

Power Line Safety for Cranes, Derricks and High Profile Vehicular and Mechanical Equipment

Facility: Y-12 National Security Complex

Best Practice Title: Power Line Safety for Cranes/Derricks and High Profile Vehicular and Mechanical Equipment

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Brief Description of Best Practice: The best practice provides requirements designed to help ensure the safety of employees while cranes/derricks are assembled, disassembled, operated or while they travel under power lines and vehicular and mechanical high profile equipment operating under power lines. The facility uses two procedures to ensure the safety of employees around power lines. The first is Y73-115, *Y-12 Hoisting and Rigging Manual*, Chapter 5, *Mobile Crane Inspections and Operations*, provides the requirements for cranes/derricks and Y73-528, *Electrical Safety Manual*, Chapter 6, *Unqualified Personnel Exposed to Electrical Hazards*, for vehicular and mechanical high profile equipment operating around overhead power lines.

Why the best practice was used: This best practice was used to ensure compliance with the OSHA requirements for cranes and derricks in construction. The practice also meets the DOE's intent that consideration of de-energizing power lines before work is performed around power lines. The practice was expanded to ensure safety of employees using vehicular and mechanical high profile equipment near power lines.

What are the benefits of the best practice: Ensures the safety of employees during operations of cranes/derricks and vehicular and mechanical high profile equipment near power lines.

What problems/issues were associated with the best practice:

- Acceptance that evaluation must include the possibility of cranes/derricks or high profile equipment making contact with power lines when work activity has equipment facing away from power lines.
- The evaluation to determine the voltage of the lines, location in relationship to work and if power lines can be de-energized.

How the success of the Best Practice was measured:

Description of process experience using the Best Practice: This practice utilizes the ISMS process to evaluate the risk of hitting power lines and provide hazard controls to prevent making contact with power lines.

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5.7 OPERATION – MOBILE CRANES IN THE VICINITY OF ELECTRICAL POWER LINES

5.7.1 General Information for Mobile Crane Operators in the Vicinity of Power Lines and Electrical Line Hazards

Person In Charge/Designated Leader/Mobile Crane Operator/Hoisting and Rigging Personnel

1. **TO** minimize the hazard of electrocution or serious injury as a result of contact between energized power lines and the crane, load line, or load, **CONSIDER** any overhead wire to be an energized line unless and until a qualified high-voltage employee or qualified electrician (who can perform work on lines normally ≤ 480 volts) indicates it is not an energized line. To ensure the lines/conductors remain deenergized, the lines/conductors must be locked out in accordance with Y73-107, *Lockout/tagout for Personnel Protection Manual*, Y18-34-ORR-4202, *ORR Power Distribution Work Permit Process*, or Y18-102, *Power Distribution Work Permit*.

Maintenance Planner/Construction Superintendent or Craft Electrical Supervisor/Person In Charge/Designated Leader

2. Ensure the work activities with the potential for contact between energized power lines and the crane, load line, or load, are analyzed for the appropriate hazards in accordance with Y73-045, *Job Hazard Analysis Manual*, and the identified controls are incorporated into work instructions, work package, or procedure.
[UCN-22330, "Mobile Crane Overhead Electrical Lines Checklist."](#) **may** be used to evaluate hazards and establish controls for mobile crane work in the vicinity of energized overhead power lines or fixed electrical conductors **and** there is a potential for the equipment or load to make contact with the energized source.

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5.8 MOBILE CRANES WORKING IN THE VICINITY OF ELECTRICAL POWER LINES

WARNING 1

Contact with overhead power lines continues to be a serious safety hazard. More than 130 fatalities each year are caused by contact with overhead power lines.

WARNING 2

When mobile cranes are working in the vicinity of, close enough for the crane or load to possibly contact overhead power lines or fixed electrical conductors, work should be planned and conducted in a manner that ensures that accidental contact does not occur.

NOTE Similar lifts involving mobile cranes at one work site (e.g., construction work site, Uranium Production Facility) may use a specific lift plan with the appropriate Operational Safety Board approval in lieu of the process described in this section.

For a mobile crane, a work zone is the area 360 degrees around the equipment, up to the equipment's maximum working radius.

Work activities should be analyzed with the appropriate hazard analysis process (e.g., Y73-045, *Job Hazard Analysis Manual*), and identified controls should be incorporated into job specific work instruction, work package or procedure.

The process contained in this section establishes controls for mobile crane work based on the electrical hazards of the following work zones:

- Crane operating in the vicinity of (crane or load **cannot** reach within 20 ft) energized overhead power lines or fixed electrical conductors.
- Crane operating in the vicinity of (crane or load **can** reach within 20 ft) energized overhead power lines or fixed electrical conductors.
- Crane operating within 20 ft and outside the Limited Approach Boundary of energized overhead power line/exposed fixed conductors.
- Crane operating within Limited Approach Boundary of energized overhead power lines/exposed fixed conductors.

5.8 MOBILE CRANES WORKING IN THE VICINITY OF ELECTRICAL POWER LINES (cont.)

5.8.1 Crane Working in the Vicinity of Energized Overhead Power Lines/Fixed Electrical Conductors

Mobile Crane Operator/Person In Charge/Designated Leader

CAUTION

Operating mobile cranes where they can become electrified from electric power lines is an extremely hazardous practice.

1. Perform the work so there is no possibility of the crane, load line, or load becoming a conductive path (Fig. 5-2, "Danger Zone for Cranes and Lifted Loads Operating in the Vicinity of Power Lines").

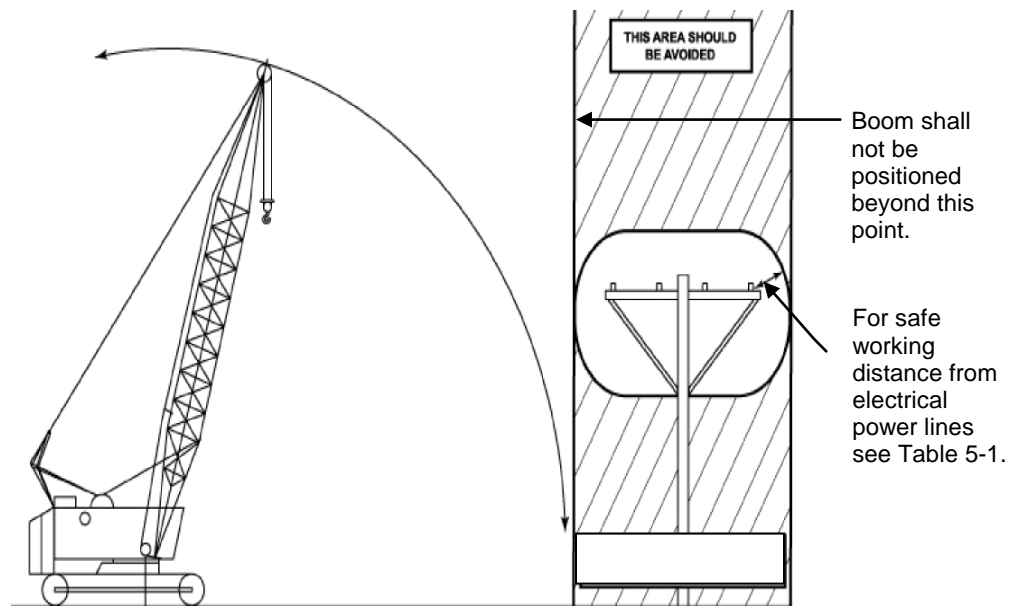


Fig. 5-2. Danger Zone for Cranes and Lifted Loads Operating in the Vicinity of Overhead Power Lines.

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5.8 MOBILE CRANES WORKING IN THE VICINITY OF ELECTRICAL POWER LINES (cont.)

5.8.1. Crane Working in The Vicinity Of Energized Overhead Power Lines/Fixed Electrical Conductors (cont.)

Maintenance Planner/Construction Superintendent or Craft Electrical Supervisor/Person In Charge/Designated Leader

2. Analyze the work activities involving potential contact between energized power lines and the crane, load line, or load, and **ENSURE** the appropriate hazards are analyzed for in accordance with Y73-045, *Job Hazard Analysis Manual*, and the identified controls are incorporated into work instructions, work package, or procedure.

If needed, get assistance from the appropriate personnel to assist with evaluating the electrical hazards and developing appropriate controls. Appropriate personnel may include the person in charge or designated leader, a mobile crane operator, power operations outage coordinator for outside power lines or building/facility manager for fixed electrical conductors, and other needed subject matter experts.

3. **IF** the review process determines that the mobile crane equipment/load **cannot reach** within 20 ft from any overhead power lines/fixed electrical conductors, **THEN** either: (1) ensure the work instructions, work package, or procedure establishes the appropriate controls to ensure the work task remains outside the 20 ft boundary; **or** (2) ensure application of lock out in accordance with Y73-107, *Lockout/Tagout for Personnel Protection Manual*, Y18-34-ORR-4202, *ORR Power Distribution Work Permit Process*, or Y18-102, *Power Distribution Work Permit*, and electrical lines greater than 480 volts are grounded before performing work. Power lines 480 volts or less shall be evaluated for grounding.

[UCN-22330, "Mobile Crane Overhead Electrical Lines Checklist,"](#) may be used to evaluate hazards and controls for mobile crane work if the work task is outside the 20-ft boundary.

4. **IF** the review process determines that the mobile crane equipment/load **can reach (but is not expected to operate)** within 20 ft from any overhead power lines/fixed electrical conductors, **THEN** either: (1) ensure application of lock out in accordance with Y73-107, *Lockout/Tagout for Personnel Protection Manual*, Y18-34-ORR-4202, *ORR Power Distribution Work Permit Process*, or Y18-102, *Power Distribution Work Permit*, and electrical lines greater than 480 volts are grounded before performing work in accordance with Section 5.8.2 (power lines 480 volts or less shall be evaluated for grounding); **or** (2) implement controls to be performed in accordance with Appendix 5-A, "Controls for Mobile Crane Operating in the Vicinity of Overhead Power Line and Fixed Electrical Conductors," Sect. A, and document the controls in the work instructions, work package, or procedure.

[UCN-22330, "Mobile Crane Overhead Electrical Lines Checklist,"](#) may be used to evaluate hazards and controls.

5. **IF** the review process determines the mobile crane equipment/load will operate **within** 20 ft from any overhead power lines/fixed electrical conductors, **THEN** proceed to Sect. 5.8.2.

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5.8 MOBILE CRANES WORKING IN THE VICINITY OF ELECTRICAL POWER LINES (cont.)

5.8.2 Work Within 20 ft of Overhead Power Lines/Fixed Electrical Conductors – De-energized or Energized Determination

Maintenance Planner/Construction Superintendent or Craft Electrical Supervisor/Person In Charge/Designated Leader

1. **IF** the mobile crane equipment/load will operate within 20 ft of the energized overhead power lines or fixed electrical conductors, **ENSURE** the appropriate personnel review the work zone to assist with analyzing the appropriate hazards with the appropriate hazard analysis process (e.g., Y73-045, *Job Hazard Analysis Manual*), and the identified controls are incorporated into work instructions, work package, or procedure.

Appropriate personnel may include the person in charge or designated leader, a mobile crane operator, power operations outage coordinator for outside power lines or building/facility manager for fixed electrical conductors, and other needed subject matter experts.

Building/Facility Manager/Power Operations Outage Coordinator

2. When requested, review the proposed mobile crane activities and walk down the area to assist with evaluating the electrical hazards and developing appropriate controls. Assist with determining whether electrical systems can be removed from service, and identify isolation points for lockout/tagout.

Maintenance Planner/Construction Superintendent or Craft Electrical Supervisor/Person In Charge/Designated Leader

3. Determine if the overhead power lines or fixed electrical conductors can be de-energized.
4. **IF** the overhead power lines or fixed electrical conductors **can be de-energized**, **THEN** document the actions in the work instructions, work package, or procedure.

[UCN-22330, "Mobile Crane Overhead Electrical Lines Checklist,"](#) may be used to evaluate hazards and controls for the mobile crane work in the vicinity of energized overhead power lines or fixed electrical conductors **and** there is a potential for the work task to be within the 20-ft boundary.

5. **IF** the power lines **can be de-energized** contact the Power Operations Outage Coordinator and/or Building/Facility Manager to **ENSURE** lockout/tagout is performed in accordance with Y73-107, *Lockout/Tagout for Personnel Protection Manual*, Y18-34-ORR-4202, *ORR Power Distribution Work Permit Process*, or Y18-102, *Power Distribution Work Permit*, and electrical lines greater than 480 volts are grounded before performing work. Power lines 480 volts or less shall be evaluated for grounding.

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5.8 MOBILE CRANES WORKING IN THE VICINITY OF ELECTRICAL POWER LINES (cont.)

5.8.2 Work Within 20 ft of Overhead Power Lines/Fixed Electrical Conductors – De-energized or Energized Determination (cont.)

Building/Facility Manager/Power Operations Outage Coordinator

6. Ensure the power lines are locked out in accordance with Y73-107, *Lockout/Tagout for Personnel Protection Manual*, Y18-34-ORR-4202, *ORR Power Distribution Work Permit Process*, or Y18-34-ORR-4202, *ORR Power Distribution Work Permit Process*.

Mobile Crane Operator/Person In Charge/Designated Leader

7. Ensure the power lines are locked out and grounded, if applicable, prior to performing work.

Maintenance Planner/Construction Superintendent or Craft Electrical Supervisor/Person In Charge/Designated Leader

8. Notify Power Operations and/or the building/facility manager for the release of LO/TO upon completion of work.

Building/Facility Manager/Power Operations Outage Coordinator

9. **IF** the overhead power lines or fixed electrical conductors **cannot be de-energized**, **THEN** document the reasons why they cannot be de-energized in the work instructions, work package, or procedure and **proceed to Sect. 5.8.3**.

Examples of situations that may preclude de-energizing power lines are: deactivation of emergency alarm systems; shutdown of hazardous location ventilation equipment; and work on circuits that form an integral part of a continuous process that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.

5.8.3 Crane Operating Within 20 ft and Outside the Limited Approach Boundary of Energized Overhead Power Line/Exposed Fixed Conductors

Building/Facility Manager/Power Operations Outage Coordinator/Maintenance Planner/ Construction Superintendent or Craft Electrical Supervisor/Person In Charge/Designated Leader

1. **IF** the mobile crane equipment/load will operate **within the Limited Approach Boundary**, as defined in Table 5-1, "Safe Working Distance from Electrical Power Lines," of any overhead power lines/fixed electrical conductors, **THEN proceed to Sect. 5.8.4**.

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5.8 MOBILE CRANES WORKING IN THE VICINITY OF ELECTRICAL POWER LINES (cont.)

5.8.3 Crane Operating Within 20 ft and Outside the Limited Approach Boundary of Energized Overhead Power Line/Exposed Fixed Conductors (cont.)

Table 5-1. Safe Working Distance from Electrical Power Lines

Normal voltage (phase to phase)	Minimum required clearance when operating near high-voltage power lines (Limited Approach Boundary)	Minimum required clearance when operating near exposed fixed conductors (Limited Approach Boundary)
< 600 V	10 ft	4 ft
13.8 kV	10 ft	5 ft
161 kV	15 ft	15 ft

NOTES:

- 1) Flash Protection Boundary per Y73-528, *Electric Safety Manual*, Chap. 6, "Unqualified Personnel."
- 2) For other voltage levels not listed above, contact Y-12 Safety Department for guidance.

Maintenance Planner/Construction Superintendent or Craft Electrical Supervisor/Person In Charge/Designated Leader

2. **IF** the mobile crane equipment/load/will operate **within** 20 ft but **outside of the Limited Approach Boundary** of energized overhead power lines or fixed electrical conductors, **THEN** select controls to be performed in accordance with Appendix 5-A, "Controls for Mobile Crane Operating in the Vicinity of Overhead Power Line and Fixed Electrical Conductors," Sect. B, and document the controls in the work instructions, work package, or procedure.

[UCN-22330, "Mobile Crane Overhead Electrical Lines Checklist."](#) may be used to evaluate hazards and document controls.

Maintenance Planner/Construction Superintendent or Craft Electrical Supervisor/Person In Charge/Designated Leader

3. Submit the completed work instructions, work package, or procedure to the following for review and approval:
 - department manager requesting the lift and
 - department manager performing the work (i.e., for a FI&S work task) **or** construction manager (i.e., for a construction work task or subcontractor work task).

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5.8 MOBILE CRANES WORKING IN THE VICINITY OF ELECTRICAL POWER LINES (cont.)

5.8.3 Crane Operating Within 20 ft and Outside the Limited Approach Boundary of Energized Overhead Power Line/Exposed Fixed Conductors (cont.)

Department Manager Requesting the Lift and Department Manager Performing the Work/Construction Manager

4. Review and approve or reject the submitted work instructions, work package, or procedure for the proposed mobile crane work.

Mobile Crane Operator/Person In Charge/Designated Leader

5. Ensure the appropriate controls as established in the work instructions, work package, or procedure for the work task are in place prior to performing work.

5.8.4 Crane Operating Within Limited Approach Boundary of Energized Overhead Power Lines/Exposed Fixed Conductors

WARNING 1

Contact with overhead electrical lines is a serious safety hazard.

WARNING 2

Working in the vicinity of, close enough for the crane or load to possible contact, overhead power lines or fixed electrical conductors should be planned and conducted in a manner that ensures that accidental contact does not occur.

Maintenance Planner/Construction Superintendent or Craft Electrical Supervisor/Person In Charge/Designated Leader

1. **IF** the mobile crane equipment/load will operate **inside the Limited Approach Boundary** of energized overhead power lines or fixed electrical conductors, **THEN** ensure the controls listed in Appendix 5-A, "Controls for Mobile Crane Operating in the Vicinity of Overhead Power Line and Fixed Electrical Conductors," Sect. C, are documented in the work instructions, work package, or procedure.

[UCN-22330, "Mobile Crane Overhead Electrical Lines Checklist,"](#) may be used to evaluate hazards and document controls.

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5.8 MOBILE CRANES WORKING IN THE VICINITY OF ELECTRICAL POWER LINES (cont.)

5.8.4 Crane Operating Within Limited Approach Boundary of Energized Overhead Power Lines/Exposed Fixed Conductors (cont.)

Maintenance Planner/Construction Superintendent or Craft Electrical Supervisor/Person In Charge/Designated Leader

2. Submit the completed work instructions, work package, or procedure to the following for review and approval:
 - department manager requesting the lift and
 - department manager performing the work (i.e., for a FI&S work task) **or** construction manager (i.e., for a construction work task or subcontractor work task).

Department Manager Requesting the Lift and Department Manager Performing the Work/Construction Manager

WARNING 1

Contact with overhead electrical lines is a serious safety hazard.

WARNING 2

Working in the vicinity of, close enough for the crane or load to possible contact, overhead power lines or fixed electrical conductors should be planned and conducted in a manner that ensures that accidental contact does not occur.

3. Review and approve or reject the submitted work instructions, work package, or procedure for the proposed mobile crane work.

Maintenance Planner/Construction Superintendent or Craft Electrical Supervisor/Person In Charge/Designated Leader

4. Submit the work document or package to the appropriate Operational Safety Board (OSB) for review and approval regarding the proposed mobile crane work.

OSB review and approval is not required if the mobile crane work involves only work in the vicinity of insulated energized overhead wiring (240 volts or less) for public address systems, fire alarm systems, security systems, pilot wiring, telecommunication, ENS, or other equivalent systems not feasible to de-energize.

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5.8 MOBILE CRANES WORKING IN THE VICINITY OF ELECTRICAL POWER LINES (cont.)

5.8.4 Crane Operating Within Limited Approach Boundary of Energized Overhead Power Lines/Exposed Fixed Conductors (cont.)

Facility or Site Operational Safety Board

5. Review and approve the work document or package in accordance with Y15-636, *Integrated Safety Management Program*.

The OSB review must include an evaluation of:

- The determination that it was not feasible to de-energize the respective overhead power lines/fixed electrical conductors.
- Whether the proposed controls are appropriate.

Mobile Crane Operator/Person In Charge/Designated Leader

6. Ensure the appropriate controls as documented in the work instructions, work package, or procedure for the work task are in place prior to performing work.

Supervisor

7. Ensure the approved work instructions, work package, or procedure are available at the work site prior to performing work.

Person In Charge/Designated Leader

8. Ensure that a copy of the work instructions, work package, or procedure is on-site prior to performing work.

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5.9 CRANE IN TRANSIT WITH NO LOAD AND BOOM CRADLED IN THE VICINITY OF POWER LINES

Designated Leader/Mobile Crane Operator

1. Evaluate mobile crane path before moving and ensure clearance stated in Table 5-2 can be maintained.

Table 5-2. Safe Working Distance from Electrical Power Lines While in Transit with No Load and Boom or Mast in Cradle

Normal voltage (phase to phase)	Minimum required clearance (Limited Approach Boundary)
< 600 V	4 ft
13.8 kV	4 ft
161 kV	9 ft

NOTES:

- 1) Flash Protection Boundary per Procedure Y73-528, *Electric Safety Manual*, Chap. 6, "Unqualified Personnel."
- 2) For other voltage levels not listed above, contact Y-12 Safety Department for guidance.

Designated Leader/Mobile Crane Operator

2. **WHEN** planning transit of the crane, **THEN** consider the effect of speed and terrain on the boom and crane movement.
3. **IF NEEDED** to ensure clearance with overhead power lines/fixed electrical conductors, **THEN ASSIGN** a spotter to observe the crane and provide direction to the Mobile Equipment Operator.
4. Ensure cranes in transit with no load and boom resting in cradle maintain clearance as specified in Table 5-2, "Safe Working Distance from Electrical Power Lines While in Transit with No Load and Boom or Mast in Cradle."

Spotter

5. Observe the clearance and give warning before the crane approaches the limits specified in Table 5-2, "Safe Working Distance from Electrical Power Lines While in Transit with No Load and Boom or Mast in Cradle."

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5.10 ACCIDENTAL CONTACT WITH OVERHEAD POWER LINES

NOTE In the event of accidental contact between a mobile crane and an energized overhead power line, these steps protect the mobile crane operator and/or associated hoisting and rigging personnel against potential electrical shock injury.

Mobile Crane Operator

1. Stay inside the cab.

Hoisting and Rigging Personnel

2. Stay away from the crane, ropes, and load, since the ground around the crane might be energized.
3. Call 911 (cellular phone: 865-574-7172) for Emergency Services and Power Operations.

Mobile Crane Operator

4. **IF** possible, **THEN** remove the crane from contact by moving it in the reverse direction from that caused the contact.
5. **IF** the mobile crane cannot be moved from the contact, **THEN** the operator **should remain inside the cab** until the power lines have been de-energized.

Mobile Crane Operator

6. **IF necessary** (e.g., fire) to exit the mobile crane, **THEN** perform the following two actions:
 - Leap with both feet as far away from the crane as possible, without touching the equipment.
 - Maintain your balance, keep your feet together, and either shuffle or bunny hop away from the equipment 10 ft or more.

5.11 OTHER REQUIREMENTS

1. Refer to [DOE-STD-1090-2007, DOE Hoisting and Rigging Standard, Chap. 9, "Mobile Cranes,"](#) for other mobile crane requirements.

5.12 APPENDICES USED IN CHAP. 5

Appendix 5-A – Controls for Mobile Crane Operating in the Vicinity of Overhead Power Line and Fixed Electrical Conductors

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Appendix 5-A
Controls for Mobile Crane Operating in the Vicinity of
Overhead Power Line and Fixed Electrical Conductors
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CAUTION

Operation of boom and load in the vicinity of overhead lines is extremely dangerous, due to perception of distance and multiple contact points as viewed from the position of the operator and/or position of the spotter.

NOTE Use of Appendix 5-A establishes the expectation that evaluation of lockout/tagout has been performed and has concluded that lockout/tagout of the appropriate overhead power lines and fixed electrical conductors will not be performed.

Section A

Controls – Crane Can Reach Within 20 Ft of Energized Overhead Power Lines or Fixed Electrical Conductors

[UCN-22330, "Mobile Crane Overhead Electrical Lines Checklist,"](#) may be used to evaluate hazards and controls.

The following controls **shall** be used when mobile crane equipment/load **can reach (but is not expected to operate)** within 20 ft of energized overhead power lines/exposed fixed conductors:

1. Pre-Job Meeting – Prior to starting the work task, a meeting with the operator and the other workers who will be in the area of the mobile crane or load to review the location of the overhead power lines/exposed fixed conductors, and the controls that will be implemented to prevent encroachment/electrocution.
2. Tag Lines – If tag lines are used, they must be non-conductive.
3. Elevated warning devices – Erect and maintain elevated warning line, barricade, or line of signs, in view of the operator, equipped with flags or similar high-visibility markings, at 20 ft or greater from the power line (preferred) or at the minimum approach distance established in Table 5-1.
4. Durable warning signs – Durable signs are installed for the duration of the job, at the operator's station and on the outside of the crane, warning that electrocution or serious bodily injury may occur unless the minimum approach distance established in Table 5-1 is maintained between the crane or the load being handled and energized power lines.

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5. One (or more) Barrier Control System – To ensure that the mobile crane does not operate or reach within 20 ft of overhead power lines or fixed electrical conductors one or more of the controls listed below shall be implemented and shall be documented in the work instructions, work package, or procedure.

- a. Proximity alarm – Proximity alarm set to give the operator sufficient warning to prevent encroachment.
- b. Dedicated spotters – Dedicated spotters who are in continuous contact with the operator. They shall have the sole responsibility to verify that the required distances are maintained.

The dedicated spotters must:

- Be equipped with a visual aid to assist in identifying the minimum clearance distance.
 - Be positioned to effectively gauge the clearance distance.
 - Where necessary, use equipment that enables the dedicated spotter to communicate directly with the operator.
 - Give timely information to the operator so that the required clearance distance can be maintained.
- c. Encroachment warning device – A device that automatically warns the operator when to stop movement, such as a range control warning device. The device must be set to give the operator sufficient warning to prevent encroachment.
 - d. Limit range device – If the mobile crane is equipped with a device that automatically limits range of movement, it must be used and set to prevent any part of the equipment, load line, or load (including rigging and lifting accessories) from breaching the minimum approach distance established.
 - e. Insulating link/device – An insulating link/device must be installed at a point between the end of the load line and the load.

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Section B

Controls – Crane Operating Within 20 ft and Outside the Limited Approach Boundary of Energized Overhead Power Line/Exposed Fixed Conductors

[UCN-22330, "Mobile Crane Overhead Electrical Lines Checklist,"](#) may be used to evaluate hazards and controls.

The following controls **shall** be used when **operating** mobile crane equipment/load within 20 ft of energized overhead power lines/exposed fixed conductors, but **outside** the limited approach distances stated in Table 5-1:

1. Pre-Job Meeting – Prior to starting the work task, a meeting with the operator and the other workers who will be in the area of the mobile crane or load to review the location of the overhead power lines/exposed fixed conductors, and the controls that will be implemented to prevent encroachment/electrocution.
2. Tag Lines – If tag lines are used, they must be non-conductive.
3. Elevated warning devices – Erect and maintain elevated warning line, barricade, or line of signs, in view of the operator, equipped with flags or similar high-visibility markings, at 20 ft or greater from the power line (preferred) or at the minimum approach distance established in Table 5-1.
4. Durable warning signs – Durable signs are installed for the duration of the job, at the operator's station and on the outside of the crane, warning that electrocution or serious bodily injury may occur unless the minimum approach distance established in Table 5-1 is maintained between the crane or the load being handled and energized power lines.
5. Two (or more) Barrier Control System – The mobile crane work task must include a control system using two or more controls that provides defense in depth and shall be documented in the work instructions, work package, or procedure.

Examples of a control for the two barrier control systems include, but are not limited to:

- a. Dedicated spotters – Spotters trained in the techniques of visually determining standoff distance and in radio communication with the operator. They shall have the sole responsibility to verify that the required distances are maintained. The spotter must:
 - Be equipped with a visual aid to assist in identifying the minimum clearance distance. Examples include: clearly visible line painted on the ground; a clearly visible line of stanchions; or a set of clearly visible line of sight landmarks.
 - Be positioned to effectively gauge the clearance distance.
 - Where necessary, use equipment that enables the dedicated spotter to communicate directly with the operator.
 - Give timely information to the operator so that the required clearance distance can be maintained.

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5. (cont.)
- b. Physical boundaries – Barriers that maintain the required distance.
 - c. Measurement of the lines and equipment clearance – Utilizing direct and remote measurement techniques to determine the actual clearance distance.
 - d. Power line visibility warning – Devices such as ribbons, balls, etc., attached to the power lines to improve visibility, or equivalent means employed.
 - e. Proximity alarm – Proximity alarm set to give the operator sufficient warning to prevent encroachment.
 - f. Encroachment warning device – A device that automatically warns the operator when to stop movement, such as a range control warning device. The device must be set to give the operator sufficient warning to prevent encroachment.
 - g. Limit range device – **IF** the mobile crane is equipped with a device that automatically limits range of movement, **THEN** it must be used and set to prevent any part of the equipment, load line, or load (including rigging and lifting accessories) from breaching the minimum approach distance established.
 - h. Insulating link/device – **IF** the working load is within 24 inches of a 13.8 kV or less energized source or 44 inches of 161 kV energized source, **THEN** an insulating link/device must be installed at a point between the end of the load line and the load.

Section C

Controls – Crane Operating Within Limited Approach Boundary of Energized Overhead Power Lines/Exposed Fixed Conductors

[UCN-22330, "Mobile Crane Overhead Electrical Lines Checklist,"](#) may be used to evaluate hazards and controls.

IF it is necessary to perform mobile crane work within the Limited Approach Boundary distance as established in Table 5-1, **THEN** the following requirements shall be documented in work instructions, work package, or procedure.

1. Pre-Job Meeting – Prior to starting the work task, a meeting with the operator and the other workers who will be in the area of the mobile crane or load to review the location of the overhead power lines, and the controls that will be implemented to prevent encroachment/electrocution.
2. Tag Lines – If tag lines are used, they must be non-conductive.
3. Elevated warning devices – Erect and maintain elevated warning line, barricade, or line of signs, in view of the operator, equipped with flags or similar high-visibility markings, at 20 ft or greater from the power line (preferred) or at the minimum approach distance established in Table 5-1.

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Chapter 5: Mobile Crane Inspections and Operation

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4. Durable warning signs – Durable warning signs are installed for the duration of the job, at the operator's station and on the outside of the crane, warning that electrocution or serious bodily injury may occur unless the minimum approach distance established in Table 5-1 is maintained between the crane or the load being handled and energized power lines.
5. Deactivate the automatic reclosing feature of the circuit interrupting device – If the power line is equipped with a device that automatically reenergizes the circuit in the event of a power line contact, the automatic reclosing feature of the circuit interrupting device must be made inoperative before work begins.
6. Area boundaries – Barricades forming a perimeter at least 10 ft away from the equipment to prevent unauthorized personnel from entering the work area. In areas where obstacles prevent the barricade from being at least 10 ft away, the barricade shall be as far from the equipment as feasible.
7. Insulating lines – Insulating line hose or cover-up shall be installed by the FI&S Utilities personnel except where such devices are unavailable for the line voltages involved.
8. Non-essential worker excluded from work zone – Only personnel essential to the operation shall be permitted to be in the area of the crane and load.
9. Insulating link/device – **IF** the working load is within 24 inches of a 13.8 kV or less energized source, or 44 inches of 161 kV energized source, **THEN** an insulating link/device must be installed at a point between the end of the load line and the load.
10. Limit range device – If the mobile crane is equipped with a device that automatically limits range of movement, it must be used and set to prevent any part of the equipment, load line, or load (including rigging and lifting accessories) from breaching the minimum approach distance established.

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11. Dedicated spotters – Dedicated spotters who are in continuous contact with the operator. They shall have the sole responsibility to verify that the required distances are maintained.

The dedicated spotters must:

- Be equipped with a visual aid to assist in identifying the minimum clearance distance.
 - Be positioned to effectively gauge the clearance distance.
 - Where necessary, use equipment that enables the dedicated spotter to communicate directly with the operator.
 - Give timely information to the operator so that the required clearance distance can be maintained.
12. Copies of the approved work instructions, work packages, procedures, or equivalent document shall be on-site.
13. Grounding of crane – The mobile crane must be properly grounded based on an Electrical Engineer's evaluation.
14. Non-conductive rigging.
15. Workers other than the operator must be prohibited from touching the load line above the insulating link/device and crane.

Mobile Crane Overhead Electrical Lines Checklist

Instructions

This checklist applies to work performed mobile crane with that performs work in the vicinity of energized overhead power lines or fixed electrical conductors **and** there is a potential for the equipment to make contact with the energized source.

Refer to Procedures Y73-115, *Y-12 Hoisting and Rigging Manual*, Section 5.8, for the appropriate application and related requirements.

Header

- Enter your name in the block marked Name.
- Enter date the evaluation was initiated in the block marked Date.
- Enter the Organization/Department Name performing work in the block marked Organization.
- Enter the location of the proposed work task in the block marked Location.

Section 1 – Work In The Vicinity Of Energized Overhead Power Lines Or Fixed Electrical Conductors

- 1.1 Describe the work activity and work zone that has the potential to contact any overhead power line or exposed fixed conductor.
- 1.2 Determine the maximum reach of the mobile crane's equipment/load. If appropriate, include the distance of the load and rigging if it extends past the crane's reach.
- 1.3 Describe or draw the orientation/position of the mobile crane while performing work or attach a diagram.
- 1.4 Determine if the crane's equipment/load **can reach or operate** within 20 ft of any overhead power line/exposed fixed conductor. Review the crane's orientation/position, and the work zone (i.e., the area 360 degrees around the mobile crane based on the crane's maximum working radius).

Mark the appropriate box (Yes or No).

If the review process determines the answer is no and the mobile crane **cannot reach**, sign and date the form. Ensure controls are established so that the work task remains outside the 20 ft boundary **or** ensure application of lockout/tagout. No further actions are necessary.

If the review process determines the answer is yes and the mobile crane **can reach (but is not expected to operate)** within 20 ft of any overhead power line/exposed fixed conductor, then proceed to Section 1.5.

If the review process determines the answer is yes and the mobile crane equipment/load will operate **within** 20 ft from any overhead power lines/fixed electrical conductors, then proceed to Section 2.1.

- 1.5 Ensure the listed requirements are documented in the work instructions, work package, or procedure.
- 1.6 Evaluate the electrical hazards and select one or more controls for the work task.

Consult with the power operations outage coordinator for overhead power lines or building/facility manager for fixed electrical conductors to ensure the appropriate controls are selected.

Ensure the controls selected are documented in the work instructions, work package, or procedure. No further actions are necessary.

Mobile Crane Overhead Electrical Lines Checklist

Instructions (Continued)

Section 2 – Work Within 20 Feet of Overhead Power Lines or Fixed Electrical Conductors – De-energized or Energized Determination

- 2.1 Obtain assistance from the power operations power coordinator or building/facility manager and/or appropriate Subject Matter Expert(s) (e.g., electrical workers, Safety Department) to evaluate the overhead power lines/exposed fixed conductors in the work area.
- 2.2 Determine if the overhead power lines or exposed fixed conductors can be de-energized and lockout/tagout performed in accordance with Y73-107, *Lockout/Tagout for Personnel Protection Manual*, Y18-34-ORR-4202, *ORR Power Distribution Work Checklist Process*, or Y18-102, *Power Distribution Work Checklist*. Electrical lines greater than 480 volts shall be grounded (power lines 480 volts or less shall be evaluated for grounding) before performing work.

If Section 2.2 is yes, no further actions are necessary.

If Section 2.2 is no, go to Section 2.3.

- 2.3 Document what overhead power line(s) or exposed fixed conductor(s) cannot be de-energized and why. The power operations outage coordinator for overhead power lines **or** the building/facility manager for indoor exposed fixed conductors should complete Section 2.3.

Proceed to Section 3.1

Section 3 - Work Within 20 Feet and Outside the Limited Approach Boundary of Energized Overhead Power Lines/Exposed Fixed Conductors

- 3.1 Evaluate if the crane's equipment/load can operate or reach within one of the conditions listed on the form. Mark the appropriate box (Yes or No).

If all answers are no, go to Section 3.2.

If any answer is yes, go to Section 4.1.

- 3.2 Ensure the listed requirements are documented in the work instructions, work package, or procedure.
- 3.3 Evaluate the electrical hazards and select two or more controls for the work task.

Consult with the power operations outage coordinator for overhead power lines or building/facility manager for fixed electrical conductors to ensure the appropriate controls are selected.

Ensure the controls selected are documented in the work instructions, work package, or procedure.

- 3.4 Approvals

Work task work is within 20 ft and outside the limited approach boundary of energized overhead power lines/exposed fixed conductors. The work instructions, work package, or procedure shall be approved by the: department manager requesting the work; and department manager performing the work (i.e., for a FI&S work task) **or** construction manager (i.e., for a construction work task).

Contents of this form may be reviewed by a derivative classifier/UCNI reviewer. This form or equivalent can be used to perform the task.

Mobile Crane Overhead Electrical Lines Checklist

Instructions (Continued)

Section 4 – Work Within Limited Approach Boundary of Energized Overhead Power Lines/Exposed Fixed Conductors

Note: Operational Safety Board review and approval is required.

4.1 Ensure the listed requirements are documented in the work instructions, work package, or procedure.

4.2 Approval

- Work task is within the limited approach boundary of energized overhead power lines/exposed fixed conductors. The work instructions, work packages, or procedures shall be approved by the: department manager requesting the work; and department manager performing the work (i.e., for a FI&S work task) **or** construction manager (i.e., for a construction work task).
- The appropriate (e.g., facility, site) Operation Safety Board must review and approve the work document or package in accordance with Y15-636, *Integrated Safety Management Program*.

OSB review and approval is not required, if the mobile crane work involves only work near insulated energized overhead wiring (240 volts or less) for public address systems, fire alarm systems, security systems, pilot wiring, or other equivalent systems not feasible to de-energize.

Contents of this form may be reviewed by a derivative classifier/UCNI reviewer. This form or equivalent can be used to perform the task.

Mobile Crane Overhead Electrical Lines Checklist

Name: _____ Date: _____
Organization: _____ Location: _____

Section 1 - Work In The Vicinity Of Energized Overhead Power Lines Or Fixed Electrical Conductors

1.1 Briefly describe the crane work that has the potential to contact any overhead power line/exposed fixed conductor and define the active work zone.

1.2 What is the maximum reach of the mobile crane equipment/load?

1.3 Describe or draw the orientation/position of the mobile crane while performing the work, or attach a diagram:

1.4 Can the crane equipment/load **reach or operate** within 20 ft of the overhead power lines/exposed fixed conductors? YES NO

If the review process determines the answer is no and the mobile crane **cannot reach**, ensure controls are established so that the work task remains outside the 20 ft boundary **or** ensure application of lockout/tagout. Sign and date below. No further actions are necessary.

If the review process determines the answer is yes and the mobile crane **can reach (but is not expected to operate)** within 20 ft of any overhead power line/exposed fixed conductor, then proceed to Section 1.5.

If the review process determines the answer is yes and the mobile crane equipment/load **will operate within** 20 ft from any overhead power lines/fixed electrical conductors, then proceed to Section 2.1.

Signature: _____ Date: _____

Contents of this form may be reviewed by a derivative classifier/UCNI reviewer. This form or equivalent can be used to perform the task.

Mobile Crane Overhead Electrical Lines Checklist

1.5 Ensure the following actions are documented in the work instructions, work packages, or procedures.

- Pre-Job Meeting to review the location of the overhead power lines/exposed fixed conductors and controls to prevent encroachment/electrocution.
- If tag lines are used, ensure they are non-conductive.
- Elevated warning devices are erected and maintained in view of the operator.
- Durable warning signs are installed for the duration of the job, at the operator's station and on the outside of the crane.

1.6 Evaluate the electrical hazards and select one or more controls for the work task.

YES

NO

Proximity alarm

Dedicated spotters

Encroachment warning device

Limit range device

Insulating link/device

Other: _____

Contents of this form may be reviewed by a derivative classifier/UCNI reviewer. This form or equivalent can be used to perform the task.

Mobile Crane Overhead Electrical Lines Checklist

Section 2 – Work Within 20 Feet of Overhead Power Lines or Fixed Electrical Conductors – De-energized or Energized Determination

2.1 List the services and nominal operating voltage levels of overhead conductors in this work area.

- < 600 volts or less
- 13.8 kV
- 161 kV

YES NO

2.2 Will all overhead power lines/exposed fixed conductors be de-energized, and lockout/tagout performed in accordance with Y73-107, *Lockout/Tagout for Personnel Protection Manual*, Y18-34-ORR-4202, *ORR Power Distribution Work Checklist Process*, or Y18-102, *Power Distribution Work Checklist*, and electrical lines greater than 480 volts are grounded (power lines 480 volts or less shall be evaluated for grounding) before performing work?

If yes, no further actions are necessary.

If no, go to Section 2.3

2.3 Document what overhead power lines/exposed fixed conductors cannot be de-energized and why.
Then proceed to Section 3.1

Mobile Crane Overhead Electrical Lines Checklist

Section 3 – Work Within 20 Feet and Outside the Limited Approach Boundary of Energized Overhead Power Lines/Exposed Fixed Conductors

- | | YES | NO |
|---|--------------------------|--------------------------|
| 3.1 Can the equipment or load operate or reach within: | | |
| a. Overhead Power Lines | | |
| - 10 ft or less from any energized < 600 V or 13.8 kV? | <input type="checkbox"/> | <input type="checkbox"/> |
| - 15 ft or less from any energized 161 kV? | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Exposed Fixed Conductors | | |
| - 4 ft or less from any energized < 600 V? | <input type="checkbox"/> | <input type="checkbox"/> |
| - 5 ft or less from any energized 13.8 kV? | <input type="checkbox"/> | <input type="checkbox"/> |
| - 15 ft or less from any energized 161 kV? | <input type="checkbox"/> | <input type="checkbox"/> |

Ensure the crane's equipment maximum reach and extended load, if applicable, is taken into consideration.

If **all** answers are no, go to Section 3.2.

If any answer is yes, go to Section 4.1.

- 3.2** Ensure the following actions are documented in the work instructions, work packages, or procedures.
- Pre-job meeting to review the location of the overhead power lines/exposed fixed conductors and controls to prevent encroachment/electrocution.
 - If tag lines are used, ensure they are non-conductive.
 - Elevated warning devices are erected and maintained in view of the operator.
 - Durable warning signs are installed for the duration of the job, at the operator's station and on the outside of the crane.

- | | YES | NO |
|---|--------------------------|--------------------------|
| 3.3 Evaluate the electrical hazards and select two or more controls for the work task. | | |
| Dedicated spotters | <input type="checkbox"/> | <input type="checkbox"/> |
| Physical boundaries | <input type="checkbox"/> | <input type="checkbox"/> |
| Measurement of the lines and equipment clearance | <input type="checkbox"/> | <input type="checkbox"/> |
| Power line visibility warning | <input type="checkbox"/> | <input type="checkbox"/> |
| Proximity alarm | <input type="checkbox"/> | <input type="checkbox"/> |
| Encroachment warning device | <input type="checkbox"/> | <input type="checkbox"/> |
| Limit range device | <input type="checkbox"/> | <input type="checkbox"/> |
| Insulating link/device | <input type="checkbox"/> | <input type="checkbox"/> |
| Other: _____ | <input type="checkbox"/> | <input type="checkbox"/> |

- 3.4** Approval
- Work task work is within 20 ft and outside the limited approach boundary of energized overhead power lines/exposed fixed conductors. The work instructions, work package, or procedure shall be approved by the: department manager requesting the lift; and department manager performing the work (i.e., for a FI&S work task) **or** construction manager (i.e., for a construction work task) .

Contents of this form may be reviewed by a derivative classifier/UCNI reviewer. This form or equivalent can be used to perform the task.

Mobile Crane Overhead Electrical Lines Checklist

Section 4 – Work Within Limited Approach Boundary of Energized Overhead Power Lines/Exposed Fixed Conductors

4.1 Ensure the following requirements are documented in the work instructions, work packages, or procedures:

- Pre-job meeting to review the location of the overhead power lines/exposed fixed conductors, and controls to prevent encroachment/electrocution.
- If tag lines are used, ensure they are non-conductive.
- Elevated warning devices.
- Durable warning signs.
- Deactivate the automatic reclosing feature of the circuit interrupting device.
- Area boundaries.
- Insulating lines.
- Non-essential worker excluded from work zone.
- Insulating link/device.
- Limit range device, as applicable.
- Dedicated spotters.
- Grounding of crane.
- Non-conductive rigging.
- Workers prohibited from touching load line above insulated link/device.

Other: _____
See Procedures Y73-115, Y-12 *Hoisting and Rigging Manual*, for additional information.

4.2 Approval

Work task is within the limited approach boundary of the energized overhead power lines/exposed fixed conductors. The work instructions, work package, or procedure shall be approved by the: department manager requesting the work; and the department manager performing the work (i.e., for a FI&S work task) **or** construction manager (i.e., for a construction work task).

The appropriate (e.g., facility, site) Operation Safety Board must review and approve the work document or package in accordance with Y15-636, *Integrated Safety Management Program*.

OSB review and approval is not required if the mobile crane work involves only work near insulated energized overhead wiring (240 volts or less) for public address systems, fire alarm systems, security systems, pilot wiring, or other equivalent systems not feasible to de-energize.

Subject: Electrical Safety Manual
Chapter 6: Unqualified Personnel Exposed to Electrical Hazards

Effective Date: 06/06/11

1.0 SCOPE

This chapter covers the actions required for unqualified personnel working in areas of exposed energized components, embedded cables, or overhead lines. This chapter does not apply to live parts that operate at less than 50 volts to ground if there will be no increased exposure to electrical burns or to explosion due to electrical arcs.

2.0 TERMS RELATING TO WORKING NEAR EXPOSED ELECTRICAL HAZARDS

Arc Flash Hazard Analysis – A study investigating a worker’s potential exposure to arc-flash energy, conducted for the purpose of injury prevention and the determination of safe work practices, Arc Flash Protection Boundary, and the appropriate levels of PPE.

Boundary, Arc Flash Protection – When an arc flash hazard exists, an approach limit at a distance from a prospective arc source within which a person could receive a second degree burn if an electrical arc flash were to occur.

Boundary, Limited Approach – An approach limit at a distance from an exposed energized electrical conductor or circuit part within which a shock hazard exists.

Boundary, Restricted Approach – An approach limit at a distance from an exposed energized electrical conductor or circuit part within which there is an increased risk of shock for personnel working in close proximity to the energized electrical conductor or circuit part.

Electrical Safe Work Condition – A state in which the conductor or circuit part to be worked on or near has been disconnected from energized parts, locked and tagged in accordance with Y73-107, *Lockout/Tagout for Personnel Protection Manual* or Y18-102, *Power Distribution Work Permit*, tested to ensure the absence of voltage, and grounded if determined necessary.

Exposed (as applied to energized electrical conductors and circuit parts) – Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to electrical conductors or circuit parts that are not suitably guarded, isolated, or insulated.

Guarded – Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger.

Insulated – Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current.

Isolated – Not readily accessible to persons, unless special means for access are used.

3.0 GENERAL

Unqualified persons shall not be permitted to enter “Qualified Only” areas, unless the electrical conductors and equipment involved are in an electrically safe work condition, or unless they are escorted by a Qualified Person. See section on “600 Volts Nominal, or Less” and “Over 600 Volts Nominal” in Chapter 3, *Electrical Requirements for Facilities/Buildings*, for determination of “Qualified Only” areas.

Subject: Electrical Safety Manual
Chapter 6: Unqualified Personnel Exposed to Electrical Hazards

Effective Date: 06/06/11

4.0 GENERAL WORK PLANNING

Maintenance Planner or Supervisor/Construction Superintendent or Craft Electrical Supervisor/Building or Facility Manager/Power Operations Outage Coordinator

1. Perform a walk-down to determine location of overhead lines/fixed conductors in relationship to the work that will be performed, voltage of lines, and actions to be taken to provide electrical safe work conditions.
 - a. Determine location of all lines in relationship to the work location.
 - b. Determine the voltage of the lines/conductors in the work area.
 - c. Refer to Table 1, *Unqualified Personnel* to determine the Limited Approach Boundary associated with the work area.

Building or Facility Manager/Power Operations Outage Coordinator

2. Provide the Maintenance Planner, Maintenance Supervisor/Construction Superintendent, or Craft Electrical with the electrical hazards and recommended controls to ensure safe electrical work conditions.

Maintenance Planner and Supervisor/Construction Superintendent or Craft Electrical Supervisor

3. Ensure work location is such that approach to energized electrical lines or conductors is possible, near the Limited Approach Boundary of Table 1, *Unqualified Personnel*, the lines shall be de-energized in accordance with Y73-107, *Lockout/Tagout for Personnel Protection Manual*, Y18-34-ORR-4202, *ORR Power Distribution Work Permit Process*, or Y18-102, *Power Distribution Work Permit*. Electrical lines greater than 480 volts shall be grounded before performing work. Power lines 480 volts or less shall be evaluated for grounding.
4. Ensure energized electrical lines or conductors to which an employee might be exposed shall be put into an electrically safe work condition before an employee works near the Limited Approach Boundary of those lines unless the employer can demonstrate that de-energizing introduces additional or increased hazards or is infeasible in a de-energized state due to equipment design or operational limitations. Energized electrical conductors and circuit parts that operate at less than 50 volts to ground shall not be required to be de-energized where the capacity of the source and any overcurrent protection between the energy source and the worker are considered and it is determined that there will be no increased exposure to electrical burns or to explosion due to electric arcs.
 - Examples of increased or additional hazards include, but are not limited to, interruption of life support equipment, deactivation of emergency alarm systems, and shutdown of hazardous location ventilation equipment.
 - Examples of infeasibility include work near circuits that form an integral part of a continuous process that would otherwise need to be completely shut down.

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Chapter 6: Unqualified Personnel Exposed to Electrical Hazards

Effective Date: 06/06/11

4.0 GENERAL WORK PLANNING (cont)

5. **IF** electrical lines or conductors cannot be de-energized **THEN** a hazard analysis shall be completed in accordance with Y73-045, *Job Hazard Analysis Manual*. The hazard analysis shall establish the controls to work outside of 20 feet from the energized lines or conductors; to work inside the 20 foot boundary, but outside the limited approach boundary; or to work inside the Limited Approach Boundary.
6. Ensure that unqualified personnel working near the Limited Approach Boundary follow all established safety related work practices, as established in the AJHA, appropriate for the working conditions and voltage level of the associated electrical system or equipment.
7. Ensure unqualified personnel are escorted by a qualified person if they must work within the Limited Approach Boundary.
8. Ensure unqualified personnel do not enter the Restricted Approach boundary or the Arc Flash Protection Boundary.

*******WARNING*******

In some cases, the Arc Flash Protection Boundary might be a greater distance than the Limited Approach Boundary (see Table 1, Unqualified Personnel). Unqualified personnel are not permitted to enter the Arc Flash Protection Boundary.

Table 1 Unqualified Personnel

Nominal System Voltage Range, Phase to Phase	Limited Approach Boundary		Flash Protection Boundary	Restricted Approach Boundary
	Exposed Movable Conductor	Exposed Fixed Conductor		
0 to 50 volts	Not specified	Not specified	Not specified	Not specified
51 to 300 volts	10 ft. 0 in.	3 ft. 6 in.	4 ft. 0 in. or Calculate	Avoid contact
301 to 600 volts	10 ft. 0 in.	3 ft. 6 in.	4 ft. 0 in. or Calculate	1 ft. 0 in.
601 to 750 volts	10 ft. 0 in.	3 ft. 6 in.	Calculate	1 ft. 0 in.
751 to 999 volts	10 ft. 0 in.	5 ft. 0 in.	Calculate	2 ft. 2 in.
1 kV to 15 kV	10 ft. 0 in.	5 ft. 0 in.	Calculate	2 ft. 2 in.
161 kV	14 ft. 0 in.	14 ft. 0 in.	Calculate	4 ft. 3 in.

Subject: Electrical Safety Manual
Chapter 6: Unqualified Personnel Exposed to Electrical Hazards

Effective Date: 06/06/11

4.1 Personnel Working near Overhead Lines/Exposed Fixed Conductors

4.1.1 When Work is Performed Outside of 20 Feet from Lines or Fixed Conductors.

NOTE 1: For requirements for unqualified personnel working near overhead lines or exposed fixed conductors see Section 4.1.

NOTE 2: For requirements for vehicular or mechanical equipment (High Profile Equipment) operating near overhead lines or exposed fixed conductors see Section 4.2.

NOTE 3: For requirements for operating Mobile Cranes near overhead lines or exposed fixed conductors see Y73-115 B&W Y12 *Hoisting and Rigging Manual*, Chapter 5, *Mobile Crane Inspections and Operations*.

Maintenance Planner or Maintenance Supervisor/Construction Superintendent or Craft Electrical Supervisor

1. De-energize lines or conductors per Y73-107, *Lockout/Tagout for Personnel Protection Manual*, Y18-34-ORR-4202, *ORR Power Distribution Work Permit Process*, or Y18-102, *Power Distribution Work Permit*, unless de-energizing is not possible per Section 4.0.
 - a. **IF** de-energized electrical lines are rated at greater than 480 volts **THEN** ground before performing work.
 - b. **IF** Power lines are 480 volts or less **THEN** evaluate for grounding.

Maintenance Planner or Supervisor /Construction Superintendent or Craft Electrical Supervisor/Building or Facility Manager/Power Operations Outage Coordinator

2. **IF** lines or conductors are not de-energized **THEN** perform a walk-down to:
 - a. Review the location of the overhead power lines/exposed fixed conductors.
 - b. Determine appropriate controls to prevent encroachment of the 20 foot boundary for overhead lines and fixed conductors for unqualified personnel and conductive objects.

Maintenance Planner/Construction Superintendent or Craft Electrical Supervisor

3. Document the controls in the work instructions, work package, or procedure.

4.1.2 When the Work is Performed within 20 feet Outside of the Limited Approach Boundary

Maintenance Planner/Construction Superintendent or Craft Electrical Supervisor

1. De-energize lines or conductors per Y73-107, *Lockout/Tagout for Personnel Protection Manual*, Y18-34-ORR-4202, *ORR Power Distribution Work Permit Process*, or Y18-102, *Power Distribution Work Permit*, unless de-energizing is not possible per Section 4.0.
 - a. **IF** de-energized electrical lines are greater than 480 volts **THEN** ground before performing work.

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Effective Date: 06/06/11

4.1.2 When the Work is performed within 20 feet, Outside of the Limited Approach Boundary (cont)

- b. **IF** power lines are 480 volts or less **THEN** evaluate for grounding.
2. **IF** lines are not de-energized, **THEN** perform a hazard analysis in accordance with Y73-045, *Job Hazard Analysis Manual*.

Maintenance Planner /Construction Superintendent or Craft Electrical Supervisor/Building or Facility Manager/Power Operations Outage Coordinator

- a. Perform a walk-down to review the location of the overhead power lines/exposed fixed conductors and establish appropriate controls to prevent encroachment/electrocution.
 - Determine the voltage of the lines/conductors in the work area.
 - Refer to Table 1, *Unqualified Personnel* to determine the Limited Approach Boundary associated with the work area.
3. Determine the Arc Flash Protection Boundary for the work area.
 - a. **IF** less than 600 volts **THEN** the Arc Flash Protection Boundary is 4 feet or calculated by an Electrical Engineer.
 - b. **IF** greater than 600 volts **THEN** have an electrical engineer calculate the Arc Flash Protection Boundary.
4. Establish one or more of the following controls to ensure personnel and conductive materials, tools, or equipment do not enter the Limited Approach Boundary and that personnel do not enter the Arc Flash Protection Boundary.
 - Dedicated spotters – Personnel who shall have the sole responsibility to verify that the required distances are maintained.
 - Physical boundaries – Barriers that maintain the required distance.
 - Power line visibility warning – Devices such as ribbons, balls, etc., attached to the power lines to improve visibility.
 - Elevated warning devices – Erect and maintain elevated warning line, barricade, or line of signs, in view of the operator, equipped with flags or similar high-visibility markings.

Maintenance Planner /Construction Superintendent or Craft Electrical Supervisor

5. Document controls/barriers in the work instructions, work package, or procedure.

Service Supervisor/Construction Superintendent or Craft Electrical Supervisor

6. Perform a pre-job briefing covering the controls and barriers, and advising the unqualified person(s) of the electrical hazard and warning unqualified persons to stay outside of the Limited Approach Boundary and Arc Flash Protection Boundary.

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Chapter 6: Unqualified Personnel Exposed to Electrical Hazards

4.1.3 When the Work is Performed Inside the Limited Approach Boundary but Outside the Arc Flash Protection Boundary and the Lines/Conductors are not De-Energized

NOTE: Department Manager and OSB review and approval is required for work inside Limited Approach Boundary

Maintenance Planner/Construction Superintendent or Craft Electrical Supervisor

1. Perform a hazard analysis in accordance with Y73-045, *Job Hazard Analysis Manual*.

Maintenance Planner /Construction Superintendent or Craft Electrical Supervisor/Building Manager, Facility Manager or Power Operations Outage Coordinator

2. Perform a walk-down to review the location of the overhead power lines/exposed fixed conductors and determine the appropriate controls to prevent encroachment/electrocution.
 - a. Determine the voltage of the lines/conductors in the work area.
 - b. Determine the Limited Approach Boundary associated with the work area refer to Table 1, *Unqualified Personnel*.
 - c. Determine the Arc Flash Protection Boundary for the work area.
 - **IF** less than 600 volts **THEN** the Arc Flash Protection Boundary is 4 feet or calculated.
 - **IF** greater than 600 volts **THEN** calculate the Arc Flash Protection Boundary.

Maintenance Supervisor/Construction Superintendent or Craft Electrical Supervisor

3. Assign a qualified electrician to continuously escort the unqualified employee when working inside the Limited Approach Boundary.

NOTE: The Maintenance Supervisor/Construction Superintendent or Craft Electrical Supervisor may assign the qualified electrician as the spotter if determined both tasks can be performed together.

4. Assign a dedicated spotter.
 - a. The dedicated spotter must:
 - Be equipped with a visual aid to assist in identifying the minimum clearance distance.
 - Be positioned to effectively gauge the clearance distance.
 - Where necessary, use equipment that enables the dedicated spotter to communicate directly with the operator.
 - Give timely information to the operator so that the required clearance distance can be maintained

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Chapter 6: Unqualified Personnel Exposed to Electrical Hazards

4.1.3 When the Work is Performed Inside the Limited Approach Boundary but Outside the Arc Flash Protection Boundary and the Lines/Conductors are not De-Energized (cont)

Maintenance Planner or Supervisor /Construction Superintendent or Craft Electrical Supervisor

5. Choice one or more of the following controls to establish that personnel and conductive materials, tools, or equipment do not enter the Restricted Approach Boundary and personnel do not enter the Arc Flash Protection Boundary.
 - Physical boundaries – Barriers that maintain the required distance.
 - Power line visibility warning – Devices such as ribbons, balls, etc., attached to the power lines to improve visibility.
 - Elevated warning devices – Erect and maintain elevated warning line, barricade, or line of signs, equipped with flags or similar high-visibility markings.

Maintenance Planner /Construction Superintendent or Craft Electrical Supervisor

6. Document controls and barriers in the work instructions, work package, or procedure.

Department Manager Requesting Work and Department Manager Performing the work/Construction Manager

7. Review and approve or reject the work instructions, work package, or procedure for the proposed work.

NOTE: OSB review and approval is not required if the work involves only work near insulated energized overhead wiring (240 volts or less) for public address systems, fire alarm systems, security systems, pilot wiring, or other equivalent systems.

Facility or Site Operation Safety Board (OSB)

8. Review and approve the work document or package in accordance with Y15-636, Integrated Safety Management Program.
9. The OSB review must include an evaluation of:
 - The determination that it was not feasible to de-energize the respective overhead power lines/fixed electrical conductors.
 - Whether the proposed controls are appropriate.

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4.1.3 When the Work is Performed inside the Limited Approach Boundary but Outside the Arc Flash Protection Boundary and the Lines/Conductors are not De-Energized (cont)

Service Supervisor/ Construction Superintendent or Craft Electrical Supervisor

10. Perform a pre-job briefing advising the unqualified person(s) of the electrical hazards and controls, and warning them:

- Not to enter and to ensure conductive materials, tools, or equipment do not enter the Restricted Approach Boundary.
- Not to enter the Arc Flash Protection Boundary.

4.2 Vehicular and Mechanical Equipment (High Profile Equipment) near Overhead Lines/Exposed Fixed Conductors

4.2.1 When Work is performed outside 20 feet from lines or Fixed Conductors.

Maintenance Planner or Supervisor/Construction Superintendent or Craft Electrical Supervisor

1. De-energize lines or conductors per with Y73-107, *Lockout/Tagout for Personnel Protection Manual*, Y18-34-ORR-4202, *ORR Power Distribution Work Permit Process*, or Y18-102, *Power Distribution Work Permit*, unless de-energizing is not possible per section 4.0. De-energized electrical lines greater than 480 volts shall be grounded before performing work. Power lines 480 volts or less shall be evaluated for grounding.

Maintenance Planner or Supervisor /Construction Superintendent or Craft Electrical Supervisor/Building or Facility Manager/Power Operations Outage Coordinator

2. **IF** lines or conductors are not de-energized **THEN** perform a walk-down to review the location of the overhead power lines/exposed fixed conductors and determine appropriate controls to prevent encroachment of the 20 foot boundary for overhead lines and fixed conductors for unqualified personnel and conductive objects.

Maintenance Planner/Construction Superintendent or Craft Electrical Supervisor

3. Document controls in the work instructions, work package, or procedure.

4.2.2 When the Work is Performed Within 20 feet, Outside of the Limited Approach Boundary and Lines/Conductors are not De-Energized.

Maintenance Planner or Supervisor/Construction Superintendent or Craft Electrical Supervisor

1. Perform a Job Hazard Analysis per Y73-045, *Job Hazard Analysis Manual*.
2. Identify the reason(s) overhead lines cannot be de-energized, grounded and locked in the work instructions, work package, or procedure.

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4.2.2 When the Work is Performed Within 20 feet, Outside of the Limited Approach Boundary and Lines/Conductors are not De-Energized (cont)

Maintenance Planner or Supervisor /Construction Superintendent or Craft Electrical Supervisor/Building or Facility Manager/Power Operations Outage Coordinator

3. Perform a walk-down to review the location of the overhead power lines/exposed fixed conductors and establish appropriate controls to prevent encroachment/electrocution. The walk-down should include the power operations outage coordinator and other needed Subject Matter Experts (SME's).
 - a. Determine the voltage of the lines/conductors in the work area.
 - b. Refer to Table 1, *Unqualified Personnel* to determine the Limited Approach Boundary associated with the work area.
4. Establish two or more of the following controls to ensure high profile equipment does not enter the Limited Approach Boundary.
 - Dedicated spotters who are in continuous contact with the operator. They shall have the sole responsibility to verify that the required distances are maintained. The dedicated spotters must:
 - Be equipped with a visual aid (i.e., flagging, use of an existing object, paint a line on the ground, etc.) to assist in identifying the minimum clearance distance.
 - Be positioned to effectively gauge the clearance distance.
 - Where necessary, use equipment that enables the dedicated spotter to communicate directly with the operator.
 - Give timely information to the operator so that the required clearance distance can be maintained.
 - Physical boundaries – Barriers that maintain the required distance.
 - Measurement of the lines and equipment clearance – Utilizing direct and remote measurement techniques to determine the actual clearance distance.
 - Power line visibility warning – Devices such as ribbons, balls, etc., attached to the power lines to improve visibility.
 - Elevated warning devices – Erect and maintained elevated warning line, barricade, or line of signs, in view of the operator, equipped with flags or similar high-visibility markings, at the Limited Approach Boundary.
 - Proximity alarm – Proximity alarm set to give the operator sufficient warning to prevent encroachment.
 - Encroachment warning device – A device that automatically warns the operator when to stop movement, such as a range control warning device. The device must be set to give the operator sufficient warning to prevent encroachment.

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4.2.2 When the Work is Performed Within 20 feet, Outside of the Limited Approach Boundary and Lines/Conductors are not De-Energized (cont)

5. Document controls/barriers in the work instructions, work package, or procedure.

Department Manager Requesting Work and Department Manager Performing the work/Construction Manager

6. Review and approve or reject the work instructions, work package, or procedure.

Maintenance Supervisor /Construction Superintendent or Craft Electrical Supervisor

7. Perform a pre-job briefing advising the unqualified person(s) of the electrical hazards and controls, and warning them that they do not allow the high profile equipment to enter the Limited Approach Boundary.

4.2.3 When the Work is Performed Inside the Limited Approach Boundary and the Lines/Conductors are not De-Energized.

NOTE: Department Manager and OSB review and approval is required for work inside Limited Approach Boundary

Maintenance Planner or Supervisor/Construction Superintendent or Craft Electrical Supervisor

1. Perform a Job Hazard Analysis per Y73-045, Job Hazard Analysis Manual.
2. Document the reason(s) overhead lines cannot be de-energized, grounded and locked out in the work instructions, work package, or procedure.

Maintenance Planner or Supervisor /Construction Superintendent or Craft Electrical Supervisor/Building or Facility Manager/Power Operations Outage Coordinator

3. A walk-down should be conducted to review the location of the overhead power lines/exposed fixed conductors and appropriate controls to prevent encroachment/electrocution. The walk-down should include the power operations outage coordinator and other needed Subject Matter Experts (SME's).
 - Determine the voltage of the lines/conductors in the work area.
 - Refer to Table 1, *Unqualified Personnel* to determine the Limited Approach Boundary associated with the work area.

Maintenance Supervisor /Construction Superintendent or Craft Electrical Supervisor

4. **IF** the power line is equipped with a device that automatically reenergizes the circuit in the event of a power line contact, **THEN** the automatic reclosing feature of the circuit interrupting device shall be made inoperative.
5. Exclude non-essential worker from work zone – only personnel essential to the operation shall be permitted to be in the area of the equipment.

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4.2.3 When the Work is Performed Inside the Limited Approach Boundary and the Lines/Conductors are not De-Energized (cont)

6. Assign a dedicated spotter. The dedicated spotter must:

- Be equipped with a visual aid (i.e., flagging, use of an existing object, paint a line on the ground, etc.) to assist in identifying the minimum clearance distance.
 - Be positioned to effectively gauge the clearance distance.
 - Where necessary, use equipment that enables the dedicated spotter to communicate directly with the operator.
 - Give timely information to the operator so that the required clearance distance can be maintained
7. Utilize elevated warning devices – Erect and maintained elevated warning line, barricade, or line of signs, in view of the operator, equipped with flags or similar high-visibility markings.
8. Utilize area boundaries – Barricades forming a perimeter at least 10 ft away from the equipment to prevent unauthorized personnel from entering the work area. In areas where obstacles prevent the barricade from being at least 10 ft away, the barricade shall be as far from the equipment as feasible.

Maintenance Planner/Construction Superintendent or Craft Electrical Supervisor

9. Document controls and barriers in the work instructions, work package, or procedure.

Department Manager Requesting Work and Department Manager Performing the work/Construction Manager

10. Review and approve or reject the work instructions, work package, or procedure.

NOTE: OSB review and approval is not required if the mobile equipment work involves only work near insulated energized overhead wiring (240 volts or less) for public address systems, fire alarm systems, security systems, pilot wiring, or other equivalent systems.

Facility or Site Operation Safety Board (OSB)

11. Review and approve the work document or package in accordance with Y15-636, Integrated Safety Management Program.

12. The OSB review must include an evaluation of:

- **The determination that it was not feasible to de-energize the respective overhead power lines/fixed electrical conductors.**
- Whether the proposed controls are appropriate.

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4.2.3 When the Work is Performed Inside the Limited Approach Boundary and the Lines/Conductors are not De-Energized (cont)

Service Supervisor/ Construction Superintendent or Craft Electrical Supervisor

13. Perform a *pre-job briefing* advising the unqualified person(s) of the electrical hazards and controls, and warning them to not allow high profile equipment to enter the Restricted Approach Boundary and not to enter the Arc Flash Protection Boundary.

5.0 WORK ADJACENT TO UNDERGROUND OR EMBEDDED ELECTRICAL CIRCUITS

An excavation/penetration permit shall be obtained in accordance with Y73-378, *Conduct of Excavation/Penetration Work*, whenever cutting, drilling, or jack-hammering to identify the location of any underground or embedded electrical circuits. The work activities with the potential for contact shall be analyzed for the appropriate hazards in accordance with Y73-045, *Job Hazard Analysis Manual*, and the identified controls are incorporated into work instructions, work package, or procedure.