

# MODULE 2

## RECOGNIZING ELECTRICAL RISK FACTORS

### Objectives

At the end of this module, participants will be able to:

- ⚡ Define electrical risk factors.
- ⚡ List and describe electrical risk factors that may contribute to workplace injuries.
- ⚡ List the most important electrical risk factors to look for in their workplaces.
- ⚡ Identify the different methods for identifying electrical hazards in the workplace.
- ⚡ Identify the causes of arc blast and the risk factors that could contribute to it.
- ⚡ Presented with a problem, describe how to determine the risk factors, then list the risk factors.

### Time

75 minutes: 10:30 to 11:45 AM

Followed by a 60-minute lunch: 11:45 AM-12:45 PM

### Agenda

1. Electrical Risk Factors—Discussion (20 minutes)
2. Process for Identifying Hazards—Presentation and Discussion (20 minutes)
3. The Warning Signs of Hazards—Activity (10 minutes)
4. The Dangers of Arc Flash and Arc Blast—Presentation and Video (10 minutes)
5. Case Studies—Activity (10 minutes)
6. Planning for Your Small Business—Activity (5 minutes)

## RECOMMENDED PROCESS

### 1. Electrical Risk Factors—Discussion (20 minutes)

Cues	Content
PPT 2-1	<ul style="list-style-type: none"><li>■ You will be covering Pages 1 through 6 in this segment. Allocate time as follows:<ul style="list-style-type: none"><li>– 5 minutes on Page 1.</li><li>– 5 minutes on Page 2.</li><li>– 10 minutes on Pages 3 through 6, spending approximately the same amount of time on each page.</li></ul></li><li>■ Show PPT 2-1 as you refer participants to Page 1 in Module 2 of their Participant Guides. Introduce the module with the following points.<ul style="list-style-type: none"><li>– Now that we've discussed the basics of electricity, we can begin learning how to recognize, evaluate and control electrical hazards.</li><li>– There are three components of an effective system for controlling and preventing electrical injuries.</li><li>– These components are the backbone of all safety and health management systems.</li></ul></li></ul>
PPT 2-2	<ul style="list-style-type: none"><li>■ Show PPT 2-2 as you make the following points.<ul style="list-style-type: none"><li>– The first component is to <u>recognize</u> the hazard. You need to be able to identify where the potential hazards are in your organization. In this module, Module 2, you will learn how to recognize electrical hazards.</li><li>– The second component is to <u>evaluate</u> the hazard. Once you have identified the hazards in your organization, you need to assess how serious they are and how much of a threat they pose to your organization. You will learn how to evaluate electrical hazards in Module 3.</li></ul></li></ul>

<p>PPT 2-3 and PPT 2-4</p>	<ul style="list-style-type: none"> <li>– The third component is to <u>control</u> the hazard. The best way to create a safe work environment is to control hazards. You will learn how to do this in Module 4.</li> </ul> <ul style="list-style-type: none"> <li>■ Show PPT 2-3 and PPT 2-4 to review the objectives of Module 2.</li> <li>■ Refer participants to Page 2. Tell them that if they are going to be identifying electrical risk factors, they need to know what a risk factor is.</li> </ul>
<p><b>Question:</b></p> <p>PPT 2-5</p>	<ul style="list-style-type: none"> <li>■ Ask participants: What is an electrical risk factor?</li> <li>■ Get a few responses from participants, then show PPT 2-5, which is the definition.</li> <li>■ Point out that, in this class, the term “electrical risk factor” means the same thing as “electrical hazard”.</li> </ul>
<p>PPT 2-6</p>	<ul style="list-style-type: none"> <li>■ Refer participants to the remainder of Page 2. Show PPT 2-6 as you point out that when they work to recognize hazards in their organizations, there are four categories of places they will look: environment, equipment, work practices, and individual.</li> </ul>
<p>PPT 2-7</p>	<ul style="list-style-type: none"> <li>■ Show PPT 2-7, and briefly explain environmental risk factors.</li> <li>■ Refer participants to Page 3. Spend about 2 minutes covering this page by doing the following: <ul style="list-style-type: none"> <li>– Address the seven environmental factors on this page in a general way. Avoid discussing each one point-by-point.</li> <li>– Ask participants to identify some environmental risk factors in their workplaces.</li> <li>– Encourage participants to write their responses in the space provided at the bottom of Page 3.</li> </ul> </li> </ul>
<p>PPT 2-8</p>	<ul style="list-style-type: none"> <li>■ Show PPT 2-8, and briefly explain equipment risk factors.</li> <li>■ Refer participants to Page 4. Spend about 2 minutes covering this page by doing the following:</li> </ul>

## PPT 2-9

- Address the six equipment risk factors on this page in a general way. Avoid discussing them point-by-point.
- Ask participants to identify some risk factors relating to equipment in their workplaces.
- Encourage participants to write their responses in the space provided at the bottom of Page 4.

■ Show PPT 2-9, and briefly explain risk factors relating to work practices.

■ Refer participants to Page 5. Spend about 2 minutes covering this page by doing the following:

- Address the eight work practices risk factors in a general way. Avoid discussing each one point-by-point.
- Ask participants to identify some risk factors relating to work practices at their organizations.
- Encourage participants to write their responses in the space provided at the bottom of Page 5.

## PPT 2-10

■ Show PPT 2-10, and briefly explain individual risk factors.

■ Refer participants to Page 6. Spend about 2 minutes covering this page by doing the following:

- Address the seven risk factors relating to the individual in a general way. Avoid discussing them point-by-point.
- Ask participants to identify some risk factors relating to the individual in their workplaces.
- Encourage participants to write their responses in the space provided at the bottom of Page 6.

■ Address participant questions.

## 2. Process for Identifying Hazards—Presentation and Discussion (20 minutes)

Cues	Content
PPT 2-11, animated	<ul style="list-style-type: none"> <li>■ You will be covering Pages 7 through 16 in this segment. Allocate time as follows:               <ul style="list-style-type: none"> <li>– Allow about 5 minutes each for Page 7 and Page 8.</li> <li>– Allow about 10 minutes for Pages 9 through 16.</li> </ul> </li> <li>■ Refer participants to Page 7. Make the following points.               <ul style="list-style-type: none"> <li>– Once you know what the electrical risk factors (or hazards) are, it is important to have some consistent methods for identifying them.</li> <li>– Chances are your organization already uses some hazard recognition tools.</li> <li>– As we review the items on this page, check the appropriate box to indicate whether the activity is something your organization does.</li> </ul> </li> <li>■ Use PPT 2-11 to review the items on Page 7. After you've reviewed all items, on the page, lead a short discussion by doing one or both of the following.               <ul style="list-style-type: none"> <li>– Ask participants to raise their hands if their organization uses any of the tools on this page.</li> <li>– Ask participants to discuss how these tools help their organization recognize hazards.</li> </ul> </li> </ul>
Advance PPT 2-11	<ul style="list-style-type: none"> <li>■ Advance PPT 2-11 as you tell participants that the items toward the top of the list on Page 7 are more proactive.</li> <li>■ This means that they tend to get people to anticipate and correct potential hazards before they actually occur.</li> </ul>

Advance PPT 2-11

- Advance PPT 2-11 as you tell participants that the items toward the bottom of the list on Page 7 are more reactive.
- This means that they show where the hazards already are.
- Emphasize that reactive isn't necessarily bad, especially if they help to identify hazards and correct them in the future.
- Refer participants to Page 8.

**Question:**

- Ask participants: Who works in an organization that conducts tailgate meetings or job briefings?

**Question:**

- Ask participants: What happens in those meetings?
- Get some responses, then point out that Page 8 makes a good checklist of things to cover in a tailgate or a job briefing meeting.
- Review the list and get some discussion from participants about what they have tried on this list and how it works.
- Tell participants that if they would like to use this checklist back at their worksites, it is available on their *Tools and Resources* CD-ROM.
- Refer participants to the note at the bottom of Page 8.
- Explain that if they would like to review an additional checklist, they can check out Annex I of the NFPA 70E standard.
- The Annex I checklist is called ***Job Briefing and Planning Checklist***.
- Refer participants to Pages 9 through 14. Tell them that these pages contain a checklist that can help them identify electrical hazards at their worksites.
- Ask participants to envision their own workplaces as you review the checklist. Review by doing the following.

- Review the five major categories on the checklist: General Electrical Safety, Power Tool Safety, Extension and Flexible Cord Safety, Ground Fault Protection and Working Around Power Lines.
- Emphasize that this list is derived from the OSHA standards, which are referenced at the end of the list.
- Point out that this list is only a small part of the OSHA standards, but it represents items that, for the most part, they can control.
- Ask participants to pick one or two of the categories on Pages 9 through 14.
- Allow participants about 5 minutes to review the items in the category they chose and to place an “X” by those that may pose a hazard at their worksites.
- When time is up, lead a discussion in which you encourage participants to share what they learned by reviewing the list.
- Tell participants that this checklist is available on their *Tools and Resources* CD-ROM, so that they can print it and use it on the job.
- Refer participants to Pages 15 and 16. Tell them that if they prefer to use a shorter checklist, this is an OSHA Small Business Checklist and is also available on their *Tools and Resources* CD-ROM.
- Close with the following points:
  - A checklist can help you learn what you need to do to make your organization more electrically safe.
  - It can also tell you what you are doing well.
  - It doesn’t matter which checklist you use—you can even create your own.
  - The important thing is to use it consistently and to teach employees to use it consistently.

### 3. The Warning Signs of Hazards—Activity (10 minutes)

#### Cues

#### Content

- You will use Page 17 for this activity. Allocate your time as follows:
  - 5 minutes for to complete Page 17 in small groups.
  - 5 minutes to debrief the activity as a large group.
- Refer participants to Page 17. Introduce this activity with the following:
  - At times, you may get an indication of a hazard. This indication may seem minor, but it is important to pay attention to it as it could be a sign of a larger danger.
  - Work in small groups. For each indication on Page 17, write what it could mean and what it could cause.
- Allow groups about 5 minutes to work. Call time every minute so that the groups can pace themselves.
- When time is up, review the group’s responses as a large group. Here are some potential responses.
- 1. Tripped circuit breaker
  - **Indication:** Something is causing the circuit to overload.
  - **What it could mean:** Could be malfunctioning equipment, or there could be a short between conductors. Either could cause shock or fire.
- 2. Warm junction box
  - **Indication:** Too much current in the circuits.
  - **What it could mean:** If the source of the heat is not identified, there could be a fire or arc blast.
- 3. GFCI that frequently shuts off a circuit



- **Indication:** There is leakage in the system.
- **What it could mean:** Continued use could cause fire or shock.
- 4. The smell of something burning
  - **Indication:** Possible overheated insulation.
  - **What it could mean:** Although it may be a match or an overcooked microwave dinner in the break room, it's important to check it out. If it's in the electrical system, it could eventually cause a fire or explosion.
- 5. Frayed insulation around a wire
  - **Indication:** The equipment is either old or has been used incorrectly.
  - **What it could mean:** The damaged equipment could cause shock or fire. In addition, this may be an indication that workers are not following proper care and handling instructions for equipment.
- 6. Frequent calls to maintenance
  - **Indication:** If calls consistently come from one work area or involve one piece of equipment, workers may be improperly trained or neglecting proper procedures.
  - **What it could mean:** Eventually, workers may cause a serious incident to occur.
- 7. Mild shock when power is used
  - **Indication:** There is leakage inside the tool. The tool is not properly grounded.
  - **What it could mean:** Continued use could cause shock.
- Close by reminding participants to pay attention to warning signs at their worksites.

#### 4. The Dangers of Arc Flash and Arc Blast—Presentation and Video (10 minutes)

Cues	Content
	<ul style="list-style-type: none"> <li>■ You will be covering Pages 18 and 19 in this segment. Allocate your time about equally between all the segments, which means this presentation will move quickly.</li> <li>■ Refer participants to the top of Page 18. Tell them they will learn to identify the hazards of arc flash and arc blast.</li> </ul>
<b>Question:</b>	<ul style="list-style-type: none"> <li>■ Ask participants: Who can remember the definitions of arc flash and arc blast?</li> </ul>
PPT 2-12	<ul style="list-style-type: none"> <li>■ Get some responses for arc flash, then show PPT 2-12 to review the definition of arc flash.</li> </ul>
PPT 2-13	<ul style="list-style-type: none"> <li>■ Get some responses for arc blast, then show PPT 2-13 to review the definition of arc blast.</li> <li>■ Refer participants to the remainder of Page 18.</li> </ul>
<b>Question:</b>	<ul style="list-style-type: none"> <li>■ Ask participants: Have any of you ever witnessed or experienced arc flash or blast?</li> <li>■ Get some responses. If someone has experienced it, ask them to describe their experience. Verify that the experience can be dangerous or deadly.</li> </ul>
<b>Question:</b>	<ul style="list-style-type: none"> <li>■ Ask participants: Who knows what happens in an arc blast?</li> <li>■ Get some responses, then show PPT 2-14, which is animated. Advance the animation each time you introduce a bullet point from the list on Page 18.</li> <li>■ Emphasize the extreme all-around intensity that arc blast causes—heat, noise, light, pressure, flying objects.</li> <li>■ Tell participants that they are now going to see an actual arc blast that was captured on a security camera.</li> </ul>
PPT 2-15, video clip	<ul style="list-style-type: none"> <li>■ Show PPT 2-15, which is a video clip of about 35 seconds.</li> <li>■ Share the following information regarding the video clip.</li> </ul>

<p>PPT 2-16 and PPT 2-17</p> <p><b>Question:</b></p>	<ul style="list-style-type: none"> <li>– The video was taken on a security camera.</li> <li>– There are three electricians working on switchgear when an electrical blast occurs.</li> <li>– One electrician is in front of the other two, and is not visible on the camera.</li> <li>– All three survive, but one had to be induced into a two-month coma.</li> <li>– Note that the two visible workers are trying furiously to remove burning clothing.</li> </ul> <ul style="list-style-type: none"> <li>■ Refer participants to the bottom of Page 18. Mention that the video showed some consequences to arc blast.</li> <li>■ Review PPT 2-16 and PPT 2-17 to review the consequences of arc blast.</li> <li>■ Ask participants: Do you think that qualified people are unlikely to be injured in an arc flash or arc blast?</li> </ul>
<p>PPT 2-18</p> <p><b>Question:</b></p>	<ul style="list-style-type: none"> <li>■ Get some responses, then show PPT 2-18. Emphasize that arc flashes and arc blasts are dangerous even for qualified individuals.</li> <li>■ Refer participants to the top of Page 19.</li> <li>■ Ask participants: Does anyone know where an arc flash or blast can occur?</li> </ul>
<p>PPT 2-19</p> <p><b>Facilitator Note</b></p>	<ul style="list-style-type: none"> <li>■ Get some responses, then show PPT 2-19 and quickly review the various places where arc blast can occur.</li> <li>■ If someone asks what the minimum conditions are for an arc flash/blast, they are a 125KV<sub>a</sub> transformer and 240 volts.</li> </ul>
<p>PPT 2-20 and PPT 2-21</p> <p><b>Facilitator Note</b></p>	<ul style="list-style-type: none"> <li>■ Review PPT 2-20 and PPT 2-21 to review the causes of arc flash and blast. Ask the participants who have experienced arc blast to describe how theirs occurred.</li> <li>■ If someone asks for an example of impurities in the air, one example is humidity.</li> </ul>

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| <b>Question:</b>   | <ul style="list-style-type: none"><li>■ Ask participants: How likely do you think it is for animals to be the cause of arc flash/blast?</li></ul>  |
| PPT 2-22, animated | <ul style="list-style-type: none"><li>■ Get some responses, then show PPT 2-22. Ask participants to take a careful look at the <u>BLACK</u> cables. Advance animation to bring attention to the snakes.</li></ul>  |
| PPT 2-23           | <ul style="list-style-type: none"><li>■ Show PPT 2-23 to reveal a better view of one of the snakes. Emphasize that it is not uncommon for animals to find their way into electrical boxes and circuitry.</li><li>■ Tell participants that to recognize arc flash and blast hazards, they need to understand which tasks are likely to cause them</li></ul> |
| PPT 2-24           | <ul style="list-style-type: none"><li>■ Show PPT 2-24 as you review the tasks that can create arc flash and blast hazards.</li><li>■ Close this segment by saying it is preferable to prevent arc flash and blast than to deal with the consequences.</li></ul>  |

## 5. Case Studies—Activity (10 minutes)

Cues	Content
PPT 2-25	<ul style="list-style-type: none"><li>■ You will be covering Page 20 for the entire 10 minutes. You will be facilitating four case studies, in which you will show photos and participants will identify hazards. Allocate time as follows.<ul style="list-style-type: none"><li>– About one minute per slide to identify the hazards.</li><li>– About one minute per slide to debrief the group’s findings.</li></ul></li><li>■ Tell participants that they have learned many techniques for recognizing electrical hazards. Now you would like to give them a chance to use some of their new tools.</li><li>■ Refer participants to Page 20. Divide the class into small groups of four to six participants each.</li><li>■ Introduce the case studies with the following.<ul style="list-style-type: none"><li>– I’m going to show you some slides.</li><li>– Your job is to work in your group and use your checklist (from Pages 9 through 14 or from Pages 15 and 16) to identify the hazards in each slide.</li><li>– Write the hazards in the spaces provided on Page 20.</li></ul></li><li>■ Show PPT 2-25, which is Case #1. Allow the groups about one minute to identify the hazards in the slide.</li><li>■ When time is up, ask the group to share what they identified. Some responses you should get are as follows.<ul style="list-style-type: none"><li>– Exposed live wires</li><li>– Missing plate cover</li><li>– Improper signage</li><li>– Bad housekeeping—too many loose wires</li></ul></li></ul>

PPT 2-26 through  
PPT 2-28

- Repeat the above process with PPT 2-26 through PPT 2-28, which are Cases #2 through #4.

- Following are some of the hazards participants should identify.

PPT 2-26

- Case #2, PPT 2-26
  - Improper hand and face protection
  - Improper fall protection
  - Metal crossbar could be an electrical hazard
  - Unclear if circuit is de-energized

PPT 2-27

- Case #3, PPT 2-27
  - Electric wires around water
  - No fall protection
  - Use of metal beam instead of ladder or scaffold
  - No PPE
  - Poor housekeeping—hand drill left laying around

PPT 2-28

- Case #4, PPT 2-28
  - Poor housekeeping
  - Duct tape instead of proper box covers
  - Too many plugs into one circuit
  - Front of box left opened and unprotected
- When all four cases are complete, ask participants if the checklist helped them to identify the hazards in the photos.
- Encourage them to use their checklists frequently on the job.

## 6. Planning for Your Small Business—Activity (5 minutes)

Cues	Content
PPT 2-29	<ul style="list-style-type: none"><li data-bbox="576 336 1409 409">■ You will be covering Page 21 in this segment. Allow 5 minutes.</li><li data-bbox="576 451 1409 525">■ Refer participants to Page 21. Show PPT 2-29 as you point out that this is another planning page.</li><li data-bbox="576 567 1409 640">■ Allow participants a couple of minutes to write some ideas on Page 21.</li><li data-bbox="576 682 1409 745">■ As time permits, have participants share some of their ideas, barriers and ways to overcome the barriers.</li></ul>
60 Minute Lunch	Take a 60 minute lunch.

