CHAPTER 4.0 TABLE OF CONTENTS

4.0 PERSONNEL QUALIFICATIONS AND TRAINING REQUIREMENTS 1
4.1 Scope.....1
4.2 General.....1
4.2.1 Program Requirements 1
4.2.2 Qualification Prerequisites 1
4.2.3 Physical Examination and Substance Abuse Testing Requirements.....2
4.2.4 Substance Abuse Testing for Commercial Motor Vehicle Drivers.....3
4.3 Training and Qualification Programs 3
4.3.1 Previous Training and Qualification 4
4.3.2 Training Subjects.....4
4.3.3 On-the-Job Training 4
4.3.4 On-the-Job Evaluation.....5
4.3.5 Qualifications 7
4.3.6 Requalification 7
4.4 Retraining 9
4.5 Written and Performance Tests 9
4.6 Training and Qualification Records.....9
4.6.1 Training Completion Records 9
4.6.2 Course Records.....9
4.6.3 Qualification Cards.....10

TABLES

Table 4-1: Powered Industrial Truck Types 5

Table 4-2: Overhead Crane Types 6

Table 4-3: Mobile Crane Types 6

Table 4-4: Activities and Requalification Methods 8

ATTACHMENTS

Attachment 4-1: Training Subject Content By Activity And/Or Equipment 11

4.0 PERSONNEL QUALIFICATIONS AND TRAINING REQUIREMENTS

4.1 Scope

This Hanford Site Hoisting and Rigging Manual (HSHRM) chapter specifies qualification and training requirements for personnel with the following responsibilities:

1. Direct hoisting and rigging (H&R) activities
2. Supervise H&R activities
3. Perform H&R activities
4. Inspect and maintain H&R equipment
5. Provide technical approval of procedures, lift plans or work instructions for H&R activities
6. Develop lift plans
7. Provide signals for H&R activities
8. Train and evaluate personnel for H&R activities and equipment operation
9. Provide safety oversight
10. Perform H&R engineering functions

Contracting organizations shall review, verify, and document that subcontractors have an acceptable training and qualification program. The contracting organization shall ensure that the program meets the requirements of this section to ensure that personnel are qualified to perform work covered by this HSHRM.

NOTE: *Refer to Occupational Safety and Health Administration (OSHA) 29 CFR 1926, Subpart R, Steel Erection, for special H&R requirements relating to steel erection.*

4.2 General

4.2.1 Program Requirements

Personnel shall be trained and qualified to a level of proficiency consistent with their assigned tasks. Managers responsible for work assignments shall ensure that work assignments do not exceed personnel qualifications. Posting a list of qualified operators adjacent to or on appropriate equipment is recommended.

4.2.2 Qualification Prerequisites

Personnel whose work falls within the scope of this HSHRM shall meet the following qualifications.

1. Be at least 18 years old
2. Be able to communicate in written and spoken English
3. Be able to meet the physical requirements of the job assignment

4.2.3 Physical Examination and Substance Abuse Testing Requirements

4.2.3.1 Physical Examination Requirements for Mobile Locomotive, and Cab- or Pulpit-Operated Overhead Crane Operators

Before operating mobile, locomotive, and cab- or pulpit-operated overhead cranes, operators, operator trainees, maintenance personnel, and inspectors shall pass a crane operator physical examination initially and at least every 36 months thereafter. The physical examination shall meet the requirements of the American Society of Mechanical Engineers (ASME) B30.17, *Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist)*, and B30.5, *Mobile and Locomotive Cranes*. The operator shall retain evidence of successfully passing the physical examination.

A mobile crane operator who successfully passes a commercial motor vehicle (CMV) driver's physical in accordance with the requirements of OSHA 49 CFR 391, Subpart E, *Physical Qualification and Examination*, satisfies the crane operator physical exam requirements.

NOTE: *A company's contract, agreement, and/or memorandum of understanding regarding physical examinations will determine the medical examiner chosen to perform the physical examination. In general, the Site Occupational Medical Director will clear all medical examinations.*

4.2.3.2 Substance Abuse Testing for Mobile Crane Operators

Mobile or locomotive crane operators, operator trainees, maintenance personnel, and inspectors shall pass, with a negative result, a substance abuse test initially and at least every 36 months thereafter. A recognized laboratory shall perform the test.

4.2.3.3 Crane Operator Certification

Crane Operators shall be certified by an operator testing organization that is accredited by a nationally recognized accrediting agency as defined in OSHA 29 CFR 1926.1427, *Operator Training, Certification, and Evaluation*. The certification shall meet the previous training requirements defined in Section 4.3.1. Certified mobile crane operators shall complete On-the-Job Training (OJT) and On-the-Job Evaluation (OJE) per MSC-STD-TQ-61033, *Hoisting and Rigging Training Program Description*, Section 4.17.

NOTE: *Maintenance and inspection personnel that are required to operate cranes in the performance of their duties are excluded from this certification requirement; however, they must maintain mobile crane operator qualification under the Hanford Site training requirements and this chapter.*

Operators of the following types of cranes shall be certified as detailed above:

- Articulating cranes (such as knuckle-boom cranes)
- Crawler cranes
- Floating cranes
- Cranes on barges
- Locomotive cranes

- Mobile cranes (wheel-mounted, rough-terrain, all-terrain, commercial truck-mounted, and boom truck cranes)
- Multi-purpose machines when configured to hoist and lower (by means of a winch or hook) and horizontally move a load
- Industrial cranes (such as carry-deck cranes)
- Dedicated pile drivers
- Service/mechanic trucks with a hoisting device when used for operations other than maintenance or repairs
- A crane on a monorail *when temporarily installed*
- Tower cranes (such as a fixed jib, i.e., "hammerhead boom," luffing boom, self-erecting)
- Pedestal cranes
- Portal cranes
- Overhead and gantry cranes *when temporarily installed*
- Straddle cranes
- Side boom cranes
- Derricks
- Digger derricks when used for operations other than placing or removing poles and handling associated materials to be installed on or removed from the poles
- Any variations of such equipment

4.2.4 Substance Abuse Testing for Commercial Motor Vehicle Drivers

The Commercial Motor Vehicle (CMV) definition found in OSHA 49 CFR 383.5, *Definitions*, shall apply to truck-mounted mobile cranes and forklifts designed for highway use with a gross vehicle weight rating of 26,001 lb or more.

CMV drivers are subject to substance abuse testing independent of the mobile crane operator's substance abuse testing requirements (see Section 4.2.3.2). The same substance abuse test can meet both CMV and crane operator requirements, but the crane operator must be retested at least every 36 months.

4.3 Training and Qualification Programs

Contractors shall have a documented training and qualification program that includes the following elements.

1. Classroom or computer-based training
2. Written tests
3. OJT (see Section 4.3.3).
4. OJE (see Section 4.3.4)

5. Established and documented pass/fail criteria (see Section 4.5)

Click here to view the Hanford Hoisting and Rigging Training Program Description.

4.3.1 Previous Training and Qualification

Documented evidence of previous training or experience may be accepted to meet training requirements.

1. Previous training or experience may include the following:
   a. Vendor or equipment manufacturer training
   b. Completion of an apprenticeship program
   c. Journeyman status in an applicable trade
2. For previous training to be acceptable for Hanford Site qualification, documented evidence of the topics listed in Attachment 4-1 of this chapter shall be included, along with the type and class of equipment operated. For qualifications not related to equipment operation, personnel shall have documented evidence of training related to an activity covered by this HSHRM. Previous training must include a written knowledge test. As a minimum, documented evidence may be any of the following.
   a. Certificates of training (See Note 4.1)
   b. Journeyman card or documents issued by a trade union
   c. A degree or accreditation from a college or trade school
3. When previous training or experience are reviewed for compliance to this HSHRM, accepted and documented, personnel shall be considered qualified after they have satisfactorily completed an OJE for the equipment or activity being performed. Operators of mobile locomotive and cab- or pulpit-operated overhead cranes shall have met the Physical Examination and Substance Abuse Testing requirements identified in Section 4.2.3.
4. When previous training or experience is reviewed for compliance to this HSHRM and not accepted, personnel will be required to complete the applicable Hanford Site approved course, the applicable challenge examination for the approved course, or an off-site course that meets the requirements of this HSHRM.

4.3.2 Training Subjects

Attachment 4-1, *Training Subject Content by Activity and/or Equipment*, contains subjects (listed by qualification area) that should be included in the training process. All approved courses must include a written knowledge test.

4.3.3 On-the-Job Training

Contractors shall make OJT available for crane and forklift operators. If a forklift or crane operator will use attachments, the OJT shall include installation and use of approved attachments (Example: Forklift boom and barrel-handling attachments and crane jibs and boom extensions). Personnel shall satisfy training requirements (see Attachment 4-1, *Training Subject Content by*

Activity and/or Equipment) before performing OJT. The OJT shall be based on the equipment manufacturer's operating instructions, typical tasks, operating environment, and facility or contractor-specific procedures.

The OJT shall provide training and practice under the direct supervision of a qualified operator or qualified OJT instructor in the appropriate work environment, using the appropriate OJE forms of Section 4.3.4. Complexity of equipment and tasks, along with the operator's experience shall determine the need for OJT. Management may allow previously qualified or experienced personnel to bypass the OJT and undergo an OJE (see Section 4.3.4). The completion or bypassing of OJT shall be documented.

4.3.4 On-the-Job Evaluation

Sections 4.3.4.1 through 4.3.4.4 contain classes of cranes, forklifts, or H&R activities that require personnel to pass an OJE before being granted qualifications. The OJEs shall have pass and fail criteria, and shall require personnel to demonstrate that they have the knowledge and skills to safely operate equipment or perform the H&R function. Personnel shall be evaluated for each type and class of equipment they operate. Personnel who pass an evaluation for a type and class of equipment are considered qualified on all equipment of the same type and class. Contractors, facilities, and organizations may choose to implement additional facility-specific OJT and/or OJE requirements. OJEs are required to be documented. As a minimum, documentation shall contain:

1. The name and signature of the person being evaluated
2. Name and signature of the qualified evaluator
3. Evaluation score
4. Instructions for the evaluator and the person being evaluated
5. Type and class of equipment or activity
6. Attachments
7. Date of the evaluation

Click here to view examples of OJE forms.

4.3.4.1 Powered Industrial Trucks

Personnel are qualified to operate powered industrial trucks according to the following designations. See Chapter 6.0, *Forklift Trucks*, for sample views of each industrial truck class designation.

Table 4-1: Powered Industrial Truck Types

Class	Powered Industrial Truck Type
1&2	Electric motor, sit-down and stand-up rider, counter balanced, and narrow-isle trucks, solid and pneumatic tires
3	Electric motor, hand trucks or hand/rider trucks, solid tires

Class	Powered Industrial Truck Type
4&5	Internal combustion engine trucks, solid and pneumatic tires
6	Electric and internal combustion engine tractors, solid and pneumatic tires
7	Rough terrain vertical-mast forklift trucks
8	Rough terrain telescopic boom forklift trucks

4.3.4.2 Overhead Cranes

Personnel are qualified to operate overhead cranes according to the following designations:

Table 4-2: Overhead Crane Types

Class	Overhead Crane Type
1	Overhead cranes, floor-operated (Facilities may designate specific qualifications to selected cranes.)
2	Overhead cranes, cab-operated.

4.3.4.3 Mobile Cranes

Personnel are qualified to operate mobile cranes according to the following designations:

Table 4-3: Mobile Crane Types

Class	Mobile Crane Type
1	Lattice boom truck cranes (multiple control stations)
2	Lattice boom crawler cranes
3	Telescopic boom cranes, (single control stations)
4	Telescopic boom cranes, (multiple control stations)
5	Commercial truck-mounted crane telescoping boom
6	Commercial truck-mounted crane non-telescoping boom
7	Telescoping boom crawler crane
8	Lattice boom wheel mounted (single control station)
9	Telescoping boom fixed control station (non-rotating operator cab)

Class	Mobile Crane Type
10	Locomotive cranes

4.3.4.4 Training and Evaluation

Personnel are qualified to perform H&R OJT instruction or evaluation once they are designated as an On-the-Job Training Instructor or an On-the-Job Evaluator.

4.3.5 Qualifications

Personnel shall be considered qualified when they accomplish the following:

1. Satisfactorily complete Hanford Site approved training, testing, and qualification or meet the requirements of previous training (see Section 4.3.1).
2. Satisfactorily complete equipment specific On-the-Job Training (OJT) for equipment operators. Management may determine that previous qualification or experience fulfills the requirement for OJT.
3. Pass an equipment specific OJE for personnel performing rigging activities and equipment operators.

4.3.6 Requalification

4.3.6.1 Requalification Frequencies

Personnel who perform any of the following tasks shall requalify in those task areas every 60 months:

1. Use rigging or perform rigging activities
2. Function as a designated lead (DL)/lift director
3. Perform OJTs/OJEs
4. Operate mobile cranes, overhead cranes, and monorails
5. Develop lift plans
6. Perform signal person duties for H&R activities
7. Perform periodic document inspections of equipment
8. Provide technical approval of lift procedures
9. Provide safety oversight of H&R operations
10. Supervise or direct H&R operations (includes DLs/lift directors)
11. Perform activities as an equipment custodian
12. Maintenance, inspection, or repair personnel who operate mobile cranes, cab- or pulpit-operated overhead cranes

Personnel who operate forklifts shall requalify every 36 months.

NOTE: *It is recommended that personnel who have not performed work or operated equipment, for which they were trained and qualified, for 12 continuous months be re-evaluated.*

4.3.6.2 Requalification Methods

Personnel performing the following activities may be requalified by the methods indicated. Personnel, who do not satisfactorily complete requalification by an identified method, shall complete training as listed in Section 4.3.1.3.

Table 4-4: Activities and Requalification Methods

Activity	Requalification Method
Powered industrial trucks (forklifts) operation.	OJE
Overhead crane and monorail operation.	OJE
Mobile crane operation (includes maintenance repair or inspection personnel who operate mobile cranes).	OJE
Incidental rigging (using slings, rigging hardware, hoists, and below-the-hook lifting devices). Rigging from overhead cranes.	OJE
Mobile equipment rigging (using slings, rigging hardware, hoists, and below-the-hook lifting devices). Rigging from forklifts, excavators, backhoes, loaders, etc.	OJE
Advanced rigging (using slings, rigging hardware, hoists, and below-the-hook lifting devices). Rigging from a mobile crane.	OJE
Inspect mobile or overhead cranes (mechanical or electrical), forklifts, wire rope, rigging hardware, below-the-hook lifting devices, hooks, and hoists.	OJE or written test
Approving technical lift procedures, acting as Designated Leader for, Safety Oversight or supervision of hoisting and rigging operations.	OJE or written test
Acting as equipment custodian.	Written test
On-the-job training or evaluation of personnel. – Note: - On-the-job Trainers and Evaluators must maintain and demonstrate both their instructional proficiency and technical proficiency.	Written test or OJE

4.4 Retraining

Retraining shall consist of satisfactorily completing training requirements for that activity or equipment (see note in Section 4.3.6). Personnel shall be retrained when any of the following occurs:

1. Equipment with new operating characteristics is acquired
2. Existing equipment is modified, changing the operation characteristics
3. Personnel receive an unsatisfactory performance evaluation
4. Changes in standards or requirements occur that could affect safety
5. Personnel are directly involved in a documented incident that compromises safety of personnel, equipment, or the environment in the performance of H&R activities
6. Personnel performance is determined to be unsatisfactory or diminished skill level is observed

4.5 Written and Performance Tests

Written, oral, and performance tests shall have established pass/fail criteria, be developed using the guidance in DOE-HDBK-1205-97, *Guide to Good Practices for Design Development and Implementation of Examinations*, and DOE-HDBK-1206-98, *Guide to Good Practices for on-the-Job Training*, and require students to demonstrate knowledge and skills identified by training objectives.

4.6 Training and Qualification Records

4.6.1 Training Completion Records

Training completion records (TCR) shall:

1. Be maintained by the issuing organization or employer for the duration of qualification
2. Contain written examinations and performance evaluation of knowledge and skills
3. Contain documentation supporting evaluation of previous training and qualifications, when applicable
4. Indicate the activity and/or equipment type and class for which qualification was issued
5. Contain the name of the qualified individual and the date the qualification was issued
6. Contain the name and signatures of instructors and students, and the date instruction was given
7. Contain the name and signature of the evaluator, the person evaluated, and the date the evaluation was conducted

4.6.2 Course Records

The following documents are considered course records:

1. Course description

2. Current lesson plans
3. Student handouts, if applicable
4. Performance evaluations
5. Written examinations or the bank of test questions

4.6.3 Qualification Cards

Qualified personnel may be issued cards identifying their equipment/activity qualifications. Information on these cards shall be derived from and supported by training and qualification records (see Section 4.6.1). If used, these cards shall contain the following information:

1. Activity covered by the qualification
2. Type of equipment or activity
3. Class of equipment
4. Date of training and/or evaluation
5. Name of qualified individual
6. Signature of qualified individual
7. Name and signature of the OJT instructor
8. Name and signature of the OJT evaluator

ATTACHMENT 4-1: TRAINING SUBJECT CONTENT BY ACTIVITY AND/OR EQUIPMENT

4-1.1 **Powered Industrial Truck (Forklift) Operation**

Training for operation of powered industrial trucks (forklifts) is divided into three categories and should cover the following:

1. **Fundamentals**
   a. Inspection and maintenance
   b. Responsibilities
   c. Standards
   d. Operating instructions, warnings, precautions, etc.
   e. Braking methods and characteristics
   f. Visibility with and without a load
   g. Stability characteristics to include center of gravity, stability triangle (with and without a load or attachments), requirement and approvals for using attachments
   h. Controls: location, function, methods of operation, identification of symbols
   i. Load-handling capabilities of forks and attachments
   j. Fueling and battery charging
   k. Guards and protective devices
   l. Difference between industrial trucks and automobiles
   m. Engine or motor operation
   n. Steering and maneuvering
   o. Other characteristics

2. **Operating Environment**
   a. Floor or ground conditions, including temporary conditions
   b. Ramps and inclines, with and without a load
   c. Trailers, railcars, and dock boards, including the use of wheel chocks, jacks, or other securing devices
   d. Fueling and battery-charging facilities
   e. Use of "classified" trucks in areas classified as hazardous because of a risk of fire or explosion, as defined in NFPA 505, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations*

f. Narrow aisles, doorways, overhead wires, piping, and other areas of limited clearance

g. Areas where the truck may be operated near other powered industrial trucks or vehicles

h. Operation near pedestrians

i. Use and capacities of elevators

j. Operation near the edge of a dock or improved surface

k. LP gas bottle change-out

l. Other special operating conditions and hazards that could be encountered

3. Operation

a. Proper pre-shift inspection and the approved method for removing a truck in need of repair from service

b. Fork/tine adjustments

c. Load-handling techniques (lifting, lowering, picking up, placing, and tilting)

d. Traveling with a load, without a load, and turning corners

e. Parking and shutdown procedures

f. Other special operating conditions for the specific application

g. Operating safety rules and practices (e.g. Designated Leader [DL]/lift director assignment)

h. Other rules, regulations, or practices required by the employer at the location where the powered truck will be used

i. LP gas bottle change-out

j. Lessons learned

k. Hand Signals

l. Operating near power lines

4-1.2 **Forklift Inspection and Maintenance**

Training for forklift inspection and maintenance should cover the following:

1. Inspection criteria
2. Determining who can make repairs
3. Fork inspection criteria
4. Forklift testing criteria
5. Hydraulic systems
6. Capacity, operational, maintenance, and name plate requirements
7. Rated capacity
8. Stability criteria
9. Maintenance and rebuilding practices
10. Forklift type
11. Controls
12. Operating mechanism
13. Components and attachments
14. Safety and warning devices
15. Operating instructions
16. Modifications requirements
17. Replacement parts and suspect counterfeit items

4-1.3 **Wire Rope and Rigging Hardware Inspection and Maintenance**

1. Wire Ropes

a. Manufacturer recommendations
b. Standards
c. Lift service return inspections
d. Wire rope replacement criteria
e. Work site receipt
f. Rope storage
g. Unreeling, cutting, seizing
h. Lubrication type and frequency
i. Replacement
j. Extra-long rope
k. Frequent, monthly, and periodic inspection criteria
l. Terminal end
m. Installation
n. Before initial load cycle
o. Initial load cycle
p. New rope stretch
q. Fastener verification
r. Replacement documentation
s. Rope qualification
t. Lessons learned
u. Suspect counterfeit items

2. Slings

a. Documentation
b. Standards
c. Defective slings
d. Rated loads
e. Sling identification
f. Effects of environment
g. Attachments
o. End attachments
p. Replacement
q. Cautions and prohibitions
r. Fabrication
s. Coatings
t. Design factors
u. Removal criteria

h. Operating practices
i. Proof test
j. Repairs
k. Minimum lengths
l. Rope grades
m. Rope properties
n. General guidelines and inspection criteria
v. Construction
w. Webbing
x. Fittings
y. Marking
z. Suspect counterfeit items
aa. Lessons learned

3. Hooks

a. New hooks
b. Standards
c. Throat latches
d. Frequent inspection criteria and intervals
e. Proof load testing and tagging
f. Inspection records
g. Nondestructive testing
h. Rigging Hardware
i. Marking and tagging
j. Inspection criteria
k. Periodic inspection criteria and intervals
l. Qualification standards
m. Lessons learned
n. Suspect counterfeit items

4. Below-the-Hook Lifting Devices

a. Design factors
b. Standards
c. Welding
d. Guarding
e. Electrical
f. Analysis
g. Marking
h. Modifications
i. Initial inspection
j. Frequent inspection criteria and intervals
k. Service classifications
l. Suspect counterfeit items
m. Inspection records
n. Repairs
o. Preventive maintenance
p. Replacement parts
q. Testing
r. Operational tests
s. Rated load test
t. Manufacturers certification in lieu of rated load test
u. Periodic inspection criteria and intervals
v. Lessons learned

4-1.4 **Overhead Crane Operation**

Training for overhead crane operation should cover the following:

1. Load and capacity
2. Math skills
3. Crane-specific information
4. Standards
5. Operational characteristics
6. Crane performance
7. Prestart and post-start inspections
8. Maneuvering and maneuvering skills
9. Shutdown and securing procedures
10. Crane manufacturer operation and maintenance instructions
11. Suspect counterfeit items
12. Operator conduct and responsibilities
13. Operating practices
14. Attaching the load
15. Holding the load
16. Moving the load
17. Personnel lifting
18. Signaling and signals
19 Lessons learned
20. DL/lift director assignment

4-1.5 **Overhead Crane Inspection and Maintenance**

1. Inspection classification
2. Standards
3. Frequent inspection criteria and intervals
4. Periodic inspection criteria and intervals
5. Determination of conditional hazards
6. Operating mechanisms (including remote operating systems, if applicable)
7. Upper-limit devices
8. Tanks, valves, pumps, lines, and other parts of air or hydraulic systems
9. Hooks and hook latches
10. Hoist ropes and end connections
11. Spooling of rope on drums and sheaves
12. Deformed, cracked, or corroded members
13. Bolts, nuts, pins, or rivets
14. Suspect counterfeit items
15. Sheaves and drums
16. Pins, bearings, wheels, shafts, gears, rollers, locking and clamping devices
17. Bumpers and stops
18. Brake system parts
19. Drive sprockets and excessive drive chain stretch
20. Controllers, master switches, contacts, limit switches, and push-button stations
21. Wind indicators
22. Gasoline, diesel, electric, or other power plants
23. Motion limit devices
24. Rope reeving
25. Function, instruction, caution, and warning labels or plates
26. Cranes not in regular service
27. Inspection records
28. Operational tests for new, reinstalled, altered, repaired, or modified cranes
29. Rated load test
30. Preventive maintenance
31. Maintenance procedure(s)
32. Adjustments, repairs, and replacements
33. Lubrication
34. Rope inspection (see Section 4-1.3)
35. Lessons learned

4-1.6 **Overhead Mechanical and Electrical Hoist Maintenance**

Training for overhead mechanical and electrical hoist maintenance should cover the following:

1. Inspection classification
2. Standards
3. Hoists not in regular service
4. Periodic inspection criteria and intervals
5. Roller chain inspection, maintenance, and replacement
6. Frequent inspection criteria and intervals
7. Operational tests
8. Load test
9. Preventive maintenance
10. Maintenance procedure
11. Adjustments, repairs, and replacements
12. Lubrication
13. Rope inspection and maintenance (see Section C)
14. Welded-link chain inspection, maintenance, and replacement
15. Suspect counterfeit items
16. Lessons learned

4-1.7 **Riggers/Signal Persons**

Training for rigging activities should cover the following:

1. Capacities
2. Math skills
3. Design factors
4. Sling angles and effects on capacity
5. Load weight calculations
6. Definitions
7. Load center of gravity, effects and determination
8. Inspections
9. Slings, types and applications
10. Rigging hardware, types and applications
11. Below-the-hook lifting devices types, applications, marking, and inspection
12. Safety requirements
13. Safe H&R practices
14. Attaching the load
15. Moving the load
16. Rigger responsibilities
17. Emergency response
18. Critical lift requirements
19. Standards
20. Signaling and signals
21. Lessons learned
22. Calculating sling loading using load angle factors, D/d ratios, and multi-leg slings
23. Calculating the center of gravity and determining pick points for symmetrically and unsymmetrically shaped loads
24. Performing flagging, setup, and working with mobile cranes
25. Working from suspended platforms
26. Working near energized sources and power lines
27. Assembling and disassembling lattice boom cranes and box-boom extensions and jibs
28. Performing critical lifts and two-crane lifts
29. Performing H&R in hostile environments.
30. DL/lift director assignment
31. Crush/pinch points/struck-by hazards

4-1.8 **Mobile Crane Operation**

Training for mobile crane operation should cover the following:

1. Mobile crane operation and setup
2. Load and capacity chart calculations in various configurations
3. Load moment indicators (LMI)
4. Math skills
5. Crane-specific and cab information
6. Standards
7. Operational characteristics
8. Controls and emergency control skills for fire and power-line contact
9. Crane performance and stability
10. Prestart and post-start inspections
11. Maneuvering and maneuvering skills
12. Shutdown and securing procedures
13. Crane manufacturer operation and maintenance instructions
14. Operator conduct and responsibility
15. Operating practices
16. Attaching the load
17. Holding the load
18. Moving the load
19. Personnel lifting
20. Signaling and signals
21. Operating near power lines
22. Traveling with and without a load
23. Suspect counterfeit items
24. Footing
25. DL/lift director assignment
26. Refueling procedure
27. Lessons learned
28. Operator aids.
29. Crush/pinch points/struck-by hazard

NOTE: *For other crane types see Chapter 1.0, Introduction.*

4-1.9 **Mobile Crane Inspection and Maintenance**

Training for mobile crane inspection and maintenance shall include requirements and applicable subjects of Section 4-1.8, *Mobile Crane Operation*, if inspection and maintenance personnel operate mobile cranes in performance of their duties. Training for mobile crane inspection and maintenance should cover the following subjects:

1. Inspection classification
2. Standards
3. Control mechanisms adjustments
4. Control mechanisms for excessive wear of components
5. Control mechanisms contamination by lubricants or other foreign matter
6. Safety mechanisms for malfunction
7. Hydraulic hoses
8. Hooks and latches
9. Rope reeving
10. Electrical apparatus
11. Hydraulic system
12. Tires
13. Crane structure and boom
14. Suspect counterfeit items
15. Bolts or rivets
16. Sheaves and drums
17. Pins, bearings, shafts, gears, rollers, and locking devices
18. Brake and clutch system, parts, linings, pawls, and ratchets
19. Load, boom angle, and other indicators
20. Gasoline, diesel, electric, or other power plants
21. Chain drive sprockets and chain
22. Crane hooks
23. Travel steering, braking, and locking devices
24. Hydraulic and pneumatic hose fittings and tubing inspection
25. Excessive abrasion or scrubbing of the outer surfaces
26. Hydraulic and pneumatic pumps, valves, and motors
27. Hydraulic filters
28. Cranes not in regular use
29. Inspection records
30. Operator aids
31. Operational tests
32. Crush/pinch points/struck-by hazards
33. Rated load test
34. Preventive maintenance
35. Maintenance procedure
36. Adjustments and repairs
37. Functional operating mechanisms
38. Safety devices
39. Control systems
40. Braking systems
41. Lubrication
42. Rope inspection (see Section 4-1.3)
43. Lessons learned

4-1.10 **Equipment Custodian**

Training for equipment custodians should cover the following:

1. Verification of current maintenance
2. Standards
3. Verification of current inspection
4. Verification of current testing
5. Record keeping
6. Proper tagging and removal from service
7. Elements of this HSHRM for the assigned equipment
8. Manufacturer's operating and maintenance instructions.

4-1.11 **Designated Leader (DL)/Lift Director**

Training for DLs/lift directors should cover the following:

1. Preparation of critical lift procedures
2. Standards
3. Proper approval of critical lift procedures
4. Documented pre-lift meeting
5. Flagger assignment and identification
7. Equipment selection
8. Equipment setup and positioning
9. Work area overview
10. Directing operations
11. Elements of this HSHRM for the work and equipment used

4-1.12 **Supervisor**

Training for supervisors should cover the following:

1. Qualified personnel for equipment operation
2. Standards
3. Safe operation of equipment
4. Preplanned and approved H&R instructions
5. Proper tagging of unsafe or restricted-use equipment
6. Custodian notifications
7. DL/lift director assignments
8. Elements of this HSHRM for work assignments of the assigned crew

4-1.13 **Lift Procedure Technical Approver/Lift Plan Developer**

Training for technical approvers/lift plan developers should cover the following:

1. Chapter 3.0, *Critical and Special Lifts*
2. Elements of this HSHRM for the work to be done and equipment to be used. For subjects refer to each category of equipment and activity listed in Attachment 4-1**,** *Training Subject Content by Activity and/or Equipment*.

4-1.14 **On-the-Job Training Instructor**

OJT instructors shall have the technical information in the subject area of training assignments and should be trained in the following:

1. OJT techniques
2. Demonstrations
3. Hands-on exercises
4. Performance evaluation
5. Use of OJT forms
6. Records management

4-1.15 **On-the-Job Evaluator**

On-the-job evaluators shall have the technical information on the subject area of evaluations, be qualified to perform OJEs of proper operator actions, and should be trained in the following:

1. Evaluation techniques
2. Test administration
3. Performance evaluation
4. Use of OJE forms
5. Records management

4-1.16 **Classroom Instructors**

Classroom instructors presenting training on subjects identified in Attachment 4-1, *Training Subject Content by Activity and/or Equipment*, shall be technically competent and trained in the following instructional areas:

1. Standards
2. Instructional techniques
3. Test administration
4. Instructional materials and media
5. Learning Objectives
6. Lesson plans
7. Lessons learned in subject area
8. Concepts of systematic approach to training
9. Principles of learning
10. Records Management

4-1.17 **Safety Oversight**

Training for personnel responsible for safety oversight of hoisting and rigging activities should cover the following:

1. General safety standards related to H&R activities.
2. HSHRM content overview and pertinent safety requirements for personnel and equipment.

4-1.18 **Rigging Engineer**

Candidates for Rigging Engineers shall have a minimum of two years of experience in H&R related work and have demonstrated capability in the technical aspects of similar work. This capability shall be achieved through education and experience.

NOTE: *Designation as a rigging engineer does not qualify personnel to perform design calculations. A Registered Professional Engineer (RPE) typically performs design calculations of hoisting and rigging equipment*.

Training for Rigging Engineers should cover the following items and may be accomplished by classroom training or by qualification card in accordance with Section 4.6.3:

1. The contents of this HSHRM, focused on those aspects pertaining to engineering.
2. The OSHA and ASME standards listed in Chapter 21.0, *References and Bibliography* – focused on those aspects of this HSHRM pertaining to engineering.
3. Reviewing structural calculations of lift points or lifting devices to determine compliance to applicable standards – determine when an RPE or a graduate of an accredited college or university is required, identification of standards (ASME; BTH-1, *Design of Below-the-Hook Lifting Devices*; AISC; others), stress levels and factor of safety for types of stress (compression, tension, shear and load combinations), design media review process, identification of various types of materials and environmental effects.
4. Personnel assignments and responsibilities – determine when an RPE or graduate of an accredited college or university is required, engineering code of ethics, acceptable practice when OSHA requires an RPE.
5. Critical and special lift criteria – the different types of lifts (Critical, Special, Engineered); ASME P30.1, *Planning for Load Handling Activities*; ASME B30.5, Attachment 4-1, *Critical Lifts*; Chapter 3.0, *Critical, Special, & Engineered Lifts*; and OSHA 29 CFR 1926.1432, *Multiple-Crane/Derrick Lifts—Supplemental Requirements*.
6. Slings, rigging hardware, and below-the-hook lifting devices characteristics and design factors – ASME B30.20, *Below-the-Hook Lifting Devices*; ASME BTH-1, *Design of Below-the-Hook Lifting Devices*; types of lifters; and BTH vs. lifting attachments. This HSHRM added requirements, freight container lifting, metallurgical fracture limits, pin to hole diameter and effects on capacity.
7. Slings, rigging hardware, and below-the-hook lifting devices removal from service criteria – engineering requirements, what constitutes damage, manufacturer's requirements, BTH design and grandfathered lifters, nondestructive testing types.
8. Mobile cranes, hoists, overhead cranes, and forklift operational characteristics, setup, and operation – equipment selection, ground loading, proper set-up and configuration, restrictions, hazard identification, fall zone, collapse zone, swing clearances required.
9. Mobile cranes, hoists, overhead cranes, and forklift testing and inspection requirements and removal from service criteria – requirements for assembly and disassembly, equipment transit weight vs. set-up weight, basic pre-use and periodic inspection requirements, hostile environment plans.

10. Mobile cranes, hoists, overhead cranes, and forklift attachments and effects on capacities – description of the various types of attachments, types allowed, effects of attachments on capacity, manufacturer's approval requirements, assembly and disassembly requirements.
11. Mobile crane load chart calculations and capacities for specific configurations – two crane lift design requirements and lift planning, how to read a load chart, tipping moment, structural limits, outrigger load charts, ground bearing and soil stability factors, outrigger pad size requirements, outrigger material types, application and limitations.
12. Rope re-reeving – effect of improper inspection, effect of improper re-reeving.
13. Suspended platform use and requirements – design requirements for platforms, code requirements, and operating procedure requirements.
14. Working around electrical energized sources requirements – code requirements, RPE requirements, distance limits, arc-flash and grounding, required documentation.
15. Crane, forklift, and rigging rated/proof load testing requirements – design requirements for various types of equipment, forklift forks, crane load testing, and ASME B30 series load test requirements for various hardware and slings.
16. Calculating slings and rigging hardware loading and effects on capacity – calculating sling loading using trigonometry, moment magnification factors on lifting attachments, forces and moments on lifting attachments and BTH lifters, cause of sling failures, types of sling protectors, sling cut protection and edge effects on slings, code requirements for "adequate" protection, D to d ratio.
17. Load weight calculations – weight estimates, contingencies for estimates, load impact factors for various types of hoisting equipment, potential hold up of liquid, and load factors.
18. Determining pick points (lifting attachments) – design criteria for lifting attachments, custom designed or ASME B30.26, *Rigging Hardware*, type of lifting attachment, center of gravity and resulting load vectors to calculate stresses, qualification of lift points by analysis, qualification by inspection and load testing.
19. Calculating load center of gravity – calculating moments to determine center of gravity, potential danger of moving loads, potential danger of rotating loads and center of gravity lifting, the use of running blocks.
20. Safe H&R practices - lesson learned, review of most common types of accidents, accidents due to engineering errors, ground bearing failures and sling failures, transportation requirements such as cribbing, tie-downs, and not using lift points as tie-downs, moving suspended loads and rotating equipment from horizontal to vertical.

4-1.19 **Assembly/Disassembly Director**

Training for personnel responsible for Assembly/Disassembly of cranes activities shall cover the following:

1. Assembly/Disassembly procedures
2. Reviewing procedures
3. Blocking material
4. Crew instructions
5. Proper location of blocking
6. Verifying assist crane loads
7. Tasks, assignments, and associated hazards
8. Boom and jib pick points
9. Hazardous positions/locations during assembly and disassembly
10. Center of gravity
11. Protecting assembly/disassembly crew members out of operator view
12. Snagging
13. Working under the boom, jib, or other components
14. Stability upon pin removal
15. Capacity limits
16. Struck by counterweights
17. Addressing specific hazards
18. Boom hoist brake failure
19. Site and ground bearing conditions
20. Loss of backward stability
21. Wind speed and weather
22. Weight of components
23. Components and configuration
24. Manufacturer instructions
25. Post-assembly inspection
26. Shipping pins
27. Outriggers and Stabilizers
28. Rigging
29. Dismantling (including dismantling for changing the length of booms and jibs)
30. Assembly/Disassembly—employer procedures
31. Power line safety during assembly/disassembly operations
32. Wire Rope
33. Fall Protection

4-1.20 **Mobile Crane Operator and Personnel Assigned to Work Around and with Mobile Cranes**

Mobile Crane Operators and personnel assigned to work around and with mobile cranes shall receive training for working around power lines that, as a minimum, includes the following:

1. The procedure to be followed in the event of electrical contact with a power line. Such training must include:
    a. Information regarding the danger of electrocution from the operator simultaneously touching the equipment and the ground.
    b. The importance to the operator's safety of remaining inside the cab except where there is an imminent danger of fire, explosion, or other emergency that necessitates leaving the cab.
    c. The safest means of evacuating from equipment that may be energized.
    d. The danger of the potentially energized zone around the equipment (step potential).
    e. The need for crew in the area to avoid approaching or touching the equipment and the load.
2. Safe clearance distance from power lines.
3. Power lines are presumed to be energized unless the utility owner/operator confirms that the power line has been, and continues to be, de-energized and visibly grounded at the worksite.
4. Power lines are presumed to be un-insulated unless the utility owner/operator or a registered engineer who is a qualified person with respect to electrical power transmission and distribution confirms that a line is insulated.
5. The limitations of an insulating link/device, proximity alarm, and range control (and similar) device, if used.
6. The procedures to be followed to properly ground equipment and the limitations of grounding.

4-1.21 **Below-the-Hook Lifting Device Operation**

Training on operations of Below-The-Hook (BTH) lifting devices should cover the following as applicable:

1. Manufacturer's suggested operating procedures.
2. Instructions in any special operations or precautions.
3. Condition and configuration of the load required for operation of the lifter.
4. The load rating of the lifting device and the capacity of the hoisting equipment.
5. Application of the lifter to the load and adjustments.
6. Proper attachment of adapters on a lifting device for special load handling.
7. Proper storage of the lifter.
8. Demonstration of the ability to operate the BTH Lifting Device as instructed.
9. Charging of the battery (if required).
10. Purpose of indicators, meters, or alarms on a vacuum lifter.

This page intentionally left blank