who is knowledgeable about the component or system to help shut it down. The staff member does not need to be LOTO trained.
4. Authorize the LOTO trained worker to perform LOTO with verbal authorization.

Inform Affected Workers of Work Being Performed

Performed By: **Authorized Worker**

1. Inform affected workers that the component or system will be shut down and LOTO performed. Consider advising them of aspects of the work that will be performed that may impact them (e.g., isolation of the work area, duration of the work).

Shut Down the Component or System

Performed By: **Knowledgeable Staff Member**

1. When directed by the controlling organization, or controlling organization delegate shut down the component or system in accordance with applicable procedures.

Isolate the Hazardous Energy Source Based on Verbal Authorization

Performed By: **Authorized Worker**

1. Isolate all hazardous energy sources from the equipment using the Hazardous Energy Isolation Practices exhibit, and perform a system isolation check.

Install Authorized Worker LOTO with Verbal Authorization and Perform Safe-to-Work Check

Performed By: **Authorized Worker(s)**

1. Install authorized worker (green) lock and danger tag directly on the energy isolating device or multi-locking device (hasp) secured to the energy isolating device. If more than one authorized worker is working under the LOTO, follow the Basic Group LOTO section of the Group Lockout and Tagout exhibit.
   Note: The lockbox option may not be used for this LOTO method.

2 Obtain a peer review of the defined isolation boundary from an independent knowledgeable, and LOTO trained worker.

3 Perform the safe-to-work check using the Authorized Worker Requirements exhibit.

Perform Work Under LOTO with Verbal Authorization

Performed By: **Authorized Worker(s)**

1. Perform the work as authorized and in compliance with all applicable requirements, follow the Authorized Worker Requirements exhibit.
2. If conditions change or concerns arise regarding the control of the potential for unexpected release of hazardous energy, suspend work and contact the controlling organization.
3. For transferring a LOTO during shift changes, see the Transferring a Lock and Tag during Shift and Personnel Change exhibit.
4. If a temporary lift of LOTO is required, see the Procedure for Temporary Lift of Lock and Tag Devices exhibit. Completion of the Lockout and Tagout Temporary Lift Form is not required for authorized worker LOTO with verbal authorization.

Remove Authorized Worker LOTO with Verbal Authorization and Inform Affected Workers

Performed By: **Authorized Worker(s)**

1. Confirm the scope of work is complete and the component or system is in a safe condition.
2. Remove the authorized worker lock and tag. If the authorized worker is absent, follow the Removal of Energy Control Device of Absent Authorized Worker exhibit.
3. After all of the authorized worker locks and tags have been removed, inform the controlling organization that the work is complete and the authorized worker LOTO has been removed.
4. Inform all affected workers that the LOTO has been removed.
5. LOTO is complete.

21.5 Perform Authorized Worker Lockout and Tagout with Written Instructions

21.5.1 Applicability

This information applies when the work activity does not meet the eight criteria for proceeding with verbal authorization only and the Controlling Organization does not choose to place their lock and tag.

21.5.2 Required Procedure

Prepare Written Instructions, Authorize Shutdown and LOTO

Performed By: **LOTO-Trained Worker, Controlling Organization**

1. A LOTO trained worker familiar with the system or equipment prepares lock and tag written instructions, including performing a technical review. Use the Lockout and Tagout Written Instruction Form unless other written instructions (i.e., procedure, permit) are approved by the LOTO subject matter expert (SME). Use the Hazardous Energy Isolation Practices exhibit to determine isolation methods.
2. The controlling organization reviews the written instructions for approval and authorizes the LOTO.

Note: Although not required, the controlling organization may use a second person to perform a technical review of the written instructions and make sure the correct energy isolating devices are identified. Consider the following:

- Complexity of the isolation boundary
- Knowledge of the operating system
- Knowledge of energy isolating devices required to achieve a safe boundary.

3. Identify a staff member who is knowledgeable about the component or system to help shut it down. The staff member does not need to be LOTO trained.

Inform Affected Workers of Work Being Performed

Performed By: **Authorized Worker**

1. Inform affected workers that the component or system will be shut down and LOTO performed. Consider advising them of aspects of the work that will be performed that may impact them (e.g., isolation of the work area, duration of the work).

Shut Down the Component or System

Performed By: **Knowledgeable Staff Member**

1. When directed by the controlling organization, or the controlling organization delegate, shut down the component or system in accordance with applicable procedures.

Isolate the Hazardous Energy Source Using Written Instructions

Performed By: **Authorized Worker**

1. Isolate all hazardous energy sources from the equipment using the written instructions and perform a system isolation check.
2. The original written instructions should be readily available to workers while active locks and tags are in place.

   Note: Although not required, the controlling organization may use a second person to make sure LOTO devices are installed on the correct energy isolating devices in the position/condition specified in the written instructions. Consider the following:
   - Complexity of the isolation boundary
   - Look-a-like equipment
   - Knowledge of the operating system
   - Knowledge of energy isolating devices required to achieve a safe boundary.

Install Authorized Worker LOTO Using Written Instructions and Perform Safe-to-Work Check

Performed By: **Authorized Worker(s)**

1. Walk down each isolation point, review and sign the Lockout and Tagout Written Instruction Form, and install authorized worker (green) lock and danger directly on the energy isolating device, or multi-locking (hasp) secured to the energy isolating device. If more than one authorized worker is under the LOTO, follow the Basic Group LOTO section of the Group Lockout and Tagout exhibit.
   Note: The lockbox option may not be used for this LOTO method.
2. Document installation of LOTO for each isolation point (component) on the Lockout and Tagout Written Instruction Form.
3. Perform the safe-to-work check using the Authorized Worker Requirements exhibit.

Note: If an authorized worker representative will be used to avoid exposing multiple workers to a hazard (e.g., a high radiation area, confined space, flash protection boundary), see the Using an Authorized Worker Representative to Perform the Lock and Tag Safe-to-Work Check exhibit.

Perform Work Under LOTO with Written Instructions

Performed By: **Authorized Worker(s)**

1. Perform the work as authorized and in compliance with all applicable requirements, follow the Authorized Worker Requirements exhibit.
2. If conditions change or concerns arise regarding the control of the potential for unexpected release of hazardous energy, suspend work and contact the controlling organization. Additional isolation points must not be added to the LOTO after it is in place without removing the locks and tags and completely revising the written instructions.
3. For temporary lift, transferring a LOTO during shift changes, or removal/installation by a different AW follow the applicable exhibit:
   - Procedure for Temporary Lift of Lockout and Tagout Devices
   - Transferring a Lock and Tag during Shift and Personnel Change

- Authorized Worker Lock Removal and/or Reinstallation by a Different Authorized Worker

Remove Authorized Worker LOTO with Written Instructions and Inform Affected Workers

Performed By: **Authorized Worker(s)**

1. Confirm the scope of work is complete and the component or system is in a safe condition.
2. Remove the authorized worker lock and tag in accordance with written instructions. If an authorized worker is absent and not available to remove their lock and tag, see the Removal of Energy Control Device of Absent Authorized Worker exhibit.
3. After all of the authorized worker locks and tags have been removed, inform the controlling organization that the work is complete and the authorized worker LOTO has been removed. Return the original written instructions to the controlling organization.
4. Inform all affected workers the LOTO has been removed.

Review the Written Instruction for Completeness

Performed By: **Controlling Organization**

1. Review the written instructions for completeness.
2. When complete, *Lockout and Tagout Written Instruction Forms* will be submitted to Worker Safety and Health Records.
3. LOTO is complete.

21.6 Perform Controlling Organization Lockout and Tagout

21.6.1 Applicability

This information applies when the work activity does not meet the eight criteria for proceeding with verbal authorization only and the Controlling Organization chooses to place their lock and tag.

21.6.2 Required Procedure

Prepare Written Instructions, Authorize Shutdown and LOTO

Performed By: **LOTO-Trained Worker, Controlling Organization**

1. A LOTO trained worker familiar with the system or equipment prepares lock and tag written instructions, including performing a technical review. Use the Lockout and Tagout Written Instruction Form unless other written instructions (i.e., procedure, permit) are approved by the LOTO subject matter expert (SME). Use the Hazardous Energy Isolation Practices exhibit to determine isolation methods.
2. The controlling organization reviews the written instructions for approval and authorizes the LOTO.

Note: Although not required, the controlling organization may use a second person to perform a technical review of the written instructions and make sure the correct energy isolating devices are identified. Consider the following:

- Complexity of the isolation boundary
- Knowledge of the operating system
- Knowledge of energy isolating devices required to achieve a safe boundary.

Inform Affected Workers of Controlling Organization LOTO

Performed By: **Controlling Organization Representative**

1. Inform affected workers the component or system will be shut down and LOTO performed. Consider advising them of aspects of the work that will be performed that may impact them (e.g., isolation of the work area, duration of the work).
2. Identify a staff member who is knowledgeable about the component or system to help shut it down. The staff member does not need to be LOTO trained.
3. Identify a staff member who is knowledgeable about the component or system to help shut I down. The staff member does not need to be LOTO trained.

Shut Down the Component or System

Performed By: **Knowledgeable Staff Member**

1. When directed by the controlling organization, or the controlling organization delegate, shut down the component or system in accordance with applicable procedures.

Isolate the Hazardous Energy Source for Controlling Organization LOTO

Performed By: **Controlling Organization Representative**

1. Isolate all hazardous energy sources from the equipment using the written instructions and system isolation check.
2. Apply the red CO LOTO after each isolation point is verified. If more than one authorized worker is working under the LOTO, refer to the Group Lockout and Tagout (Word) exhibit. Basic group LOTO or lockbox may be used for controlling organization LOTO.
3. Perform a system isolation check

Apply the Controlling Organization LOTO

Performed By: **Controlling Organization Representative**

1. Document installation of CO LOTO for each isolation point (component) on the Lockout and Tagout Written Instruction Form
   NOTE: Although not required, the controlling organization may use a second person to make sure lockout and tagout devices are installed on the correct energy isolation devices in the position/condition specified in the written instructions. Consider the following:
   -complexity of the isolation boundary
   -look-a-like equipment
   -knowledge of the operating system

-knowledge of energy isolating devices required to achieve a safe boundary

2. The original written instructions should be readily available to workers while active lockout and tagouts are in place.

Install Authorized Worker LOTO Using Written Instructions and Perform Safe-to-Work Check

Performed By: **Authorized Worker(s)**

1. Walk down each isolation point, review and sign the Lockout and Tagout Written Instructions Form, and install authorized worker (green) lock and danger tag directly on the energy isolating device, multi-locking device (hasp) secured to the energy isolating device, or lockbox according to the Lockout and Tagout Written Instructions.

2. Perform the safe-to-work check using the Authorized Worker Requirements exhibit.

Note: If an authorized worker representative will be used to avoid exposing multiple workers to a hazard (e.g., a high radiation area, confined space, flash protection boundary), see the Using an Authorized Worker Representative to Perform the Lock and Tag Safe-to-Work Check exhibit.

Perform Work Under LOTO with Written Instructions

Performed By: **Authorized Worker(s)**

1. Perform the work as authorized and in compliance with all applicable requirements, follow the Authorized Worker Requirements exhibit.

2. If conditions change or concerns arise regarding the control of the potential for unexpected release of hazardous energy, suspend work and contact the controlling organization. Additional isolation points must not be added to the LOTO after it is in place without removing the locks and tags and completely revising the written instructions.

3. For temporary lift, transferring a LOTO during shift changes, or removal/installation by a different AW follow the applicable exhibit:
   - Procedure for Temporary Lift of Lockout and Tagout Devices
   - Transferring a Lock and Tag during Shift and Personnel Change
   - Authorized Worker Lock Removal and/or Reinstallation by a Different Authorized Worker

Remove Authorized Worker LOTO Using Written Instructions

Performed By: **Authorized Worker(s)**

1. Confirm the scope of work is complete and the component or system is in a safe condition.
2. Remove the authorized worker lock and tag in accordance with written instructions. If an authorized worker is absent and not available to remove their lock and tag, see the Removal of Energy Control Device of Absent Authorized Worker exhibit.

3. After all of the authorized worker locks and tags have been removed, inform the controlling organization that the work is complete and the authorized worker LOTO has been removed. Return the original written instructions to the controlling organization.

Clear Controlling Organization LOTO and Inform Affected Workers

Performed By: **Controlling Organization Representative**

1. Verify the work is complete and system configuration supports removal of the controlling organization "Danger - Do Not Operate" (DDNO) LOTO.
2. Authorize the COR to remove the CO DDNO LOTO.
3. Inform affected workers the CO DDNO LOTO has been removed.
4. Document removal of each LOTO isolation point (component) on the written instructions.

Review Written Instructions for Completeness

Performed By: **Controlling Organization**

1. Review the written instructions for completeness.
2. When complete, the Lockout and Tagout *Written Instruction* Forms will be submitted to Worker Safety and Health Records.
3. LOTO is complete.

21.7 Training

21.7.1 Required Procedure

All Contractor and Subcontractor employees are considered affected workers and will receive an initial lockout/tag out general awareness briefing before they begin work for Battelle and an annual refresher briefing thereafter.

To become an authorized worker Contractor and Subcontractor employees must complete the PNNL Lock and Tag for Authorized Workers (course 692) training within the previous 2 years. PNNL will accept reciprocity for HAMMER Lockout/Tagout training course 003131.

To assume Controlling Organization responsibilities, an individual must be a Battelle staff member trained as an authorized worker.

An alternative to becoming an authorized worker or short-term authorized worker is for the Contractor and Subcontractor employee to remain outside the control boundary and direct a Battelle authorized worker to perform the work.

Vendors and service personnel may receive on-the-job training (2592) and be qualified as a conditional authorized worker when the following criteria can be met:

- Work will be performed on specific equipment or machine
- The scope is well defined (e.g., service contract, statement of work)
- The task will be completed in short duration for a specific timeframe agreed upon by the PNNL point of contact and the LOTO subject matter expert (SME).

- The PNNL point of contact and LOTO SME review work scope to determine applicability. If agreement is reached, the PNNL point of contact develops a plan with the assistance from the LOTO SME to provide on-the-job training to each vendor/service person covering the following topics:
    - Purpose and function of the PNNL LOTO program
    - Roles and responsibilities associated with hazardous energy control (e.g., controlling organization, authorized workers)
    - Recognition of applicable hazardous energy sources
    - The type and magnitude of the energy associated with the specific task
    - The methods and means necessary for energy isolation and control including placement of their individually-assigned locks and tags prior to initiating the work activity.
- Each vendor/service must complete the on-the-job training and sign an attendance roster.
- Records documenting on-the-job training attendance must be provided to the Laboratory training coordinator.

This on-the-job training does not qualify an individual as an authorized worker as achieved by *Lockout Tagout for Authorized Workers* (692) or *Lockout and Tagout Gap Training* (1992).

21.8 References

29 CFR 1910.147, The Control of Hazardous Energy (Lockout/Tag out)

29 CFR 1910.333, Selection and Use of Work Practices

29 CFR 1926, Safety and Health Regulations for Construction

WAC Chapter 296-803, Lockout/Tag out (Control of Hazardous Energy)

WAC 296-155-429, Lockout and Tagging of Circuits

NFPA 70E, Standard for Electrical Safety in the Workplace

21.8.1 Records

Lockout and Tagout Written Instruction Form

Lockout and Tagout Temporary Lift Form

Management Removal of Lock and Tag (Word)

21.8.2 Forms

Management Removal of Authorized Worker Lockout and Tagout Form

Lockout and Tagout Written Instruction Form

Lockout and Tagout Temporary Lift Form

Isolation-Outage Request Form

21.8.3 Exhibits

Alternate Means of Isolating Hazardous Energy from Specific Equipment

Authorized Worker Requirements

Authorized Worker Lock Removal and/or Reinstallation by a Different Authorized Worker

Eight Criteria for Proceeding with Verbal Authorization Only

Group Lockout and Tagout

Hazardous Energy Isolation Practices

Locks, Tags, and Other Devices for Hazardous Energy Control

Lockout and Tagout Hazards Analysis Process

Lockout and Tagout Written Instruction Form Instructions

Procedure for Temporary Lift of Lockout and Tagout Devices

Removal of Energy Control Devices of an Absent Authorized Worker

Temporary Protective Grounding

Transferring a Lock and Tag during Shift and Personnel Changes

Using an Authorized Worker Representative to Perform the Lock and Tag Safe-to-Work Check

22.0 Hand and Power Tools

22.1 Purpose

This section establishes the requirements for the selection, use, and maintenance of hand and portable power-operated tools.

22.2 Responsibility

The Contractor shall be responsible for implementing this section.

Employees shall be responsible for complying with the provisions of this section.

22.3 General Requirements

The selection, use, and maintenance of hand and portable power-operated tools shall comply with the following statutory requirements:

- 29 CFR Part 1926, Subpart I; Tools – Hand and Power.
- 29 CFR Part 1910, Subpart P; Hand and Portable Powered Tools and Other hand-Held Equipment.
- WAC 296-155; Part G; Tools - Hand & Power

Hand and power tools and similar equipment shall be maintained in safe condition.

Employees shall inspect hand and power-operated tools prior to use. Defective tools shall be tagged with an accident prevention tag and turned in for repair or replacement.

When power-operated tools are designed to accommodate blade/wheel guards, they shall be equipped with such guards when in use.

Appropriate personal protective equipment shall be identified, provided, and used for the safe operation of hand/power tools in accordance with the JSA requirements.

Power tools shall be disconnected from their energy source when changing attachments or conducting repairs/maintenance on the tool.

Portable power tools shall be equipped with a constant-pressure switch that will shut off power when the operator releases the pressure. **Exceptions:** Hand-held powered grinders with wheels 2 in or less in diameter, routers, planers, laminate trimmers, nibblers, shears, scroll saws, and jig saws with blade shanks ¼ in wide or less, may be equipped with a positive “ON-OFF” switch.

Blades and wheels shall have the proper rating and revolutions per minute for the tool.

22.4 Procedure

22.4.1 Hand-Tools

Impact tools, such as drift pins, wedges, and chisels, shall be kept free of mushroomed heads.

Wooden handles of tools shall be kept free of splinters or cracks and shall be kept tight on the tool.

22.4.2 Electric Tools

Electric power-operated tools shall be double insulated or grounded in accordance with applicable OSHA/ANSI standards.

Power tools shall not be hoisted or lowered by their electric cords.

22.4.3 Pneumatic Tools

Pneumatic tools shall not be hoisted or lowered by their hoses.

Safety clips or retainers shall be securely installed and maintained on pneumatic impact tools to prevent attachments from being accidentally expelled.

All pneumatically driven nailers, staplers, and other similar equipment provided with an automatic fastener feed shall be equipped with a safety device on the muzzle to prevent the tools from ejecting fasteners when the muzzle is not in contact with the work surface. **Exception:** Pneumatic nailers or staplers utilizing “fine wire” brads or staples do not require a muzzle contact safety device under the following circumstances:

- The overall weight of the fastening device does not exceed the weight of 1-1/2 in of standard 18 gauge wire.
- The operator and any other person within 12 ft of the point of operation wear approved eye protection.

All hoses exceeding ½ in ID shall have a safety device at the source of supply or branch line to reduce pressure in case of hose failure.

Pneumatic power tools shall be secured to the hose or whip to prevent the tool from becoming accidentally disconnected.

All pneumatic tools shall be equipped with deadman switches. Governor-controlled pneumatic tools shall be equipped with an air filter and oilier.

Pneumatic tools shall not be connected to an air supply that exceeds the tool rating.

22.4.4 Fuel Powered Tools

Fuel powered tools shall be stopped and allowed to cool prior to being refueled, serviced, or maintained.

22.4.5 Hydraulic Powered Tools

The manufacturer's safe operating pressures for hoses, valves, pipes, filters, and other fittings shall not be exceeded.

22.4.6 Powder Actuated Tools

Only qualified operators (trained by the manufacturer) shall be permitted to use powder-actuated tools.

When in use, powder actuated tools shall be tested each day before loading (in accordance with the manufacturer's recommended procedure) to verify that safety devices are in proper working condition.

Tools shall not be loaded until just prior to the intended firing time. Neither loaded nor empty tools shall be pointed at people.

Loaded tools shall not be left unattended.

Powder actuated tools shall not be use in atmospheres having a 10% or greater reading for Lower Explosive Limit.

Tools shall always be used with the correct shield, guard, or attachment as recommended by the manufacturer.

Powder actuated tools shall be stored in labeled, lockable containers so as to render them unavailable to unauthorized persons.

Tools shall be operated in strict accordance with the manufacturer's instructions. Only those types of fasteners and powder loads recommended by the tool manufacturer shall be used.

Prior to driving a fastener, the operator shall inspect the line-of-fire to assure safety should the fastener penetrate completely through the work surface.

In the event of a misfire, the operator shall follow the explicit instructions set forth by the tool manufacturer.

A sign at least 8 x 10 in using boldface type at least one inch in height shall be posted in plain sight on all construction projects where powder actuated tools are in use. The sign shall bear wording similar to the following: "POWDER ACTUATED TOOL IN USE."

Spent shell casing shall be picked up and deposed daily.

Misfire shells shall be placed in water until the end of shift.

22.4.7 Abrasive Wheels and Tools

Abrasive wheels shall be closely inspected for cracks or defects and ring-tested before mounting.

Machine spindle speeds shall be checked before mounting the wheel to be certain that the wheel will not exceed the maximum operating speed marked on the wheel.

Abrasive wheels shall be used only on machines with safety guards except as follows:

- Wheels used for internal work while within the work being ground
- Mounted wheels 2 in and smaller in diameter used in portable operations
- Types 16, 17, 18, 18R, and 19 cones and plugs, and threaded hole pot balls where the work offers protection.

Abrasive wheels shall be handled and stored in a manner that prevents damage to the wheels.

Stationary grinding machines shall be equipped with a transparent spark shield, tongue guards (adjusted within ¼ in of the wheel), and a work rest (adjusted within 1/8 in of the wheel).

Pneumatic grinding machines shall be operated at the correct pressures and off a regulated air supply.

22.4.8 Woodworking Tools

All portable power-driven circular saws shall be equipped with guards above and below the base plate or shoe. Lower guards shall be properly maintained to so they will automatically and instantly return to the covering position when the tool is withdrawn from the work.

22.5 References

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

WAC 296-155, Safety Standards for Construction Work

ANSI B7.1-1988, The Use, care, and Protection of Abrasive Wheels

ANSI 01.1-1961, Safety Code for Woodworking Machinery

ANSI A10.3-1985, Safety Requirement for Powder Actuated Fastening Systems.

23.0 Cutting, Welding, Grinding

23.1 Purpose

This section outlines required controls for conducting safe hot work in compliance with Occupational Safety and Health Act and Washington Industrial Safety and Health Act standards. The provisions of this procedure apply to work activities associated with open flames, welding, cutting, or grinding and other tasks performed by Battelle Contractors and Subcontractors.

23.2 Definitions

Hot Work: In this context, refers to work involving open-flame, welding, cutting, and grinding (any work that generates sparks).

Fire Watch: Process of watching for fire for a specified period during and after hot work. The fire watch person is solely dedicated to this task. Fire watch person require special training, including hands-on fire extinguisher training.

23.3 Requirements

This procedure has the following program elements:

- Working with Open Flame, Welding, Cutting, or Grinding
- Fire Safety Precautions
- Personnel Protective Equipment (PPE) for performance of hot work
- Contractor personnel shall know how to respond to fires in the work area, including initiating alarms, fire department contact and communication with Battelle Point of Contact.

23.3.1 Working with Open Flame, Welding, Cutting, or Grinding

The following requirements apply to Contractors conducting hot work:

- Contractor personnel will identify when Hot Work is required.
- The contractor shall perform Hot Work in accordance with a Hot Work Permit approved by Battelle. Contact the CM for this form.
- Contractors must use approved listed (Factory Mutual or “FM Approved”) fire curtains, blankets, or pads meeting the requirements of NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*. The selection and use of the fire curtains, blankets, or pads shall be consistent with the manufacturer’s instructions.
- The permit requirements will be communicated to all applicable contractor personnel via a pre-job briefing.

- Contractor personnel who perform fire watch duties must receive Battelle fire watch training (PNNL Course #002504). Individual performing fire watch duties must complete hands-on fire extinguisher training (PNNL Course #000654 or equivalent).
- Alternatives to performing hot work (e.g., saw cutting instead of grinding wheel or torch cutting; crimp-type pipe fittings instead of soldered fittings) should be used where practical. Hot work should be performed in contractor shops or designated areas (e.g., pre-approved weld booths or shop areas) where practical.
- Return completed Hot Work Permit to the CM when work is complete.

23.3.2 Fire Safety Precautions

Battelle's best management practices on fire safety precautions while conducting hot work are provided below. However, the descriptions below do not provide comprehensive requirements; contract and/or project-specific requirements should be evaluated on a case-by-case basis.

23.3.2.1 Equipment for Open Flames or Welding

Inspect hoses, tubing, cable or wire insulation, or other easily damaged parts to be sure they are in good condition. Clamped hose or tubing connections must be used to prevent the hose/tubing from becoming disconnected while under pressure. Repair or replace damaged hoses or cables before starting work.

Protect fuel and oxidizer hoses or tubing from the heat of the flame or sparks during operations.

When fuel gas and oxygen are used together, properly designed and FM-approved and/or UL-listed hose, fittings, and reverse flow check valves must be installed.

Use welding and cutting equipment that is FM-approved or UL-listed.

Keep the equipment in good condition and remove unsafe equipment from service.

Compressed gas cylinders, including propane cylinders, must be secured to prevent them from tipping or falling over. Gas cylinders must be protected from damage, such as overhead movement of materials and moving vehicles.

23.3.2.2 Facility Features

Do not conduct open-flame, welding, cutting, or grinding work during facility fire-sprinkler system outages.

Know where fire extinguishers are mounted. When applicable, a fire watch shall have dedicated fire extinguishers available. Building fire extinguishers are not to be used by fire watch personnel.

Know where fire alarm pull boxes are located.

Know how to call the fire department from the work location where you are located.

Have emergency communications, such as cellular phones or radios, available when working in remote or outside areas.

23.3.2.3 Fire Prevention

Remove or protect combustible materials as specified in the Hot Work Permit

Fully inspect areas below/underneath equipment and the work location for combustible materials. For overhead or elevated work, fire watches may be necessary on multiple levels.

Protect openings in walls, floors, roofs, and ceilings where sparks can travel beyond the work area to inaccessible or unprotected areas.

Beware of heat conduction through penetrations.

Keep flammable liquids in closed containers and remove the containers from the work area.

Before performing work, clean containers that have been used to store flammable materials or materials that produce flammable or toxic products. Make sure no cleaning solvent remains on the portion of the container that will be exposed to flame. Be aware that heating nonflammable solvents can produce toxic vapors or gases.

Wear fire retardant personal protective clothing when exposed to open flames or to welding, cutting, or grinding operations in confined spaces, radiation areas, hazard waste sites, and controlled access areas.

23.3.2.4 Operational Practices

Remain at the work area whenever an open flame is present.

Confirm that the personnel who will be operating the equipment have been trained in its use and know how to use it safely.

Maintain a fire watch for unplanned fires during hot work operations and for at least 1 hour after the completion of the hot work operation (or as specified by the Hot Work Permit). The fire watch observes staff conducting the welding, cutting, or grinding operations and monitors adjacent areas. Stop work if sparks travel beyond the area that fire watch can observe. The fire watch is not assigned any other duties during hot work operations and for the 1 hour after completion of the hot work.

Maintain good housekeeping in the work area.

Provide adequate ventilation in the hot work area in accordance with the Hot Work Permit.

Post a guard, barrier, or other type of warning to keep passersby away from the work area in accordance with the Hot Work Permit.

When using arc-producing equipment, use protective screens positioned to protect staff from exposure to light from the arc.

Shut down electric welding machines and shut off gas supplies at the point of supply when work is halted even for a short time, such as when stopping for a break.

Remove electrodes and place them far enough away from the machine so accidental contact cannot occur. Welding machines that have been used outside a designated area must be disconnected at the power source.

23.3.3 Personal Protective Equipment

23.3.3.1 General

Select clothing to minimize the risk of ignition based on the location and nature of the work being performed.

Select heavier materials, such as woolen clothing, heavy cotton, or leather, when possible.

Keep sleeves and collars buttoned with no pockets on the front of clothing. Do not cuff or roll pant legs (e.g., to discourage lodged sparks).

Avoid wearing frayed clothing.

Select clothing that provides sufficient coverage to minimize the potential for burns.

Select clothing that is clean with no contaminants (e.g., oils or grease that could reduce effectiveness of the protective properties).

23.3.3.2 Aprons, Leggings, Capes, Sleeves

Wear flame-resistant leggings or guarding where necessary to give added protection.

Wear flame-resistant cape-sleeves or shoulder covers with bibs for overhead welding, cutting, or other operations, as necessary.

Wear durable, flame resistant aprons to protect the front of the body when additional protection against sparks and radiant energy is needed.

Use insulated linings to protect areas exposed to high-radiant energy.

23.4 References

29 CFR 1926, Safety and Health Regulations for Construction

NFPA 51B, Standard for Fire Prevention during Welding, Cutting, and Other Hot Work.

ANSI Z49.1, Safety in Welding, Cutting, and Allied Processes

23.5 Records

None

23.6 Forms

Hot Work Permit

24.0 Fall Protection

24.1 Purpose

This section establishes the requirements, responsibilities, and procedures for the selection, assembly, use, maintenance, and disassembly of fall restraint/arrest systems and equipment.

24.2 Responsibility

The provisions of this procedure apply to Contractors performing work at locations where fall hazards of 6 ft or more are known or anticipated.

The Contractor shall be responsible for implementation and compliance with this procedure, and developing and implementing fall protection work plans.

Employees shall be responsible for complying with the provisions of this section.

24.3 General Requirements

Fall Protection: Each employee subject to a fall hazard of 6ft (OSHA/WISHA) or more shall be protected by a fall arrest or fall restraint system 100 percent of the time, except as described below.

Fall arrest/restraints shall be provided, maintained, and documented in accordance with the Contractor's Fall Protection Work Plan.

Prior to the start of activities, a Fall Protection Work Plan shall be developed and implemented for areas where employees may be exposed to fall hazards of 6ft or more. The plan is a supplement to the JSA and shall be maintained at the jobsite until activities have been completed.

If a fall hazard of 6 ft or more is recognized after activities have begun, the work in that area shall be stopped and a Fall Protection Work Plan shall be written and implemented (or the existing plan modified) prior to allowing activities to restart in the area of the hazard.

Fall arrest/restraint shall be provided during the erection of scaffolding whenever feasible.

No type of work shall be performed on a ladder over 25 ft from the ground or floor unless a safety harness is worn and the safety lanyard is secured to an adequate fall arrest or fall restraint attachment point.

Whenever feasible, fall arrest/restraint shall be provided when employees are establishing fall protection anchorage points on roofs.

Fall arrest/restraint shall be provided when employees are working within 6 ft of a leading edge, outer edge, or other unprotected perimeter where the fall hazard is 6 ft or more.

The use of safety monitors shall be permitted as follows:

- During inspection, investigation, and estimating of roof level conditions where the workers will not be within 6 ft of an unguarded perimeter edge, leading edge, or open hole.
- During maintenance and construction activities where the workers will not be within 6 ft of an unguarded perimeter edge, leading edge, or open holes.

The use of warning line systems shall be permitted for roof activities taking place no closer than 6 ft to an unguarded perimeter edge, leading edge, or open holes. For non-roofing activities the warning line system must be erected no closer than 15 feet from unguarded perimeter edge or open holes. When used, warning line systems shall be deployed in accordance with the applicable OSHA/WISHA requirements.

Where employees must work within 6 ft of an unguarded perimeter edge, leading edge, or open holes, the appropriate fall arrest/fall restraint systems shall be required. A safety monitoring system is prohibited by PNNL unless approved.

Fall restraint protection shall consist of standard guardrails or full body harnesses attached to securely rigged restraint lines or other appropriate anchorage points.

Anchorage points for fall restraint shall be capable of supporting four times the maximum intended load.

Fall restraint protection shall be rigged to allow employees to move only as far as the edges of the unprotected walking/working surfaces.

Fall arrest protection shall consist of a Class III full body harness. Safety belts shall not be used. The full body harness system shall be rigged to minimize free fall distance to a maximum of 6 ft and such that the employee will not contact any lower level.

Lifelines, harnesses, and lanyards shall be used only for employee safeguarding. Any of these devices subjected to an actual fall-arrest load situation (as distinguished from static load testing) shall be immediately removed from service and destroyed to preclude their inadvertent continued use.

When Class A self-retracting lifelines or other deceleration devices are used which limit free fall to 2 ft, anchorages shall be capable of withstanding 3,000 pounds.

Self-retracting lifelines (Class B) and lanyards which do not limit free fall distance to 2 feet or less shall be capable of withstanding 5,000 pounds of tensile strength.

Horizontal lifelines shall be designed, installed, and used, under the supervision of a qualified person, as part of a complete personal fall arrest system, which maintains a safety factor of at least two. Lifelines shall be protected against being cut or abraded.

Ripstitch, tearing, and deforming lanyards shall be capable of sustaining a minimum tensile load of 5,000 pounds.

For lifelines, lanyards, droplines, etc., suitability for service (including tensile strength) shall be determined based on the manufacturer’s data and visual inspection of the equipment.

For lifeline and lanyard attachment points, suitability for use (including breaking strength meeting the requirements of applicable Occupational Safety and Health Act/Washington Industrial Safety and Health Act (OSHA/WISHA) standards shall be determined by at least one of the following:

- manufacturer's data
- existing engineering/design documents
- evaluation by a qualified engineer

The means by which attachment points have been determined to be suitable for use shall be documented on the Fall Protection Work Plan.

Exceptions to fall protection requirements (including those situations where providing fall protection is not feasible) shall be justified on the Fall Protection Work Plan and approved by Battelle prior to beginning the activity.

Snap hooks shall not be connected to loops made in webbing-type lanyards unless designed by the manufacture. To any object which is incompatibly shaped or dimensioned in relation to the snap-hook such that unintentional disengagement could occur by the connected object being able to depress the snap-hook keeper and release itself. Only locking type snaphooks shall be used.

24.3.1 Training Requirements

Employees shall be trained, prior to starting work, to the requirements of the job-specific Fall Protection Work Plan and the manufacturer's instructions for inspection, maintenance, and use of equipment. Training shall include the following topics:

- recognition of fall hazards
- nature of fall hazards
- correct procedure for erecting, maintaining, disassembling, and inspecting the fall protection system to be used
- use and operations of guardrail systems, PFAS, warning-line systems, safety monitoring systems, controlled access zones, and other protection to be used
- role of each employee in the safety monitoring system when this system is used
- limitations on the use of mechanical equipment during the performance of roofing work on low-sloped roofs
- correct procedures for handling and storage of equipment and materials, and the erection of overhead protection
- role of employees in fall protection plans
- rescue considerations

Training shall be documented on the Training Attendance Record.

24.3.2 Fall Protection Work Plan

The Fall Protection Work Plan consists of the following mandatory elements:

- identification of all fall hazards in the work area
- description of the method of fall arrest or fall restraint to be provided
- description of the correct procedures for the assembly, maintenance, inspection, and disassembly of the fall protection system to be used
- description of the correct procedures for handling, storing, and securing tools and materials
- description of the method of providing overhead protection for workers who may be in or pass through the area below the worksite
- description of the methods for prompt, safe removal of injured employees
- description of the method used to determine the adequacy of attachment points

24.3.3 Fall Protection Equipment/Systems

Fall restraint/arrest systems shall be used to eliminate employee exposure to fall hazards at elevations of 6 ft or more above the ground, water, or floor levels.

Fall restraint/arrest systems shall be selected based on evaluation of the following:

- nature of the work to be performed
- duration of the work to be performed
- number of affected personnel
- degree of mobility necessary for personnel to accomplish the work
- limitations dictated by facility/worksite layout
- physical or environmental factors affecting the integrity of the fall protection equipment
- proximity of acceptable attachment/anchorage points

In as much as possible, fall restraint/arrest equipment shall be protected against damage and maintained in a clean, dry condition. Fall protection equipment damaged by cuts, abrasions, burns, excessive moisture, etc. (when such damage affects the integrity of the equipment) shall be destroyed to preclude its inadvertent continued use.

Self-retracting lifelines shall be functionally inspected prior to use, and returned to the manufacturer for inspection as specified by the manufacturer’s recommendations.

Catch platforms, when used, shall be installed within 6 of the work area. The catch platform’s width shall equal the distance of the fall but shall be a minimum of 45 in wide and shall be equipped with standard guardrails on all open sides.

A person acting in the capacity of safety monitor shall be trained in the function of both the safety monitor and warning lines system, and shall:

- Be a competent person.
- Have control authority over the work as it relates to fall protection
- Be instantly distinguishable over members of the work crew.
- Engage in no other duties while acting as safety monitor.
- Be positioned in relation to the workers under their protection, so as to have a clear, unobstructed view and be able to maintain normal voice communication.
- Supervise no more than eight exposed workers at one time.

Warning lines shall consist of a rope, wire, or chain and supporting stanchions erected as follows:

- The rope, wire, or chain shall be flagged at not more than 6 ft intervals with high-visibility material.
- The rope, wire, or chain shall be rigged and supported in such a way that its lowest point (including sag) is no less than 39 in from the roof surface and its highest point is no more than 45 in from the roof surface.
- After being erected, with the rope, wire, or chain attached, stanchions shall be capable of resisting, without tipping over, a force of at least 16 pounds (71 Newtons) applied horizontal against the stanchion, 30 in (0.76 meters) above the roof surface, perpendicular to the warning line, and in the direction of the roof edge.
- The rope, wire, or chain shall have a minimum tensile strength of 500 pounds (227 kilograms), and after being attached to the stanchions, shall be capable of supporting, without breaking, the loads applied to the stanchions.
- The line shall be attached at each stanchion in such a way that pulling on the section of the line between stanchions will not result in slack being taken up in adjacent sections before the stanchion tips over.

Access paths shall be erected as follows:

- Points of access, materials handling areas, and storage areas shall be connected to the work area by a clear access path formed by two warning lines.
- When the path to a point of access is not in use, a rope, wire, or chain, equal in strength and height to the warning line, shall be placed across the path at the point where the path intersects the warning line erected around the work area.

24.4 References

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

WAC 296-155, Safety Standards for Construction Work

24.5 Records

Document	Submittal Responsibility	Record Retention Responsibility
Fall Protection Work Plan	Contractor	Jobsite
Pre-job Safety Planning Signoff	Contractor	Jobsite

25.0 Scaffolds

25.1 Purpose

This section defines the responsibilities and requirements for the safe use, erection, and maintenance of scaffolds.

25.2 Responsibility

The Contractor shall be responsible for compliance with this section.

Employees shall be responsible for complying with provisions of this section.

25.3 General Requirements

Construction, maintenance, use, and inspection of scaffolds shall comply with the following statutory requirements:

- 29 CFR 1926, Subpart L; Scaffolding
- 29 CFR 1910, Subpart D; Walking and Working Surfaces
- WAC 296-874, Scaffolds.

A competent person shall be designated in writing who will:

- Direct scaffold selection and erection/dismantling.
- Train scaffold erectors and inspectors.
- Resolve issues.

Scaffolding materials purchased, erected, and used shall meet applicable OSHA/WISHA safety standards and the manufacturer's rules and instructions for safe use and erection of scaffolding.

Scaffolds and component parts shall be maintained in a safe condition. Any scaffold parts damaged or weakened from any cause shall not be used.

Scaffolds and their components shall be capable of supporting at least four times the maximum intended load without failure. Ladders or makeshift devices shall not be used to increase the working height of scaffolds.

Standard guardrails (capable of sustaining 200-pound lateral force) and toe-boards shall be installed on all open sides and ends of scaffolds and platforms more than 10 ft above the ground or floor.

Baker scaffolds 6 feet or greater require standard guardrails, due to limited work platform size.

The height of manually propelled mobile scaffolds shall not exceed four times the minimum base dimension.

Platforms shall be fully secured. Platforms shall be a minimum width of two 10” planks (if using planking), or at least 18 in (if using other material, such material shall be of sufficient type and strength/thickness).

A personnel Fall Protection Work Plan shall be developed for workers exposed to fall hazards of 10 ft or more. Personal fall protection equipment or other means of equivalent protection shall be provided and used when guardrails cannot be installed.

Tube and coupler scaffolds shall be erected according to manufacturer’s design.

The poles, legs, or uprights of scaffolds shall be plumb and securely and rigidly braced to prevent swaying and displacement.

25.4 Procedure

Scaffolds shall be erected, dismantled, or altered under the supervision of a competent person. All scaffolds shall have the appropriate status tag attached to or near the access ladder. This status tag shall be installed by the scaffold erectors, and shall be attached at all times during erection, use, and dismantlement of scaffold. The status tags (see scaffold sample tags below) shall be color-coded and shall have the following meanings:

- Red Tag: KEEP OFF/DO NOT USE. This tag is used to prohibit use of the scaffold during installation, alteration, or dismantlement except by the erecting crew performing installation, alteration, or dismantlement activities
- Yellow Tag: SPECIAL CONDITIONS/ADDITIONAL CONTROLS. This tag indicates special safety measures for use of scaffold (e.g., fall protection or head protection).
- Green Tag: SCAFFOLDING IS ERECTED TO CODE/APPROVED FOR USE: This tag is used to indicate that the completed scaffold meets all erection codes, standards, and company procedures, and is safe for use. The backside of the tag is signed and dated to indicate that the scaffold has been inspected by a competent person before each work shift.

Test Scaffolding planks are scaffold grade or equivalent as recognized by approved grading rules for the species of wood used.

An access ladder or equivalent safe access shall be provided for each working level.

Scaffold work levels shall be kept clear of trash, snow, ice, and excess accumulation of materials or tools.

Footings and anchorages for scaffolds shall be firm and capable of carrying the maximum intended load without settling or displacement. Unstable objects, such as boxes, barrels, and concrete blocks, shall not be used. Mud plates shall be used on loose footings.

Scaffolds shall be placed as close to the work as possible. Where fall protection is being provided by the structure (building, wall, adjacent platform, etc.) on which work is being performed, the maximum allowable distance between the scaffold platform and the structure is 14 in.

Where a scaffold's height exceeds 4 times its smallest base dimension, guy, tie, or brace the unit at the closest horizontal member to the 4:1 height. Repeat every 26 ft vertically or 20 ft for those units less than or equal to 3 ft in width and 30 ft horizontally.

Planking shall be secured from movement.

Planking 10 ft or less in length shall extend over end supports a minimum of 6 in but not more than 12 in unless guard railed or designed to prevent cantilevering. Planking greater than 10 ft in length shall extend over end supports a minimum of 6 in but not more than 18 in unless guard railed or designed to prevent cantilevering.

Where persons are required to work or pass under the scaffold, scaffolds shall be provided with a screen between the toe-board and the guardrail, extending along the entire opening, consisting of No. 18 gauge U.S. Standard wire ½-in mesh, or the equivalent.

Conductive parts of scaffolds shall not be erected or positioned within 10 ft of exposed live electrical equipment unless the equipment is de-energized and locked out, or it is protected from contact by insulating blankets.

When scaffolding is to be erected within 20 ft of overhead utility or electrical lines, Utilities shall be notified.

If the scaffolding is to be erected 10 ft or less from overhead electrical lines, Utilities shall be contacted for assistance in de-energizing or insulating the lines prior to scaffold erection.

Workers shall not ride a manually propelled scaffold while it is being moved.

Workers shall not straddle or work outside of the guardrails.

All tools and materials shall be secured or removed from the platforms of mobile scaffolds before the scaffold is moved.

Mobile scaffolds rest upon suitable footings and stand plumb. The casters or wheels are locked to prevent movement.

A registered professional engineer shall design scaffolding over 125 ft in height.

The height of freestanding scaffolding towers shall not exceed four times the minimum base dimension. All scaffolding components and materials shall be inspected before use.

For rolling towers under 30 ft, 5 in or larger casters shall be used. For rolling towers 30 ft and over, 8 in or larger casters shall be used.

Where moving vehicles are present, the scaffold area shall be marked with warnings such as flags and/or barricades.

25.5 Training

A competent person shall provide training to employees who are involved in erecting, dismantling, moving, and inspecting scaffolds. Training shall include:

- The nature of scaffold hazards.
- The correct procedures for erecting, dismantling, moving, repairing, inspecting, and maintaining the type of scaffold in use.
- Design criteria and load-carrying capacities.
- Other pertinent requirements.

A qualified person shall provide training to employees who perform work while on a scaffold. Training shall include:

- The nature of any electrical hazards, fall hazards, and falling object hazards in the work area.
- The correct procedures for dealing with electrical hazards and for erecting, maintaining, and disassembling the fall protection systems and falling object protection systems.
- The proper use of the scaffold, and the proper handling of materials on the scaffold.
- Design criteria and load-carrying capacities.
- Other pertinent requirements.

Retraining of employees is required:

- Where changes at the worksite present a hazard for which an employee has not been previously trained.
- Where changes in the types of scaffolds, fall protection, falling object protection, or other equipment is made when an employee has not been previously trained.
- When employees demonstrate inadequacies while working with scaffolds.

25.6 References

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

WAC 296-874, Scaffolds

25.7 Records

Document	Record Submittal Responsibility	Record Retention Responsibility
Competent Person Designation	Contractor	Contractor
Training Attendance Record	Contractor	Contractor

25.8 Forms

Scaffolds Inspection Checklist

25.9 Exhibit

Scaffold Status Tags

26.0 Ladders

26.1 Purpose

This section defines the responsibilities and requirements for the safe use, handling, storage, and construction of ladders that ensure compliance with applicable ANSI, OSHA/WISHA, and the NFPA requirements.

26.2 Responsibility

The Contractor shall be responsible for ensuring compliance with this section.

Employees shall be responsible for complying with the provisions of this section.

26.3 General Requirements

Use, care, and storage of ladders shall comply with the following statutory requirements:

- 29 CFR 1926, Subpart X; Stairways and Ladders.
- 29 CFR 1910, Subpart D; Walking and Working Surfaces.
- WAC 296-876, Ladders, portable and fixed..

Ladders shall be maintained in good condition at all times. Those that are defective in any way shall be removed from service and tagged with an unsafe equipment tag until made safe for use, or destroyed.

Ladders may be repaired only if repairs will restore the ladder to a condition meeting its original design criteria.

Ladders used on construction sites shall be appropriate for industrial applications (Class I or 1-A). Light-duty household ladders are not permitted.

Job-made ladders shall be constructed in accordance with ANSI A14.4, Safety Requirements for Job-Made Ladders.

When ascending or descending a ladder, the user shall face the ladder and always keep 3 limbs in firm contact with the ladder. Carry tools or equipment in a work belt or fanny pack, or hoist them to the work area using a rope or bucket.

Metal ladders shall not be used where potential electrical hazards exist. Wood or fiberglass ladders having metal parts (other than hardware) shall not be used where potential electrical hazards exist unless they bear a manufacturer’s label that indicates the following:

- The ladder complies with ANSI A14.5.
- The ladder is approved for electrical use.

Wood ladders shall not be coated with any opaque covering (i.e., paint) except for identification or warning labels, which may be placed on one face only of a side rail.

Employees shall be trained to the requirements of this section.

26.4 Procedure

26.4.1 Use of Ladders

Ladders shall be inspected by the user before each use.

Employees shall ensure that their shoes and the ladder steps are free of grease, mud, or other materials that could cause them to slip while climbing.

Do not place ladders against any structure or equipment that is not strong and rigid enough to support the ladder, or that is not sufficiently anchored.

Straight ladders shall be used at an angle of approximately 75 degrees from the horizontal. The ladder is set at the proper angle when the horizontal distance from the top support to the foot of the ladder is approximately one-quarter the working length of the ladder.

No type of work shall be performed on a ladder 25 ft or more from the ground or floor unless a safety harness is worn and the safety lanyard is secured to an adequate fall arrest or fall restraint attachment point.

Use ladders only for short duration jobs with limited work scope.

Ladders shall be used only on firm, stable, and level surfaces and shall be secured to prevent accidental displacement.

Note: Step ladders need not be secured except when required by this section.

Ladders shall not be used on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental displacement. Slip-resistant feet shall not be used as a substitute for care in placing, lashing, or holding a ladder that is used upon slippery surfaces.

Ladders placed in any location where they can be displaced by workplace activities or traffic, such as in passageways, doorways, or driveways shall be secured to prevent accidental displacement or a barricade shall be used to keep the activities or traffic away from the ladder.

Ladders shall not be spliced together to form longer sections.

Prior to climbing an extension ladder, the user shall ensure that the rung locks are securely in place.

Ladders used to gain access from one level to another shall be long enough for the top to extend 3 feet above the landing or suitable grab rails shall be provided for safe movement to or from the point of access.

The platform and top step of ordinary types of stepladders shall not be used as steps.

Cross-bracing on the rear section of stepladders shall not be used for climbing unless the ladder is designed and provided with steps for climbing on both front and rear sections.

Stepladders shall not be used as straight ladders, and shall be used with legs fully extended.

Ladders shall not be used as braces, skids, levers, runways, platforms, scaffolds, or for any other purpose for which they are not intended.

Ladders shall not be climbed by more than one person at a time unless designed to support more than one person.

26.4.2 Care of Ladders

Ladders shall be handled with care and shall not be subjected to unnecessary abuse or misuse.

When not in use, ladders shall be stored where they are protected from potential damage by collision, temperature, moisture, etc.

Ladders shall be returned to the proper storage location when the job is completed.

Ladders shall not be painted.

26.4.3 Training Requirements

The employer shall train each employee using ladders. This program shall enable each employee to recognize hazards related to ladders.

The employer shall ensure that each employee has been trained by a competent person in the following areas, as applicable:

- The nature of fall hazards in the work area.
- The correct procedures for erecting, maintaining, and disassembling the fall protection system to be used.
- The proper construction, use, placement, and care in handling of ladders.
- The maximum intended load-carrying capacities of ladders used.
- The information contained in this section.

Retraining shall be provided for each employee as necessary so that the employee maintains the understanding and knowledge acquired through compliance with this procedure.

26.5 References

29 CFR 1926, Subpart X; Stairways and Ladders

29 CFR 1910, Subpart D; Walking and Working Surfaces

WAC 296-876, Ladders, portable and fixed

ANSI A14.1, Ladders – Portable Wood – Safety Requirements

ANSI A14.4, Safety Requirements for Job-Made Ladders

ANSI A14.5, Safety Requirements for Portable Reinforced Plastic Ladders

26.6 Records

Document	Record Submittal Responsibility	Record Retention Responsibility
Training Attendance Record	N/A	Contractor

26.7 Forms

Training Attendance Record

27.0 Aerial Lifts

27.1 Purpose

This section defines the system for safe operation and maintenance of elevated work platforms and aerial lifts.

27.2 Responsibility

The Contractor shall be responsible for compliance with this section.

Employees shall be responsible for complying with the provisions of this section.

27.2.1 General Requirements

Aerial lifts and elevating work platforms shall comply with the following statutory requirements:

- 29 CFR 1926, Subpart N; Cranes, Derricks, Hoists, Elevators and Conveyors
- 29 CFR 1910, Subpart F; Powered Platforms, manlifts, and Vehicle-Mounted Work Platforms
- WAC 296-155, Part J-1, Elevating Work Platforms

Personnel who operate elevated work platforms and aerial lifts shall be trained to the requirements of this procedure.

Lift controls shall be tested by the user each day prior to use to determine that controls are in safe condition.

Fall protection for employees in vehicle-mounted articulating or extensible boom type elevating and rotating aerial devices (i.e., JLGs) shall be in accordance with the following:

- Workers shall stand on the basket floor, and shall not sit or climb on the edge or handrail. Workers also shall not use planks, ladders, or other devices for a work position.
- A full body harness and lanyard shall be worn and attached to the manufactured attachment point.
- Tying-off to an adjacent pole, structure, or equipment while working in an aerial lift is prohibited.

Fall protection for employees on self-propelled elevating work platforms (scissor lifts) shall be in accordance with the following:

- Self-propelled elevating work platforms (scissor lifts) shall be provided with standard guardrail or the equivalent.
- Personnel shall maintain a firm footing on the platform or basket. Do not stand, sit, or climb on the guardrail. Do not use planks, ladders, or other devices to reach work locations.

Boom and basket load limits posted on the unit shall not be exceeded.

Elevating work platforms or aerial lifts shall not be used to hoist materials that would otherwise require special lifting equipment such as chain-falls, forklifts, cranes, etc. Only material that can be readily handled by the employee using the work platform shall be lifted or moved using the platform. Additionally, only those materials that will be readily utilized (i.e., within two hours) shall be taken on a platform at one time.

Aerial lift trucks shall not be moved when the boom is elevated in a working position with personnel in the basket. The only exception is equipment specifically designed for this type of operation.

Articulating boom and extensible boom platforms shall have both upper and lower controls. Lower controls shall be capable of overriding upper controls. All controls shall be plainly marked as to their function.

The brakes shall be set and outriggers shall be fully extended and positioned on pads or a solid surface. Wheel chokes shall be used when working on inclines.

Operators shall verify that the area surrounding the work platform is clear of personnel and equipment before lowering the platform.

The user shall inspect aerial lifts and elevating work platforms (based on the manufacturer's manual) prior to use. Defective equipment shall be reported to the supervisor/manager, tagged out of service, and not used until repaired.

Aerial lifts shall be inspected daily.

Limit switches shall be checked weekly.

Manufacturer's maintenance and operator's manuals shall be provided with each work platform.

27.3 References

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

27.4 WAC 296-155, Safety Standards for Construction Work Records

Document	Record Submittal Responsibility	Record Retention Responsibility
Maintenance, Operator Manuals	Contractor	Job Site
Inspection Records	Contractor	Contractor

28.0 Hoisting and Rigging

The Contractor, and affected Subcontractors, must follow the DOE Standard *Hoisting and Rigging* (DOE-STD-1090-2011) for all hoisting and rigging activities.

28.1 Sling Inspection

28.1.1 Initial Inspection

Before any new or repaired slings (synthetic or wire rope) are used, a qualified person shall inspect them to ensure the slings are safe for use in the field.

28.1.2 Frequent Inspection

This inspection shall be made by the person handling the sling each day and after each use.

28.1.3 Periodic Inspection

The periodic inspection shall be at least annually and performed by a qualified person using one of the following documentation methods.

- Mark a serial number on the sling and maintain inspection records by serial numbers
- Institute a comprehensive marking program (such as color coding) to indicate when the next periodic inspection is required. The following color codes are used to indicate current status of annual inspections:

Color	Years Covered
Orange	Even Numbered Years
Purple	Odd Numbered Years

- Mark each sling with a tag that indicates when the next periodic inspection is required. This tag becomes the record.

28.2 Portable A-Frame Assembly

Portable A-Frames shall only be assembly by qualified personnel and in accordance with manufacturer's requirements for setup and assembly. The competent person form shall be used to document personnel are qualified to perform assembly and initial inspection requirements prior to use. Initial, periodic and preoperational checks shall be conducted in accordance with the manufacturer's recommendations. The initial and periodic inspection shall be documented using the following color code system.

Color	Years Covered
Orange	Even Numbered Years
Purple	Odd Numbered Years

28.3 Planning

Planning for the use of cranes, derricks, hoists, cableways, aerial devices, and material lifting accessories shall use ASME P30.1 *Planning for Load Handling Activities* to provide guidance on general planning considerations and practices for load handling operations occurring on Battelle property.

28.4 References

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

AMSE P30.1 2014 Planning and Load Handling Activities

DOE-STD-1090-2011 Hoisting and Rigging

WAC 296-155, Safety Standards for Construction Work

28.5 PNNL Hoisting and Rigging Manual Records

Document	Record Submittal Responsibility	Record Retention Responsibility
Inspection Records (lift equipment, rigging)	Contractor (for own equipment. Battelle (for Battelle-owned equipment)	Contractor Battelle
Training and Qualifications Records (including medical)	Contractor	Contractor

29.0 Unbound Engineered Nanoparticles

29.1 Purpose

The purpose of Battelle's Nanoscale Research Safety Program is to protect workers, the environment, and the general public from health effects related to unbound engineered nanoparticle (UNP) exposure. The toxicological properties of many unbound engineered nanoparticles are not well studied in humans. Until the toxicological properties of unbound engineered nanoparticles are considered well studied, Battelle's approach to protecting workers and the environment is using the "precautionary principle", i.e., treating unbound engineered nanoparticles in the short-term as acutely toxic agents and in the long-term, as chronic toxins, controlling exposures to unbound engineered nanoparticles and minimizing their release to the environment. This is done by identifying and minimizing unbound engineered nanoparticles hazards to levels as low as practical within the scope of essential work. Battelle's program to protect workers who handle unbound engineered nanoparticles, or equipment and building systems contaminated with unbound engineered nanoparticles is based on DOE N 456.1, *The Safe Handling of Unbound Engineered Nanoparticles*.

Battelle uses a control banding approach to assign control measures for unbound engineered nanoparticle exposure hazards. Nanoscale Material Level Precautions are based upon the potential for work to generate airborne, unbound engineered nanoparticles. The list below defines the exposure levels:

- Bound Engineered Nanoparticles precautions are assigned to work were bound nanoparticle work is not anticipated to generate airborne unbound engineered nanoparticles
- Unbound Nanoparticle Storage Only precautions are assigned to laboratories that store but do not use or work with unbound engineered nanoparticles that are not contained within a matrix that would be expected to prevent the nanoparticles from being separately mobile and a potential source of exposure.
- Nanoscale Material Level I precautions are assigned to work were only small quantities of unbound engineered nanoparticles are used intermittently and an industrial hygiene risk/exposure assessment has found that the engineered nanoparticles are effectively bound (are contained in a matrix that prevents the nanoparticles from being separately mobile and a potential source of occupational exposure).
- Nanoscale Material Level II precautions are assigned to work were unbound nanoparticle work has little risk of generating airborne unbound engineered nanoparticles. This work must be performed in full or partial enclosures operated at a negative pressure to the worker's breathing zone, i.e. laboratory hood. When the work cannot be enclosed, alternative controls are used to capture any fugitive unbound engineered nanoparticles at the source.
- Nanoscale Material Level III precautions are assigned to work were unbound nanoparticle work are anticipated to generate airborne unbound engineered nanoparticles. Control measures must be in place to prevent exposure from aerosolized unbound engineered nanoparticles and to filter or otherwise clean (scrub) exhaust air before releasing it to building systems, the environment, or back in to the workspace.

29.2 Applicability

The Battelle Nanoscale Research Safety Program applies to current Battelle workers, Contractors, and Subcontractors whose work potentially involves unbound engineered nanoparticles.

29.3 Battelle Unbound Engineered Nanoparticle Tasks and Potential Exposures

All current unbound engineered nanoparticle tasks at Battelle involve either laboratory use of unbound engineered nanoparticles or maintenance/repair of equipment and building systems potentially contaminated with unbound engineered nanoparticles. Battelle will assess and manage the potential for exposure from these tasks. Battelle also manages DOE facilities where unbound engineered nanoparticles has been used in the past. Since areas of legacy contamination may pose a potential exposure risk to employees, work in these areas will also be actively assessed and managed by internal Battelle procedures.

29.4 Designated Nanomaterial Workers

For each of its employees and subcontract employees who,

- handle unbound engineered nanoparticles and has the potential for inhalation or dermal exposure to unbound engineered nanoparticles,
- routinely spends time in an area in which unbound engineered nanoparticles have the potential to become dispersed in the air, or
- works on equipment that might contain or bear unbound engineered nanoparticles and that could release nanoparticles during servicing or maintenance,

The Contractor shall designate these workers as nanomaterial workers. Each nanomaterial worker is required to be:

1. Enrolled in the PNNL nanomaterial worker registry.
2. Informed of the requirements of the DOE Medical Surveillance Program requirements contained in DOE N 456.1, Section 5, Exposure Assessment.
3. Provided training specific to nanotechnology activities involving unbound engineered nanoparticles.

Note: Supervisors of nanomaterial workers are also required to be provided training specific to nanotechnology activities involving unbound engineered nanoparticles.

29.5 Training

At the time of initial assignment to perform work with unbound engineered nanoparticles at Battelle, the Contractor shall provide all nanomaterial workers and their supervisors with training specific to nanotechnology activities involving unbound engineered nanoparticles.

This training must include, as a minimum, the following topics:

- Uncertainties of properties and hazards of unbound engineered nanoparticles.
- Differences in reactivity and toxic potential of nanoscale and macro forms of the same materials.
- Unusual exposure routes and transport within the body.
- Limitations on evaluating the significance of exposures and environmental releases.
- The importance of minimizing exposure to unbound engineered nanoparticles and their release into the environment.
- Hazard controls including the limitations on their effectiveness.
- Permissible and recommended exposure limits for unbound engineered nanoparticles.
- The location and availability of reliable reference material on the hazards, safe handling, storage and disposal of unbound engineered nanoparticles; including material safety data sheets (MSDSs).
- Battelle site-specific policies, procedures, and hazard controls for unbound engineered nanoparticles.

29.6 Exposure and Risk Assessment

Work performed on contaminated or potentially contaminated equipment or building systems is assessed in the job planning or alternative hazard analysis processes. Where the hazard assessment indicates a history of unbound engineered nanoparticle activities in an area, the level of Nanoscale Material Precautions will be determined by the cognizant industrial hygienist based upon process history and the potential of work to generate airborne unbound engineered nanoparticles. For uncharacterized areas, such as closed systems or inaccessible areas of facilities or rooms where unbound engineered nanoparticle contamination may be present, the highest level of Nanoscale Material precautions will be applied. Where engineered control measures cannot eliminate the risk of potential airborne exposures, employees shall be provided personal protective clothing and equipment. The cognizant industrial hygienist will prescribe the appropriate postings and labels, protective equipment, work controls, and conduct exposure monitoring.

29.7 Controls

Consistent with sound professional industrial hygiene practice and Department of Energy Notice 456.1, exposure to unbound engineered nanoparticles will be controlled primarily by engineering controls, such as exhaust ventilation and enclosures. A summary of controls based on exposure levels is provided in Tables 29.1 and 29.2 below.

Generally, nanomaterials have the greatest risk to enter the body if they become airborne or come into contact with the skin. The potential for inhalation exposure is controlled by working on potentially contaminated equipment inside ventilated enclosures, such as HEPA filtered hoods, glove boxes, glove bags, enclosures, or HEPA filtered snorkels, and transporting contaminated equipment in sealed containers or sealed in two layers of plastic. Administrative controls, i.e., good work practices that supplement engineered controls and minimize inhalation, dermal, and ocular exposure, include the use of

wet wiping methods for cleaning work areas and good housekeeping. Personal protective equipment provide defense in depth and include the use of respiratory protection, disposable gloves and coveralls, and eye protection.

It should be noted that no available ventilation or engineering controls can provide 100% protection for the worker. Contractors must recognize the limitations of their equipment and address them through appropriate work practices. The effectiveness of laboratory hoods and other ventilated enclosures in containing unbound engineered nanoparticles depends on proper technique. Therefore, observation of current work practices, equipment, and the physical layout of laboratory workspaces where unbound engineered nanoparticles are handled will serve as an initial assessment of work practices and will be supplemented with emissions monitoring.

Table 29.1: Nanoscale Material Precautions - Non-Invasive/Non-Dust Disturbing Activities

Controls for Repair and Maintenance of Equipment or Building Systems Potentially Contaminated With Engineered Nanoparticle					
Nanoscale Material Precautions: Non-Invasive/Non-Dust Disturbing Activities					
	Unbound Engineered Nanoparticle Storage Only	**Bound Engineered Nanoparticle**	**Nanoscale Material Level 1 Precautions**	**Nanoscale Material Level 2 Precautions**	**Nanoscale Material Level 3 Precautions**
Training	Does Not Meet Criteria For Requiring Training Read IOPS Hazard Awareness Summaries	Does Not Meet Criteria For Requiring Training Read IOPS Hazard Awareness Summaries	Read IOPS Hazard Awareness Summaries or Engineered Nanoscale Materials Orientation Course #1748	Read IOPS Hazard Awareness Summaries or Engineered Nanoscale Materials Orientation Course #1748	Read IOPS Hazard Awareness Summaries or Engineered Nanoscale Materials Orientation Course #1748
Exposure Assessment	Routine Exposure Assessment	Routine Exposure Assessment	Routine Exposure Assessment **Note:** Maintenance Work That May Generate Airborne Unbound Engineered Nanoparticles Should Be Planned As Dust Disturbing Work	Routine Exposure Assessment **Note:** Maintenance Work That May Generate Airborne Unbound Engineered Nanoparticles Should Be Planned As Dust Disturbing Work	Routine Exposure Assessment **Note:** Maintenance Work That May Generate Airborne Unbound Engineered Nanoparticles Should Be Planned As Dust Disturbing Work
	No Representative Air Sampling Required	No Representative Air Sampling Required	No Representative Air Sampling Required	No Representative Air Sampling Required	No Representative Air Sampling Required
Medical Surveillance	Does Not Meet Criteria For Enrollment In Nanoparticle Worker Registry Or Medical Surveillance Program.	Does Not Meet Criteria For Enrollment In Nanoparticle Worker Registry Or Medical Surveillance Program.	Does Not Meet Criteria For Enrollment In Nanoparticle Worker Registry Or Medical Surveillance Program.	Does Not Meet Criteria For Enrollment In Nanoparticle Worker Registry Or Medical Surveillance Program.	Does Not Meet Criteria For Enrollment In Nanoparticle Worker Registry Or Medical Surveillance Program.

Controls for Repair and Maintenance of Equipment or Building Systems Potentially Contaminated With Engineered Nanoparticle					
Nanoscale Material Precautions: Non-Invasive/Non-Dust Disturbing Activities					
Engineering Controls	No Requirement Specific To Nanoscale Material Since Work Will Not Disturb Unbound Engineered Nanoparticles	No Requirement Specific To Nanoscale Material Since Work Will Not Disturb Unbound Engineered Nanoparticles	No Requirement Specific To Nanoscale Material Since Work Will Not Disturb Unbound Engineered Nanoparticles	No Requirement Specific To Nanoscale Material Since Work Will Not Disturb Unbound Engineered Nanoparticles	No Requirement Specific To Nanoscale Material Since Work Will Not Disturb Unbound Engineered Nanoparticles
Administrative Controls	No Requirement Specific To Nanoscale Material	No Requirement Specific To Nanoscale Material	No Requirement Specific To Nanoscale Material	No Requirement Specific To Nanoscale Material	No Requirement Specific To Nanoscale Material
Personal Protective Equipment	No Requirement Specific To Nanoscale Material	No Requirement Specific To Nanoscale Material	No Requirement Specific To Nanoscale Material	No Requirement Specific To Nanoscale Material	No Requirement Specific To Nanoscale Material
Posting	No Requirement Specific To Nanoscale Material	No Requirement Specific To Nanoscale Material	No Requirement Specific To Nanoscale Material	No Requirement Specific To Nanoscale Material	No Requirement Specific To Nanoscale Material
Transportation	No Requirement Specific To Nanoscale Material Since Nanoscale Materials Are Only Stored	No Requirement Specific To Nanoscale Material	Transport Waste In Sealed, Labeled Containers	Transport Waste In Sealed, Labeled Containers	Transport Waste In Sealed, Labeled Containers
Waste Management	No Nanoparticle Bearing Waste Generated Since Unbound Engineered Nanoparticles Are Only Stored	No Unbound Engineered Nanoparticle Bearing Waste Generated	No Unbound Engineered Nanoparticle Bearing Waste Generated	No Unbound Engineered Nanoparticle Bearing Waste Generated	No Unbound Engineered Nanoparticle Bearing Waste Generated

Table 29.2: Nanoscale Material Precautions - Invasive/Dust Disturbing Activities

Controls for Repair and Maintenance of Equipment or Building Systems Potentially Contaminated With Engineered Nanoparticle					
Nanoscale Material Precautions: Invasive/Dust Disturbing Activities					
	Unbound Engineered Nanoparticle Storage Only	**Bound Engineered Nanoparticle**	**Nanoscale Material Level 1 Precautions**	**Nanoscale Material Level 2 Precautions**	**Nanoscale Material Level 3 Precautions**
Training	Does Not Meet Criteria For Requiring Training Read IOPS Hazard Awareness Summaries	Does Not Meet Criteria For Requiring Training Read IOPS Hazard Awareness Summaries	Engineered Nanoscale Materials Orientation Course #1748	Engineered Nanoscale Materials Orientation Course #1748	Engineered Nanoscale Materials Orientation Course #1748
Exposure Assessment	Standard Industrial Hygiene	Standard Industrial Hygiene	1. Repair or maintenance Work On	1. Repair or maintenance Work On	1. Repair or maintenance Work On

Controls for Repair and Maintenance of Equipment or Building Systems Potentially Contaminated With Engineered Nanoparticle					
Nanoscale Material Precautions: Invasive/Dust Disturbing Activities					
	Exposure Assessment	Exposure Assessment	Equipment or Building Systems Potentially Contaminated with Unbound Engineered Nanoparticles Must Be Reviewed by a Worker Safety & Health Representative 2. Assure Appropriate Engineering Controls Are In Place to Filter or Otherwise Clean (Scrub) Exhaust Air Before Releasing It To The Environment or Back In To The Workspace.	Equipment or Building Systems Potentially Contaminated with Unbound Engineered Nanoparticles Must Be Reviewed by a Worker Safety & Health Representative 2. Assure Appropriate Engineering Controls Are In Place to Filter or Otherwise Clean (Scrub) Exhaust Air Before Releasing It To The Environment or Back In To The Workspace.	Equipment or Building Systems Potentially Contaminated with Unbound Engineered Nanoparticles Must Be Reviewed by a Worker Safety & Health Representative 2. Assure Appropriate Engineering Controls Are In Place to Filter or Otherwise Clean (Scrub) Exhaust Air Before Releasing It To The Environment or Back In To The Workspace.
	No Representative Air Sampling Required	No Representative Air Sampling Required	Representative Air Sampling	Representative Air Sampling	Representative Air Sampling
Medical Surveillance	Does Not Meet Criteria For Enrollment In Nanoparticle Worker Registry Or Medical Surveillance Program.	Does Not Meet Criteria For Enrollment In Nanoparticle Worker Registry Or Medical Surveillance Program.	Enroll Affected Staff In Nanoparticle Worker Registry & Offer Medical Surveillance Baseline Examination.	Enroll Affected Staff In Nanoparticle Worker Registry & Offer Medical Surveillance Baseline Examination.	Enroll Affected Staff In Nanoparticle Worker Registry & Offer Medical Surveillance Baseline Examination.
Engineering Controls	No Requirement Specific To Nanoscale Material	No Requirement Specific To Nanoscale Material	Assure Appropriate Engineering Controls Are In Place to Filter or Otherwise Clean (Scrub) Exhaust Air Before Releasing It To The Environment or Back In To The Workspace.	Assure Appropriate Engineering Controls Are In Place to Filter or Otherwise Clean (Scrub) Exhaust Air Before Releasing It To The Environment or Back In To The Workspace.	Assure Appropriate Engineering Controls Are In Place to Filter or Otherwise Clean (Scrub) Exhaust Air Before Releasing It To The Environment or Back In To The Workspace.
Testing Ventilation Systems	No Requirement Specific To Nanoscale Material	No Requirement Specific To Nanoscale Material Research	Regularly Test All Ventilation Systems Used To Control Worker Exposure To Unbound Engineered Nanoparticles	Regularly Test All Ventilation Systems Used To Control Worker Exposure To Unbound Engineered Nanoparticles	Regularly Test All Ventilation Systems Used To Control Worker Exposure To Unbound Engineered

Controls for Repair and Maintenance of Equipment or Building Systems Potentially Contaminated With Engineered Nanoparticle					
Nanoscale Material Precautions: Invasive/Dust Disturbing Activities					
			According To Prescribed Procedures Or The Manufacturer's Recommendations	According To Prescribed Procedures Or The Manufacturer's Recommendations	Nanoparticles According To Prescribed Procedures Or The Manufacturer's Recommendations
Administrative Controls	No Requirement Specific To Nanoscale Material	No Requirement Specific To Nanoscale Material	1. Wet Wipe, Tack Roll, or HEPA Vacuum Work Area After Work Activities 2. Wash Hands And Forearms After Removing PPE	1. Wet Wipe, Tack Roll, or HEPA Vacuum Work Area After Work Activities 2. Wash Hands And Forearms After Removing PPE	1. Wet Wipe, Tack Roll, or HEPA Vacuum Work Area After Work Activities 2. Wash Hands And Forearms After Removing PPE
Personal Protective Equipment	No Requirement Specific To Nanoscale Material	No Requirement Specific To Nanoscale Material	If work activity disturbs unbound engineered nanoparticles, wear: 1. Respiratory Protection 2. Disposable Coveralls 3. Surgeons Gloves 4. Goggles, If Respirator Does Not Cover Eyes	If work activity disturbs unbound engineered nanoparticles, wear: 1. Respiratory Protection 2. Disposable Coveralls 3. Surgeons Gloves 4. Goggles, If Respirator Does Not Cover Eyes	If work activity disturbs unbound engineered nanoparticles, wear: 1. Respiratory Protection 2. Disposable Coveralls 3. Surgeons Gloves 4. Goggles, If Respirator Does Not Cover Eyes
Posting	No Requirement Specific To Nanoscale Material	No Requirement Specific To Nanoscale Material	Post Areas When Working On Equipment That Generate Airborne Unbound Engineered Nanoparticles	Post Areas When Working On Equipment That Generate Airborne Unbound Engineered Nanoparticles	Post Areas When Working On Equipment That Generate Airborne Unbound Engineered Nanoparticles
Transportation	Equipment And Building Systems Should Not Be Contaminated with Unbound Engineered Nanoparticles – Storage Area Only	Equipment And Building Systems Should Not Be Contaminated with Unbound Engineered Nanoparticles – Bound Work Only	Transport Waste or Contaminated Equipment In Sealed, Labeled Containers or Bags	Transport Waste or Contaminated Equipment In Sealed, Labeled Containers or Bags	Transport Waste or Contaminated Equipment In Sealed, Labeled Containers or Bags
Waste Management	No Unbound Engineered Nanoparticle Bearing Waste Generated	No Unbound Engineered Nanoparticle Bearing Waste Generated	Any Material Coming in Direct Contact With Unbound Engineered Nanoparticles Is Considered Nanoparticle Bearing Waste	Any Material Coming in Direct Contact With Unbound Engineered Nanoparticles Is Considered Nanoparticle Bearing Waste	Any Material Coming in Direct Contact With Unbound Engineered Nanoparticles Is Considered Nanoparticle Bearing Waste

29.8 Protective Clothing and Equipment

Battelle requires the use of protective clothing when unbound engineered nanoparticles may contact the skin, enter breaks in the skin, or contact the eyes. Battelle further requires that protective clothing and/or equipment be used when airborne exposure to unbound engineered nanoparticles is anticipated (e.g., maintenance within, or removal of, hoods or ventilation systems where unbound engineered nanoparticles are or have been used). In addition, skin and eye protection must be used when there is likelihood of skin or eye exposure to unbound engineered nanoparticles. The cognizant industrial hygienist will determine the level of protective clothing and equipment appropriate to the task. Protective clothing and equipment will be made available to any nanomaterial worker who requests it, regardless of measured exposure levels. Organizations laundering such protective clothing and equipment will be informed of the potential hazards of unbound engineered nanoparticles precautions to prevent airborne unbound engineered nanoparticles.

29.9 Respiratory Protection

The use of NIOSH-approved respiratory protection is required for workers potentially exposed to airborne unbound engineered nanoparticles. Battelle requires respirator use when airborne exposures are anticipated unless airborne particle counts in similar operations or tasks have been evaluated and found to be consistent with background particle counts.

Any worker who requests the use of a respirator for protection against airborne unbound engineered nanoparticle exposures will be provided NIOSH-approved respiratory protection, regardless of measured exposure levels. All workers who use respiratory protection must be enrolled in the respiratory protection program.

29.10 Emissions Monitoring

Emission monitoring will be managed by an industrial hygienist and conducted using Battelle’s exposure assessment methodologies. The primary purpose of air monitoring is to determine the effectiveness of engineering controls by screening for suspect emissions and atypical/upset conditions that deserve further investigation, and to associate the resulting data to tasks, processes, and personnel.

29.11 Exposure Monitoring

Currently no regulatory or consensus occupational exposure limits (OEL) for airborne exposure to unbound engineered nanoparticles. In the absence of OELs, definitive conclusions cannot be drawn from any data that would allow a determination to be made between safe and unsafe levels of airborne exposure to unbound engineered nanoparticles.

29.12 Unbound Engineered Nanoparticle Emergencies

Emergencies involving unbound engineered nanoparticle are unlikely to occur at Battelle due to the small quantities of unbound engineered nanoparticle present in our facilities. Should quantities large enough to require an emergency plan be brought into Battelle facilities, an emergency plan will be developed.

29.13 Unbound Engineered Nanoparticle Posting and Labeling

The Contractor must post signs indicating hazards, personal protective clothing and equipment requirements, and administrative control requirements at entry points into designated areas where dispersible unbound engineered nanoparticles are handled. A designated area may be an entire laboratory, an area of a laboratory, or a containment device, such as a laboratory hood or glove box.

Label waste containers and unbound engineered nanoparticle contaminated equipment to plainly indicate that the contents include unbound engineered nanoparticles (e.g., "nanoscale zinc oxide particles" or other identifier instead of just "zinc oxide").

The label should read "Caution: Unbound Engineered Nanoparticles consisting of (technical description here). Contact (name of point of contact) at (contact number) in case of container breakage."

CAUTION

Unbound Engineered Nanoparticles

Consisting of (Technical Description Here)
Contact: (POC)
at (Contact number)
in Case of Container Breakage

When waste containers or unbound engineered nanoparticle contaminated equipment are transported outside of a laboratory or if unbound engineered nanoparticles are in the form of dry, dispersible particles, add the following line of text: "Nanoparticles may exhibit unusual reactivity and toxicity. Avoid breathing dust, ingestion, and skin contact."

CAUTION
Unbound Engineered Nanoparticles

Consisting of (Technical Description Here)
Contact: (POC)
at (Contact number)
in Case of Container Breakage

Engineered Nanoparticles May Exhibit Unusual Reactivity And Toxicity

Avoid Breathing Dust, Ingestion, and Skin Contact

29.14 Release of Unbound Engineered Nanoparticle Contaminated Material

Battelle will not release unbound engineered nanoparticle contaminated materials or equipment to the general public unless it has been decontaminated and approved for release by a Battelle Worker Safety and Health Representative.

29.15 Housekeeping

Unbound engineered nanoparticle contaminated floors and surfaces must be cleaned no less frequently than at the end of each shift using a wet method, HEPA vacuuming, or other cleaning method, such as sticky tack cloths that avoid the production of airborne dust. Keep all working surfaces and items (e.g., benches, glassware, apparatus, exhaust hoods, support equipment) free of unbound engineered nanoparticle contamination, as practicable. Cleaning equipment that is used to clean unbound engineered nanoparticle contaminated surfaces must be labeled, controlled, and not used for non-hazardous materials. Surfaces in occupied areas of facilities, or unoccupied areas where work is anticipated, with unbound engineered nanoparticle contamination will be decontaminated. A decontamination plan will be developed prior to conducting decontamination.

29.16 Waste Disposal

Work should be planned to minimize the amount of unbound engineered nanoparticle contaminated waste. Liquid suspensions and colloids that contain unbound engineered nanoparticles and unbound engineered nanoparticle contaminated waste materials (e.g., protective gloves, cleaning materials, etc.) must be placed in sealed, chemically compatible containers and labeled.

30.0 Equipment and Motor Vehicle Operation

30.1 Purpose/Scope

To define the responsibilities and requirements for operating motor vehicles and equipment on Battelle work sites.

Contractors/subcontractor/vendors are not allowed to use Battelle-PNWD owned or leased vehicles.

30.2 Responsibility

The Contractor shall be responsible for compliance with this section.

Employees shall be responsible for complying with the provisions of this section.

30.3 Requirements

30.3.1 General Vehicle Use Safety Practices

Personnel must have a current state or international driver's license in their possession when operating any contractor vehicle at a project site.

All personnel operating a motor vehicle, as well as the occupants in the vehicle, will wear a seatbelt/shoulder harness regardless of the distance to be traveled.

Articulating Dump Trucks (ADT's) must have written approval from Battelle prior to being operated on PNNL jobsites.

Practices that are not condoned during the operation of motor vehicles at project sites include:

- Cell phone use while driving
- Wearing devices that restrict or impair hearing or vision
- Leaving an unattended motor vehicle running and/or with its keys in the ignition
- Carrying more passengers than a vehicle is designed for
- Transporting passengers in cargo area of vehicles
- Exceeding posted speed limits and not observing traffic signs
- Transporting prohibited items (e.g., weapons, alcohol, controlled substances)
- Committing any such act that could result in the suspension or revocation of a class C driver's license of a Commercial Driver's License

30.3.2 Vehicles and Equipment

Employees exposed to vehicular or mechanized equipment must wear reflective or high visibility clothing (i.e. shirt, vest, or jacket).

Prior to vehicle operation check the overall vehicle condition and surroundings. Inspect the vehicle for such items as properly functioning lights, brakes, windshield wipers, steering, and tires before operating the vehicle. Verify that the vehicle contains emergency equipment. Secure and support loads that are carried outside of the vehicle cab.

Vehicles believed to be unsafe and/or delinquent on necessary maintenance shall not be driven and removed from service. (Tag out of service)

The contractor will document using the Competent Person Designation that only trained and qualified operators are authorized to operate mechanized (heavy) equipment onsite.

Mechanized equipment will be equipped with:

- Cabs that have safety glass or equivalent installed with no visible distortions affecting the safe operation of any machine

- Roll over protection (ROP)
- Seat belts except for equipment designed for standup operation
- Braking systems capable of stopping and holding the equipment fully loaded
- Fenders on wheels for earthmoving haulage equipment with pneumatic tires
- 10 lbs. ABC fire extinguisher
- Audible backup alarm

When using operating heavy equipment:

- Inspect mechanized equipment daily and correct any unsafe conditions
- Handle loads being lifted or transported by mechanized equipment in a manner that ensures stability, prevents loss of the load, and protects employees working underneath loads.
- Place barricades or reflectors around equipment left unattended and adjacent to roadways
- Maintain 20 feet working distance from power lines or energized transmitters
- Do not operate equipment while talking on cell phone.
- Secure loose items in operator cab (i.e. thermos, clothing, lunch box, etc)
- Do not mount or dismount equipment while it is in motion
- Wear seatbelts provided and do not allow riders on equipment unless it is designed for more than one person
- Set the parking brake when equipment is parked
- Do not operate tracked units on paved roads except for approved crossings
- Stop, secure, and substantially block or crib the equipment being repaired to prevent falling or shifting before allowing employees to work under or between equipment.
- Loose clothing could catch on operating controls and cause the equipment to suddenly move. Operator must engage safety interlocks prior to exiting equipment.
- Spill Kit shall be available onsite

30.3.3 Control of Roadways during Contractor Activities

In preparation for construction, maintenance, or other contractor activities that causes a detour, restriction, or otherwise affects access to Battelle facilities or traffic on roads the contractor shall initiate the following action:

- Notify Battelle 5 days prior to detours or road closures
- Submit a traffic control to Battelle for approval.
- In accordance with U.S. Department of Transportation, Federal Highway Administration Manual on Traffic Control Services for Streets and Highways identify effective locations for temporary traffic controls signs, devices, signals, and barricades

Once activities begin the following controls must be in place and supported by qualified personnel:

- Warning signs erected facing in all directions when activities are adjacent to a roadway or intersection
- Illuminated signs or signs with reflectors intended for warning during hours of darkness
- Flaggers shall possess a Washington State Flagger Certification or equivalent.
- Covering existing warning devices (lights/traffic signs) if not utilized for traffic flow

Once activities are completed regular traffic controls signs and devices should be returned to operational status or the temporary traffic controls put in place should be removed.

30.3.4 Accident Management

If any driver is involved in a motor vehicle accident in association with contracted Battelle-PNWD work activities s/he will notify their direct supervision as well as Battelle project management.

30.3.5 Training

Contractor personnel who operate utility vehicles and other motor equipment will be trained for the specific equipment they use. Seatbelts must be installed in utility vehicles.

Contract drivers of special purpose vehicles or driver's transporting hazardous waste will obtain proper training and certification to perform this function. A state commercial driver's license with proper endorsements for the class of vehicle driven is acceptable proof of training.

30.4 References

41 CFR, Subpart 109-38.51 Utilization of Motor Equipment

49 CFR, Transportation, Section 3.4, Commercial Driver's License

Washington State Licensing

10 CFR 851, Worker Safety and Health Program

30.5 Records

None

31.0 Respirable Crystalline Silica Control

31.1 Purpose

This section defines the responsibilities and requirements for protecting personnel engaged in silica work, work scope that has the potential for employee exposure to respirable crystalline silica in excess of the PNNL Occupational Exposure Limit (OEL) of 25 µg/m^3, calculated as an 8-hour time-weighted average (TWA_8). The required work controls including work planning, exposure assessment, and engineering controls, administrative controls, personal protective equipment, training and medical surveillance.

31.2 Responsibility

The Contractor shall be responsible for the following:

- Compliance with the procedure

- Employee training
- Development of written exposure control plan
- Designate competent person
- Review and evaluate the effectiveness of the written exposure control plan
- Medical Surveillance Requirements
- Annual review of written exposure control plan
- Records

31.3 General Requirements

Exposure to occupational respirable silica shall be conducted in accordance with the following requirements:

- 10 CFR 851
- 29 CFR 1926, Subpart Z Respirable Crystalline Silica
- WAC 296-840 Respirable Crystalline Silica
- 2016 ACGIH TLV for Crystalline Silica

Employees shall not be exposed to respirable crystalline silica in excess of the PNNL Respirable Silica OEL of 25µg/m^3 (TWA_8).

31.4 Exposure Assessment Requirements

Contractor shall assess the exposure of each employee who is or may reasonably be expected to be exposed to respirable crystalline silica at or above the OEL in accordance with either the Performance Option or the Scheduled Monitoring Option.

31.4.1 Performance Option

Contractor shall assess the 8-hour TWA exposure for each employee on the basis of any combination of air monitoring data or objective data sufficient to accurately characterize employee exposures to respirable crystalline silica.

31.4.2 Scheduled Monitoring Option

Contractor shall perform initial monitoring to assess the 8-hour TWA exposure for each employee on the basis of one or more personal breathing zone air samples that reflect the exposures of employees on each shift, for each job classification, in each work area.

Where several employees perform the same tasks on the same shift and in the same work area, the contractor may sample a representative fraction of these employees in order to meet this requirement. In representative sampling, the contractor shall sample the employee(s) who are expected to have the highest exposure to respirable crystalline silica.

If initial monitoring indicates that employee exposures are below the OEL, the contractor may discontinue monitoring for those employees whose exposures are represented by such monitoring.

- Where the most recent exposure monitoring indicates that employee exposures are above the OEL, the contractor shall repeat such monitoring within three months of the most recent monitoring.
- Where the most recent (non-initial) exposure monitoring indicates that employee exposures are below the OEL, the contractor shall repeat such monitoring within six months of the most recent monitoring until two consecutive measurements, taken 7 or more days apart, are below the TWA, at which time the contractor may discontinue monitoring for those employees whose exposures are represented by such monitoring.
- When unable to meet the performance option or scheduled monitoring option the employer must provide respirators to workers when dust control methods cannot limit exposures to the OEL.

31.4.3 Reassessment of Exposures

The contractor shall reassess exposures whenever a change in the production, process, control equipment, personnel, or work practices may reasonably be expected to result in new or additional exposures at or above the OEL, or when contractor has any reason to believe that new or additional exposures at or above the OEL have occurred.

31.5 Exposure Sampling Requirements

31.5.1 Methods of Sample Analysis

Contractor shall ensure that all samples are evaluated by a laboratory that analyzes air samples for respirable crystalline silica in accordance with NIOSH Manual of Analytical Methods (NMAM).

31.5.2 Employee Notifications

After completing a quantitative exposure assessment contractor shall individually notify each affected employee in writing of the results of that assessment or post the results in an appropriate location accessible to all affected employees. Notifications for construction work must occur within 5 days, all other notifications must occur within 15 days.

Whenever an exposure assessment indicates that employee exposure is above the OEL, contractor shall describe in the written notification the corrective action being taken to reduce employee exposure to or below the OEL.

31.5.2.1 Observation of Monitoring

Where air monitoring is performed to comply with the requirements of this section, PNNL shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to respirable crystalline silica.

When observation of monitoring requires entry into an area where the use of protective clothing or equipment is required for any workplace hazard, PNNL shall provide the observer with protective clothing and equipment at no cost and shall ensure that the observer uses such clothing and equipment.

31.6 Engineering and Work Practice Controls

31.6.1 Required Exposure Control Methods

Contractor shall use engineering and work practice controls to reduce and maintain employee exposure to respirable crystalline silica to or below the OEL, unless contractor can demonstrate that such controls are not feasible.

Wherever such feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the OEL, contractor shall nonetheless use them to reduce employee exposure to the lowest feasible level and shall supplement them with the use of respiratory protection

Contractor shall comply with other OSHA standards when abrasive blasting is conducted using crystalline silica-containing blasting agents, or where abrasive blasting is conducted on substrates that contain crystalline silica.

31.7 Restricted Areas Requirements

31.7.1 Written Plan to Restrict Access

Contractor shall establish a procedure used to restrict access to work areas, when necessary, to minimize the number of employees exposed to respirable crystalline silica and their level of exposure, including exposures generated by other sub-contractors.

A separate written plan is not required if means and methods are detailed in the written exposure control plan discussing how to restrict access to silica levels above the OEL.

31.8 Written Exposure Control Plan

Contractor shall establish and implement a written exposure control plan that contains at least the following elements:

- A description of the tasks in the workplace that involve exposure to respirable crystalline silica;
- A description of the engineering controls, work practices, and respiratory protection used to limit employee exposure to respirable crystalline silica for each task; and
- A description of the housekeeping measures used to limit employee exposure to respirable crystalline silica.
- Designate a competent person to make frequent and regular inspections of job sites, materials, and equipment to implement the written exposure control plan.
- Review and evaluate the effectiveness of the written exposure control plan at least annually and update the plan as necessary.

- The written exposure control plan shall be readily available for review by Battelle and copying, upon request, to each employee covered by this section.

31.9 Respiratory Protection

When respiratory protection is required, contractors must provide each worker training, fit test and medical evaluation prior to issuing an appropriate respirator. Respiratory protection must comply with CESH section 7.0 Respiratory Protection.

- Where exposures exceed the OEL during periods necessary to install or implement feasible engineering and work practice controls;
- Where exposures exceed the OEL during tasks, such as certain maintenance and repair tasks, for which engineering and work practice controls are not feasible;
- During tasks for which the contractor has implemented all feasible engineering and work practice controls and such controls are not sufficient to reduce exposures to or below the OEL; and
- During periods when the employee is in restricted areas.

31.10 Housekeeping

Contractor shall not allow dry sweeping or dry brushing where such activity could contribute to employee exposure to respirable crystalline silica unless wet sweeping, HEPA-filtered vacuuming or other methods that minimize the likelihood of exposure are not feasible.

Contractor shall not allow compressed air to be used to clean clothing or surfaces where such activity could contribute to employee exposure to respirable crystalline silica unless:

- The compressed air is used in conjunction with a ventilation system that effectively captures the dust cloud created by the compressed air; or
- No alternative method is feasible.

31.11 Medical Surveillance

31.11.1 Initial Medical Surveillance

Contractor shall make an initial (baseline) medical examination available; by a qualified physician, at no cost to its employees, and at a reasonable time and place, when employees are:

- Performing silica related construction tasks and required to use a respirator for thirty or more days per year.

The baseline examination shall consist of:

- A medical and work history, with emphasis on: past, present, and anticipated exposure to respirable crystalline silica, dust, and other agents affecting the respiratory system; any history of respiratory system dysfunction, including signs and symptoms of respiratory disease (e.g., shortness of breath, cough, wheezing); history of tuberculosis; and smoking status and history.

- A History of tuberculosis. The history of tuberculosis should include completion of the WA State Department of Labor and Industries *Form F 252-113-000, Adult Tuberculosis Screening Tool for Workers Exposed to Respirable Crystalline Silica*
- A physical examination with special emphasis on the respiratory system;
- A chest X-ray (a single posteroanterior radiographic projection or radiograph of the chest at full inspiration recorded on either film (no less than 14 x 17 inches and no more than 16 x 17 inches) or digital radiography systems), interpreted and classified according to the International Labour Office (ILO) International Classification of Radiographs of Pneumoconioses by a NIOSH-certified B Reader;
- A pulmonary function test to include forced vital capacity (FVC) and forced expiratory volume in one second (FEV1) and FEV1/FVC ratio, administered by a spirometry technician with a current certificate from a NIOSH-approved spirometry course;
- Testing for latent tuberculosis infection; and
- Any other tests deemed appropriate by the Physician or other licensed health care professional (PLHCP).

31.11.2 Periodic Examinations

Contractor shall make available medical examinations at least every three years, or more frequently if recommended by the PLHCP.

31.12 Information provided to the PLHCP

Contractor shall ensure that the examining PLHCP has a copy of this standard, and shall provide the PLHCP with the following information:

- A description of the employee's former, current, and anticipated duties as they relate to the employee's occupational exposure to respirable crystalline silica;
- The employee's former, current, and anticipated levels of occupational exposure to respirable crystalline silica;
- A description of any personal protective equipment used or to be used by the employee, including when and for how long the employee has used or will use that equipment; and
- Information from records of employment-related medical examinations previously provided to the employee and currently within control of the employer.

31.12.1 PLHCP Written Medical Report for the Employee

Contractor shall ensure that the PLHCP explains to the employee the results of the medical examination and provides each employee with a written medical report within 30 days of each medical examination performed. The written report shall contain:

- A statement indicating the results of the medical examination, including any medical condition(s) that would place the employee at increased risk of material impairment to health from exposure to respirable crystalline silica and any medical conditions that require further evaluation or treatment;

- Any recommended limitations on the employee's use of respirators;
- Any recommended limitations on the employee's exposure to respirable crystalline silica; and
- A statement that the employee should be examined by a specialist if the chest X-ray provided in accordance with this section is classified as 1/0 or higher by the B Reader, or if referral to a specialist is otherwise deemed appropriate by the PLHCP.

31.12.2 PLHCP's Written Medical Opinion for PNNL

PNNL shall obtain a written medical opinion from the SOMD within 30 days of the medical examination. The written opinion shall contain only the following:

- The date of the examination;
- A statement that the examination has met the requirements of this section; and
- Any recommended limitations on the employee's use of respirators.
- If the employee provides written authorization, the written opinion shall also contain either or both of the following:
- Any recommended limitations on the employee's exposure to respirable crystalline silica;
- A statement that the employee should be examined by a specialist if the chest X-ray provided in accordance with this section is classified as 1/0 or higher by the B Reader, or if referral to a specialist is otherwise deemed appropriate by the PLHCP.
- Contractor shall ensure that each employee receives a copy of the written medical opinion within 30 days of each medical examination performed

31.12.3 Additional Examinations

If the PLHCP written medical opinion indicates that an employee should be examined by a specialist, contractor shall make available a medical examination by a specialist within 30 days after receiving the PLHCP’s written opinion. Contractor shall ensure that;

- The examining specialist is provided with all of the information that the contractor is obligated to provide to the PLHCP.
- The specialist explains to the employee the results of the medical examination and provides each employee with a written medical report within 30 days of the examination.
- A written opinion is obtained from the specialist within 30 days of the medical examination.

31.12.4 Communication of Hazards to Employees

31.12.4.1 Hazard Communication

Contractor shall include respirable crystalline silica in the *Hazard Communication.* Each employee shall have access to labels on containers of crystalline silica and safety data sheets, and is trained. Contractor shall ensure that at least the following hazards are addressed: Cancer, lung effects, immune system effects, and kidney effects.

31.12.4.2 Signs

Contractor shall barricade and post signs at all entrances to minimize access to work areas where employees are performing silica related work activities in accordance with their written exposure control plan.

31.12.4.3 Employee Information and Training

Contractor shall ensure that each employee covered by this section can demonstrate knowledge and understanding of at least the following:

- The health hazards associated with exposure to respirable crystalline silica;
- Specific tasks in the workplace that could result in exposure to respirable crystalline silica;
- Specific measures to protect employees from exposure to respirable crystalline silica, including engineering controls, work practices, and respirators to be used
- The contents of CESH; and
- The purpose and a description of the medical surveillance program.
- The identity the designated competent person.

Contractor shall make section 31 of the CESH readily available without cost to each employee.

31.13 Recordkeeping

31.13.1 Air Monitoring Data

Contractor shall make and maintain an accurate record of all exposure measurements taken to assess employee exposure to respirable crystalline silica. This record shall include at least the following information:

- The date of measurement for each sample taken;
- The task monitored;
- Sampling and analytical methods used;
- Number, duration, and results of samples taken;
- Identity of the laboratory that performed the analysis;
- Type of personal protective equipment, such as respirators, worn by the employees monitored; and
- Name, employee number, and job classification of all employees represented by the monitoring, indicating which employees were actually monitored.
- Ensure employee notification is completed per section 31.6.b

Contractor shall ensure that exposure records are maintained and made available.

31.13.2 Objective Data

Contractor shall make and maintain an accurate record of all objective data relied upon to comply with the requirements of this procedure. This record shall include at least the following information:

- The crystalline silica-containing material in question;
- The source of the objective data;
- The testing protocol and results of testing;
- A description of the process, task, or activity on which the objective data were based; and
- Other data relevant to the process, task, activity, material, or exposures on which the objective data were based.

Contractor shall ensure that objective data are maintained and made available. PNNL may request copies of objective data to help with the development of a data base for silica related work activities. This information can be leveraged for future exposure assessments when working with respirable crystalline silica.

31.13.3 Medical Surveillance

Contractor shall make and maintain an accurate record for each employee covered by medical surveillance. The record shall include the following information about the employee:

- Name and employee number;
- A copy of the PLHCP and specialists' written medical opinions; and
- A copy of the information provided to the PLHCP and specialists.

PNNL shall ensure that medical records are maintained and made available.

31.14 References

29 CFR 1926, Safety and Health Regulations for Construction

WAC 296-155, Safety Standards for Construction Work

2016 ACGIH TLV’s and BEL’s

Appendix A: Definitions

Action Level: The airborne concentration of a non-carcinogenic contaminant that is 50 percent of the established threshold limit value (TLV) for that contaminant, or the concentration of a known or suspected carcinogen that is consistent with as low as reasonably achievable (ALARA) principles. OR the level of airborne beryllium exposure (0.2 µg /m^3 as an 8-hour time-weighted average) above which protective measures outlined in 10 CFR 850.23 must be implemented.

Actual Slope: The slope to which an excavation face is excavated.

Administrative Controls: Work practices designed to confine exposure to hazards to within permissible limit values.

Affected Employee: A person whose position requires him to operate or use a system which is under lockout or tag out or whose position requires him to work in an area where a system which is under lockout or tag out is being serviced or maintained.

Aerial Lift: Vehicle-mounted aerial devices used to elevate personnel for work sites aboveground, including the following:

- extensible and articulating boom platforms
- aerial ladders
- vertical towers
- combination of any of the above

Note: These devices are considered aerial lifts regardless of rotating capacity or power source.

Air Gap A state in which equipment and/or facility has been physically and permanently disconnected from all potential sources of hazardous energy and has no potential to internally store hazardous energy. The disconnection of all sources of hazardous energy must be accomplished in a manner that cannot be readily restored **ALARA (As Low As Reasonably Achievable):** As it pertains to industrial hygiene (non-radiological), the practice of limiting employee exposures (physical, chemical, and biological) to toxic agents to a level "as low as reasonably achievable."

Anchorage: A secure point of attachment for lifelines, lanyards, or deceleration devises which is capable of withstanding the forces specified in the applicable sections of this procedure and Washington Industrial Safety and Health Act (WISHA) standards.

Approved: Tested and certified by the manufacturer, or any recognized national testing laboratory, to possess the strength requirements specified.

Authorized Worker: Individuals who perform the work and, for their personal safety, place their individually assigned locks and tags prior to initiating the work activity. The authorized worker's role is described in the Authorized Worker Requirements (Word) exhibit. Authorized workers must be trained and qualified

Beryllium-affected Worker: A worker affected medically by beryllium exposure (e.g., beryllium sensitization, CBD, or a medical condition otherwise associated with beryllium exposure).

Beryllium Article: A manufactured item that is formed to a specific shape or design during manufacture that has end-use functions that depend in whole or in part on its shape or design during end use; and does not release beryllium or otherwise result in exposure to airborne concentrations of beryllium under normal conditions of use.

Beryllium-associated Worker: A current worker who is or was exposed or potentially exposed to airborne concentrations of beryllium at a DOE facility, including: (1) a beryllium worker; (2) a current worker whose work history shows that the worker may have been exposed to airborne concentrations of beryllium at a DOE facility; (3) a current worker who exhibits signs or symptoms of beryllium exposure, or (4) a current worker who is receiving medical removal protection benefits.

Beryllium-contaminated Material: Refers to equipment and/or items that were used in beryllium production work, or have surface contamination levels greater than 0.2 µg/100 cm_2 or the background level for local soils, whichever is greater.

Beryllium Contamination Area: Location in which there is beryllium contamination on accessible or inaccessible surfaces that is at or greater than the release criteria ($\geq$ 0.2 µg/100 cm^2) or 1.25 ppm (as appropriate for the sampling method). Measurable levels of airborne beryllium (i.e., $\geq$ 0.02 µg/m^3) would not be expected under normal conditions.

Beryllium Regulated Area: Refers to an area in which the airborne concentration of beryllium exceeds, or can reasonably be expected to exceed, the action level.

Beryllium Work Restriction: When the occupational medical provider issues a beryllium medical recommendation, a temporary or permanent work restriction will be implemented to comply with the recommendation. The purpose of the restriction is to prevent current and future employee exposure to airborne beryllium.

Beryllium Worker: A current worker who is regularly employed in a DOE beryllium activity.

Biologic Hazard: A condition created by any microbial unit presenting a risk or potential risk to man, either directly or through disruption of the environment.

Body Belt (Safety Belt): Shall not be used.

Boom-Supported Elevating Work Platform: A type of aerial lift commonly known as the "JLG" manlift.

Bound Engineered Nanoparticle: With reference to engineered nanoscale particles, those nanoscale particles incapable, as a practical matter, from becoming airborne or be expected to generate or release unbound engineered nanoparticles in occupational settings under the particular circumstances of use (e.g., unbound engineered nanoparticles dispersed or otherwise fixed within a solid, strongly bonded to a substrate or contained within a liquid matrix such as aggregated primary crystals of pigments in paints).

Note: An engineered nanoparticle dispersed and fixed within a polymer matrix, incapable, as a practical matter, of becoming airborne, would be "bound," while such a particle suspended as an aerosol or in a liquid would be "unbound."

Carcinogen: Any chemical known or suspected by the Occupational Safety and Health Administration (OSHA), American Conference of Governmental Industrial Hygienists (ACGIH), National Toxicology Program (NTP), or International Agency for Research on Cancer (IARC) to cause cancer in humans or laboratory animals.

Catenary Line: See "Horizontal Lifeline."

Cave-In: The separation of a mass of soil or rock material from the side of an excavation, or loss of soil from under a trench shield or support system, and movement into the excavation in quantity that it could entrap, bury, injure, or immobilize a person.

Chemical Agent: Any chemical substance in the form of vapor, gas, dust, fume or mist, which is capable, or potentially capable, of presenting a risk to the well-being of humans.

Competent Person: One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt, corrective measures to eliminate them. A Competent Person is also one who has extensive knowledge/experience in a particular activity or job function.

Conditional Authorized Worker: Vendors and contracted service personnel who perform work and, for their personal safety, place their individually assigned locks and tags prior to initiating the work activity. Conditional Authorized Workers must be trained and qualified

Container: Any bag, barrel, bottle, box, can, cylinder, drum, vessel, tank, tank truck, or rail car that contains a hazardous chemical. (Piping systems or pipes are not considered containers for the purpose of the hazard warning labels, but must be identified as to their content.)

Secondary Containers: Those that are filled from an original container.

Subsequent Containers: Those that are filled from a secondary container.

Note: Secondary and subsequent containers are usually of decreasing volume to facilitate field use.

Continuous Fall Protection: The design and use of a fall protection system such that no exposures to an elevated fall hazard occurs. This may require more than one fall protection system or a combination of preventative or protective measures.

Controlling Organization: The organization, individual, or delegate responsible for the operation of a building, utility, facility, system, or equipment associated with the work to be performed. Individuals assuming controlling organization responsibilities must be PNNL staff authorized workers.

- The property custodian is normally considered to be the controlling organization.

- The building manager is assigned responsibility for several categories of key operating systems or equipment. In those instances, the building managers are considered to be the controlling organization.
- When the property custodian is not an authorized worker, they must delegate controlling organization responsibility to another authorized worker by written memorandum or to Facilities & Operations (via the Service Request System). Additionally, the owner must support the determination of proper isolation boundaries and authorized workers.
- The property custodian or delegated authorized worker assigned responsibility for laboratory equipment is considered to be the controlling organization for that equipment.
- In the event that multiple organizations are involved in the need for LOTO, a single organization needs to assume controlling organization LOTO responsibility.

Controlling Organization Representative: An individual(s) (e.g. Work Team Lead, Power Operator, Facility Services Specialist, or knowledgeable LOTO-trained worker) appointed by the Controlling Organization. Responsibilities may include informing affected workers, isolating hazardous energy sources, installing and removing Controlling Organization lock and tags and updating the Written Instructions to reflect lock and tag removal/installation status.

Cross Braces: The horizontal members of a shoring system installed perpendicular to the sides of the excavation; the ends bear against either uprights or walls.

Danger Tag: The individually assigned tag that is used by authorized workers for hazardous energy control. Work is performed under this tag.

Danger: Do Not Operate Tag: The tag that is used by the controlling organization to control the isolation boundary for the purpose of energy control. No work may be performed under this tag unless a danger tag has been installed by an authorized worker.

Deceleration Device: Any mechanism (e.g., a rope grab, rip stitch lanyard, specifically woven lanyard, and automatic self-retracting lifeline) which serves to dissipate more energy during fall arrest than does a standard line or strap webbing lanyard.

Distress: Soil in a condition where a cave-in is imminent or likely to occur. Distress indications may be fissures, slumping, spalling, raveling, or small amounts of materials separating from the face. The bottom may bulge or heave and the edge may sink or lower.

Demolition: The dismantling, razing, or wrecking of any fixed building or structure or any part thereof.

Durable: (1) Lockout and tagout devices capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected. (2) Tagout devices are constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible. (3) Tags will not deteriorate when used in corrosive environments such as areas where acid and alkali chemicals are handled and stored.

Equipment: Ladders, scaffolds, ramps, runaways, railings, barricades, sheet piling, shoring, bracing and any such safeguards. Protective construction and devices used in affording protection to the worker engaged in excavation work.

Electrical equipment: Any device that produces, consumes stores, transmits, or converts electrical energy.

Electrical Line: Any conductor used in the transmission of electrical energy from one point to another.

Embankment: An artificial or man-made bank of earthen material.

Energy Control Procedure: The overall written procedure (including responsibilities, procedural steps for lockout and tagout, and requirements for testing the effectiveness of energy control measures) to be used for the control of hazardous energy.

Energy isolating device: A mechanical device that physically prevents the transmission or release of energy. Examples of energy isolating devices include, but not limited to, manually operated electrical circuit breakers; disconnect switches; manually operated switches by which the conductors of a circuit can be disconnected from all ungrounded supply conductors, and, in addition, no pole can be operated independently; valves; blocks; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.

Energy Source: Includes but is not limited to electrical, mechanical, hydraulic, pneumatic, chemical, nuclear, magnetic, and thermal energies, as well as various forms of potential energy, such as that stored in springs, compressed gases, or suspended objects (i.e., gravitational).

Engineering Controls: Ventilation, isolation, guarding, material substitution, limit switches, and other feasible means for minimizing exposure to hazards.

Engineered Nanoparticle: An intentionally-created (in contrast with natural or incidentally-formed) particle with one or more dimensions greater than 1 nanometer and less than 100 nanometers. By way of reference, this size range is 100 - 10,000 x smaller than a typical fiber optic strand, which is on the order of ~10 microns in diameter. Engineered nanoparticles are inhibited from becoming airborne or unlikely to generate or release unbound engineered nanoparticles in occupational settings under the particular circumstances of use (e.g., unbound engineered nanoparticles dispersed or otherwise fixed within a solid, strongly bonded to a substrate or contained within a liquid matrix such as aggregated primary crystals of pigments in paints).

Excavation: Any man-made cavity or depression in the earth's surface, including its sides, walls, or faces, formed by earth removal and producing unsupported earth conditions by reasons of the excavation. If installed forms or similar structures reduce the depth-to-width relationship, an excavation may become a trench.

Exclusive control: The employee has the authority to, and is continuously in a position to, prevent (exclude) other individuals from re-energizing the machine or equipment during his servicing or

maintenance activity. This term applies to cord and plug connected equipment that is within line of sight and arm's reach.

Faces or Sides: The vertical or inclined earth surfaces formed because of excavation work.

Failure: The breakage, displacement, or permanent deformation of a structural member or connection to reduce its structural integrity and its supportive capabilities.

Fall Arrest System: The use of multiple, approved safety equipment components (such as body harnesses, lanyards, deceleration devices, drop lines, horizontal and/or vertical lifelines, and anchorages) interconnected and rigged as to arrest a free fall.

Fall Protection Work Plan: A written planning document which identifies all areas on the jobsite where a fall hazard of 6 ft/10 ft or greater exists. The plan describes the method(s) of fall protection to be utilized to protect employees, and includes the procedures governing the installation, use, inspection, and removal of the fall protection method(s) selected.

Fall Restraint System: An approved device and any necessary components that function together to restrain an employee in such a manner as to prevent that employee from falling to a lower level. (Examples: Standard guardrails or harness attached to securely rigged restraint lines or anchorage points.)

Floor Hole: Any opening measuring less than 12 in, but more than one inch in its least dimension in any floor, roof, or platform through which materials may fall.

Floor Opening: An opening measuring 12 in or more in its least dimension in any floor, roof, or platform through which persons may fall.

Foot Protection: Substantial footwear made of leather or equally firm material, shall be worn by all employees in any occupation in which there is a danger of injury to the feet (required in all construction work areas). Tennis shoes, thin or soft-soled athletic shoes, open-toed sandals, slippers, or other similar shoes shall not be worn. Exceptions may be approved for special or unique situations, and justifications documented in the JSA.

Full Body Harness (Class III): A configuration of connected straps to distribute a fall arresting force over at least the thighs, shoulders, and pelvis, with provisions for attaching a lanyard, lifeline, or deceleration device.

Full Body Harness System: A Class III full body harness and lanyard which is attached to an anchorage meeting the requirements of Part C-1, WAC 296-155, or attached to a horizontal or vertical lifeline which is properly secured to an anchorage capable of withstanding the forces specified in the applicable sections of WAC 296-155 and this procedure.

Full Personnel Protection: When a tag out device is used in place of a lockout device, full personnel protection is provided when 1) the tag out device is attached at the same location as the lockout device would have been attached, 2) all tag out-related requirements of this Section have been complied with, and 3) additional means have been taken to provide a level of safety commensurate with that of a lockout device. Such additional means include the removal of an isolating circuit element, blocking

of a control switch, opening and tagging an extra (separated by distance) disconnecting device, or the removal of a valve handle to reduce the likelihood of energization.

Group Lockout Tagout: Group LOTO allows authorized workers to be protected from hazardous energy when they are part of a group (two or more authorized workers) performing servicing or maintenance. Group LOTO is the means by which each authorized worker performing the servicing and/or maintenance exercises his or her control over the associated hazardous energy by attaching his or her personal LOTO onto a group LOTO mechanism.

Hazardous Energy: Energy that has reasonable potential to cause injury to a staff member.

Hazardous Energy Control Plan: The written plan which clearly and specifically identifies the hazardous energy sources and outlines the scope, purpose, responsibilities, and procedural steps for lockout and tagout and the requirements for testing the effectiveness of energy control measures to be used for the control of hazardous energy from stated sources.

Hazardous Material: Any substance that presents a physical or health hazard to humans.

Health Hazard: Any substance or agent that may cause acute or chronic effects to employees who are exposed to it.

Horizontal Lifeline (Catenary Line): A horizontal rope, wire rope, rail, or synthetic cable that is installed on a horizontal plane between two anchorages and used for attachment of a worker's lanyard, either by tying or by means of a sliding connection.

Hot-Tap: A procedure used in repair, maintenance and servicing activities, which involves welding on a piece of equipment (pipelines, vessels or tanks) under pressure, in order to install connections or appurtenances. It is commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, steam, and petrochemical distribution systems.

Incidental Employee: An employee who, under normal circumstances, would not be in an area where a system is under lockout but is required to enter or pass through such an area.

Industrial Hygienist: A person having a college or university degree or degrees in engineering, chemistry, physics, or medicine or related biological sciences who, by virtue of special studies and training, has acquired competence in industrial hygiene. Such special studies and training must have been sufficient in all of the above cognate sciences to provide the abilities to recognize the environmental factors and stresses associated with work and work operations and to understand their effect on people and their wellbeing; to evaluate, on the basis of experience and with the aid of quantitative measurement techniques, the magnitude of these stresses in terms of ability to impair an individual's health and well being; and to prescribe methods to eliminate, control or reduce such stresses when necessary to alleviate their effects. (See the Bulletin of the American Board of Industrial Hygiene for additional details.)

Inspection: A documented visit to and evaluation of a facility or work area in respect to compliance with applicable safety standards and regulations.

Isolation Boundary: Energy isolating devices that are configured and checked to provide a safe condition where servicing and maintenance are to be performed.

Integral: The activity must be inherent to the production process.

Lanyard: A rope, suitable for supporting one person, with one end fastened to a safety belt or harness and the other end secured to an anchorage point or a lifeline.

Lockout Device: A lock that requires a key to operate (i.e., not a combination lock) and holds an isolation point in the required position for the protection of personnel. The locks used for control of hazardous energy are singularly identified by color. Only green locks are used by authorized workers to control hazardous energy for their personal safety during service and maintenance activities and cannot be used for other purposes. (Locks are not required to have the owner's name printed on them since they are fastened through the grommet of a tag having the authorized worker's name.) Red locks are used by Controlling Organizations to set the isolation boundary and cannot be used for any other purpose.

Lock Box: A specifically identified and job-specific container or device used in group lockout tagout activities which is capable of being locked. A lockbox contains keys that are unique to the lockbox. Valve handles, hand wheels, fuses may be, but are not required, to be secured in lockboxes. An option used to administer LOTO for a group of authorized workers during complex jobs to reduce the group’s exposure to a hazard or when isolating points will not accept multiple locks.

Lockout and Tagout: Installation of a lock and tag on the isolation points so that work can be performed safely. The lock and tag keep the isolation point and the equipment or system they isolate or control from being operated until the lock and tag are removed.

Manufacturer’s Label: Written, printed, or graphic material displayed on, or affixed to, containers of hazardous chemicals in accordance with applicable regulations.

Material Safety Data Sheet (MSDS): A document concerning a hazardous chemical prepared in accordance with applicable regulations.

Maximum Allowable Slope: The steepest incline of an excavation face that is acceptable for the most favorable site conditions is the ratio of horizontal distance to vertical rise (H:V).

Moving Ground: Any ground, which for any reason, will not remain in its original location.

Nanoparticle: A dispersible particle having in two or three dimensions greater than 0.001 micrometer (1 nanometer) and smaller than about 0.1 micrometer (100 nanometers) and which may or may not exhibit a size-related intensive property.

Normal Operations: The utilization of equipment to perform its intended function.

Pressure Systems: All pipe, tubing, valves, controls, and other devices which operate or are maintained above atmospheric pressure. *See definition of vacuum systems*

Physical Agent: Potentially harmful conditions such as excessive noise, temperature extremes, ionizing radiation, non-ionizing radiation, and pressure extremes.

Protective System: A method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping systems, shield systems, and other systems that provide the necessary protection.

Readily Identifiable: Easily determined to be the correct component for the equipment or system to be serviced and is positively known to be accurate, by both the CO and AW. This is accomplished by visual confirmation or a review of verified documentation reflecting current system configuration.

Registered Professional Engineer: A person registered as a Professional Engineer in the State of Washington in the appropriate discipline. The registered Professional Engineer shall comply with the Washington State Department of Licensing requirements, Chapter 18.43 RCW.

Repetitive: The activity must be repeated regularly as part of the production process or cycle.

Routine: The activity must be performed as part of a regular and prescribed course of procedure and be performed in accordance with established practices.

Runaway: A passageway for people, elevated above the surrounding floor or ground level.

Safe-to-Work Check: The inspection or test that an authorized worker performs to confirm that no hazardous energy exists where servicing or maintenance will be performed. For electrical energy, this involves the use of test equipment by a qualified electrical worker.

Self-Propelled Elevating Work Platform: A type of aerial lift commonly known as the “scissor” type aerial lift.

Servicing and/or Maintenance: Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energization or startup of the equipment or release of hazardous energy.

Sheeting: The members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (shield system): A structure that can withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or designed to be portable and moved along as work progresses. Shields can be remanufactured or job-built according to data from the manufacturer or designed by a registered Professional Engineer. Shields used in trenches are usually called “trench boxes” or “trench shields”.

Shoring (shoring system): A structure such as a metal hydraulic, mechanical, or timber shoring system that supports the sides of an excavation that is designed to prevent cave-ins.

Sides, Walls, or Faces: The vertical or inclined earth surfaces formed because of excavation work.

Sloping (sloping system): A method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation to prevent cave-in.

Snap Hook: A self-closing connecting device with a gatekeeper latch or similar arrangement that will remain closed until manually opened. This includes single action snap hooks that require a second action on a gatekeeper before the gate can be opened.

Standard Railing: A railing that consists of a top rail, intermediate rail, toe board, and posts, and shall have a vertical height of 42 in from upper surface top rail to floor, platform, runway, or ramp. The railing shall be able to withstand at least the minimum of 200 pounds top rail pressure with a minimum of deflection.

Startle Hazard: A startle hazard is any unexpected change to the work environment that causes the body's natural startle response. Initiators of startle hazards may result from unexpected release of low pressure fluid from a pipe, unexpected loud noise from a compressor starting, unexpected flash of bright light and/or unexpected vibration from excavating equipment. A startle can result in a worker being exposed to a hazard if they are working from ladder, around chemicals, on energized electrical components, working on or near sharp objects and/or on or near rotating equipment. Startle hazards can be mitigated by identifying the hazardous startle work environment, de-energizing and applying a lockout and tagout whenever possible and/or making worker(s) aware of startle initiators.

Static Line: See "horizontal lifeline."

Stored Energy: Energy (electrical, mechanical, or chemical) that might be found in a charge capacitor, a loaded spring, chemical solutions, or other similar hazardous form.

Substantial: (1) Lockout devices. Removal of lockout devices require the use of excessive force or unusual techniques, such as with the use of bolt cutters or other metal cutting tools. (2) Tagout devices. Tagout devices, including their means of attachment, prevent inadvertent or accidental removal. All DDNO tags shall be attached by grommet and/or by a non-reusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than 50 pounds and having the general design and basic characteristics of being at least equivalent to a one-piece, all-environment-tolerant nylon cable tie.

Support System: A structure such as underpinning, bracing or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

System: Includes machinery, equipment, and electrical, hydraulic, and pneumatic lines and their subsystems.

System Isolation Check: The comprehensive inspection and test of the isolating boundary performed to confirm that the isolating boundary is controlled to prevent exposure from all sources of hazardous energy and material.

Tag: A Danger or Danger: Do Not Operate device that can be securely fastened to an energy isolation point with the lock through the grommet or using an environmentally tolerant nylon cable tie or equivalent to indicate that the energy isolation point and the equipment being controlled cannot be operated until the tag is removed.

Tagout: The installation of a Danger or Danger: Do Not Operate tag on an isolation point to prevent the operation of any component or equipment when operation could cause personal injury or death. Tagout (without a lockout) is used only when the isolation point is physically incapable of being locked and the provisions of Locks, Tags, and Other Devices for Hazardous Energy Control Exhibit are met.

Technical Review: A review to properly identify, document, and verify the isolating boundaries through the use of accepted, controlled as-built drawings or databases, written procedures, and walk-downs as part of each specific lockout instruction.

Threshold Limit Value (TLV): TLVs refer to airborne concentrations of substances, and represent conditions under which it is believed nearly all workers may be repeatedly exposed day after day without suffering adverse health effects.

Toeboard: A vertical barrier at floor level erected along exposed edges of a floor opening, wall opening, platform, runway, or ramp to prevent material falling.

Trench: A narrow excavation made below the surface of the ground. The depth is generally greater than the width, but the width of a trench is not greater than15 ft.

Trench Jack: Screw or hydraulic type jacks used as cross bracing in a trench shoring system.

Unattended: Equipment or lockbox with an AW lock installed is considered “attended” for that worker. By removing the individual’s AW lock, the job location is considered unattended for that worker.

Unbound Engineered Nanoparticle (UNP): Engineered nanoparticles that, under reasonably foreseeable conditions encountered in the work process, are not contained within a matrix that would be expected to prevent the nanoparticle from being separately mobile and a potential source of exposure.

Note: An engineered nanoparticle dispersed and fixed within a polymer matrix, incapable, as a practical matter, of becoming airborne, would be "bound," while such a particle suspended as an aerosol or in a liquid would be "unbound."

Unprotected Side/Edge: Any side or edge where there is not a wall or handrails.

Unstable Rock: Rock material on the side or sides of the excavation not secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Unstable Soil: Earth material, which because of its nature cannot be depended upon to remain in place without extra support such as a system of shoring.

User: A person who packages, handles, transfers, or otherwise comes in contact with hazardous chemicals during the workday.

Vertical Lifeline (Dropline): A vertical rope from a fixed anchorage, independent of the work surface, to which the lanyard is affixed or tied.

Wales: Horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

Warning Line System: A barrier erected on a walking and working surface or a low pitch roof (4 in 12 or less), to warn employees that they are approaching an unprotected fall hazard(s).

Vacuum Systems: All pipe, tanks, tubing, valves, controls, and other devices that operate or are maintained below atmospheric pressure.

Violation: An omission or commission, a condition, or a situation that is in conflict with the procedures, standards, or requirements of OSHA, Division of Occupational Safety and Health (DOSH: formally WISHA), National Fire Protection Association (NFPA), National Electric Code (NEC), American National Standards Institute (ANSI), or other safety and health agencies.

- De minimis: Minor, non-serious violations that can usually be corrected on-the-spot and present no potential for serious injury.
- Non-serious: Minor violations that present a low potential for serious injury/property damage.
- Serious: Violations that present a moderate to high potential for serious injury/property damage.
- Repeated: Occurring more than once; may be de minimis, non-serious, or serious.
- Imminent Danger: An impending or threatening situation which, if left uncorrected, is likely to result in serious injury/property damage.
- Stop Work Orders: A directive to cease work issued for failure to follow procedures, imminent danger situation/conditions, accumulation of safety violations, etc.

Appendix B: Exhibits

Alternate Means of Isolating Hazardous Energy from Specific Equipment

Authorized Worker Requirements

Authorized Worker Lock Removal and/or Reinstallation by a Different Authorized Worker

Checklist for Insulating Rubber Gloves

Eight Criteria for Proceeding with Verbal Authorization Only

Excavation Detail Sketch

Exceptions to Lockout/Tagout Requirements

Federal and State Medical Surveillance Requirements

Group Lockout and Tagout

Hazardous Energy Isolation Practices

Job Safety and Health Protection

Locks, Tags, and Other Devices for Hazardous Energy Control

Lockout and Tagout Hazards Analysis Process

Lockout and Tagout Written Instruction Form Instructions

Procedure for Temporary Lift of Lockout and Tagout Devices

Removal of Energy Control Devices of an Absent Authorized Worker

Right to a Safe and Healthful Workplace

Temporary Protective Grounding

Transferring a Lock and Tag during Shift and Personnel Changes

Using an Authorized Worker Representative to Perform the Lock and Tag Safe-to-Work Check

Worker Protection for DOE Contractor Employees

Appendix C: Forms

Activity Specific Electrical Worker Qualification, Course 2024

Competent Person Designations and Instructions

Confined Space Entry Form

Construction Supervisor Safety Inspection Checklist

Daily Excavations/Trenches Safety Inspection Checklist and Inspection Log

Electrical Work Permit

Hot Work Permit

Isolation-Outage Request

Job Safety Analysis

Lockout and Tagout Temporary Lift Form

Lockout and Tagout Written Instruction Form

Orientation Checklist

Orientation Record

Management Removal of Authorized Worker Lockout and Tagout Form

Contractor Employee Job Task Analysis Form

Periodic Inspection Checklist

Pre-job Safety Planning Signoff

Safety Meeting Sign-in Roster

Scaffolds Inspection Checklist

Training Attendance Record Weekly

Safety Meeting Agenda

Approval History

Back to Task List

- Activity: Approval was ACCEPTED by Deichman, Mark L (3L355) on Sep 24 2019 10:56AM.
- Activity: Approval was ACCEPTED by Faulk, Diane E (37850) on Sep 24 2019 12:40PM.
- Activity: Approval was ACCEPTED by Sweesy, Jason J (902434) on Sep 24 2019 12:54PM.
- Activity: Approval was ACCEPTED by Taylor, Cassie N (3H874) on Sep 25 2019 10:36AM.
- Activity: Approval was ACCEPTED by Buchanan, Clint R (3G692) on Sep 25 2019 11:04AM.

Process Details

Document Type:
OSD Document Approval

Document Description:
REVISED MANUAL: CESH_R18

Document ID:
CESH Manual_R18 - FINAL - September 2019

Date Submitted:
09/24/2019 09:36 AM

Document Originator:
Taylor, Cassie N

Document Beneficiary:
Taylor, Cassie N

Process ID:
3613657

Process State:
APPROVED

Process Status:
Approval: ACCEPTED by: 3G692

Application/Mgmt. System:
Operational Systems (Directorate) (about)