

MODULE 3

EVALUATION ELECTRICAL RISK FACTORS

Objectives

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

- ⚡ Recognize the purpose and various methods for evaluating arc flash.
- ⚡ Identify arc flash approach boundaries and their meaning.
- ⚡ List the steps for conducting a task analysis.
- ⚡ Recognize how to conduct a fall hazard evaluation.
- ⚡ Given a case study, analyze the hazards and recommend improvements.

Time

65 minutes: 12:45 to 1:50 PM

Followed by a 10-minute break: 1:50-2:00 PM

Agenda

1. Introduction to Electrical Evaluation—Presentation and Discussion (30 minutes)
2. Case Study—Activity (30 minutes)
3. Planning for Your Small Business—Activity (5 minutes)

RECOMMENDED PROCESS

1. Introduction to Electrical Evaluation—Presentation and Discussion (30 minutes)

Cues	Content
	<ul style="list-style-type: none"> ■ You will be covering Pages 1 through 7 in this segment. <ul style="list-style-type: none"> – Briefly present the objectives on Page 1. – Allow about 5 minutes each for Pages 2 and 3. – Allow about 10 minutes for Pages 4 and 5, with most of the time spent on Page 4. – Allow about 5 minutes each for Pages 6 and 7.
PPT 3-1	<ul style="list-style-type: none"> ■ Show PPT 3-1 as participants return to the room after lunch.
PPT 3-2, Animated	<ul style="list-style-type: none"> ■ Show PPT 3-2 (which is animated so that the “evaluate” grows) as you refer participants to Page 1 in Module 3 of their Participant Guides. ■ Introduce the module with the following points. <ul style="list-style-type: none"> – Now that we have talked about how to recognize electrical hazards, let’s turn our attention to evaluating them.
PPT 3-3 and PPT 3-4	<ul style="list-style-type: none"> ■ Show PPT 3-3 and PPT 3-4 as you introduce the objectives to this module. ■ Refer participants to Page 2. Make the following points. <ul style="list-style-type: none"> – When electrical components operate at 50 volts nominal and above, workers should de-energize equipment when they work on it. – This means that it should be locked out, tagged out, and then tested to ensure that it is indeed de-energized. – Additionally, the qualified person performing these functions should be outfitted in the appropriate PPE.

PPT 3-5

- If the components cannot be de-energized because of the nature of the work to be performed or because of an increased risk posed by de-energizing, then a Shock Hazard Analysis and a Flash Hazard Analysis should be performed.
- There are three desired outputs for these evaluations.

- Show PPT 3-5 as you review these outputs.
- Refer participants to the two boxes on Page 2 and point out that NFPA provides specifications for a Shock Hazard Analysis and a Flash Hazard Analysis.
- Review the Shock Hazard Analysis and the Flash Hazard Analysis by covering the information provided in the boxes on Page 2.
- Refer participants to Page 3. Point out that there are many methods for evaluating arc flash.
- Emphasize that, unless they are a qualified person, they will not be performing these evaluations.
- However, it is helpful for them to be familiar with the different methods.

PPT 3-6

- Show PPT 3-6 as you review the methods for evaluating arc flash.

Question:

- Ask participants: How much experience do you think is required before someone can perform the calculations described on this page?
- Get some responses, then say that the amount of training will vary from organization to organization, but to provide an idea, here are the requirements at a leading electric company.
 - Must be a professional engineer with 5-10 years of experience
 - Must go through six weeks of training
 - Must have one year of supervision

- Question:**
- Ask participants: Are you qualified to do this?
- Question:**
- Get some responses, then ask participants: Is anyone in your organization qualified to do this?
- Question:**
- Get some responses, then ask participants: Where do you go to get it done?
 - Get some responses, then say that this is when they would call an outside company for help.
 - Emphasize that there is also a measure of liability protection in going with an outside person or firm.
 - Tell them that there is a listing for professional assistance on their *Tools and Resources* CD-ROM.
 - Refer participants to Page 4. Point out that regardless of the type of analysis that is performed, the result will be some limits of approach.
 - Point out that these boundaries will vary from situation to situation depending on a number of factors.
 - Equipment class
 - Gap between conductors
 - Grounding type
 - Working distance
 - System voltage
 - Available 3 Phase Bolted current
- PPT 3-7, Animated
- Show PPT 3-7 as you point out that the blinking red dot represents the live energized part and the rings represent the various boundaries as determined in the arc flash analysis.
- PPT 3-8, Animated
- Show PPT 3-8 (which is animated to highlight the outermost ring) as you make the following points.

PPT 3-9, Animated

- Let's spend some time looking at what these boundaries mean to the worker
- Look at the outermost ring.
- This is the flash protection zone and it is marked by the flash protection boundary.
- Everything inside the flash protection boundary is off limits to normal employees.
- This zone should be clearly marked with signs and tape to prevent people from entering.
- Employees who do enter this zone to work must wear flash protective equipment.

■ Show PPT 3-9 (which is animated to highlight the second outermost ring) as you make the following points.

- Now let's look at the second outermost ring.
- This is the limited approach zone and it is marked by the limited approach boundary.
- Everything inside the limited approach boundary is off limits to all but qualified employees.
- People working in this zone must be qualified to do the job or task.
- They must also wear flash protective equipment.
- Anyone not qualified to do the job or task is prohibited from entering this zone.

PPT 3-10,
Animated

■ Show PPT 3-10 (which is animated to highlight the third outermost ring) as you make the following points.

- Now let's look at the third outermost ring.
- This is the restricted approach zone and it is marked by the restricted approach boundary.

PPT 3-11,
Animated

- A person operating in this zone is in restricted space.
 - Obviously, only qualified people are allowed in this space, but even these people must have an approved written plan.
 - They must also wear the appropriate PPE.
 - Because this is a dangerous zone, employees must keep as much of their body out of it as possible.
 - They must constantly take care not to cross any part of the body into the prohibited zone.
- Show PPT 3-11 (which is animated to highlight the innermost ring that is closest to the exposed energized part) as you make the following points.
- Now let's look at the closest ring to the exposed energized part.
 - For all practical purposes, NO ONE should enter into this zone because it is the same as being in contact with the live part.
 - On the rare occasion when someone has to be in this zone, it must be a qualified person.
 - They must have specified training for working on live parts.
 - They must have a written plan and a risk hazard analysis, and both must be approved by an authorized manager.
 - They must use PPE that is specifically made for working on live parts.
 - You will learn more about the appropriate PPE in Module 4.
- Answer participant questions.

Question:

PPT 3-12 and PPT
3-13

PPT 3-14 through
PPT 3-16

PPT 3-17

Question:

- Refer participants to Page 5. Emphasize that in addition to setting approach limits, the Flash and Shock Hazard Analyses help to determine the type of PPE that should be worn.
- However, sometimes electrical work must begin before the Flash and Shock Hazard Analyses are complete.
- When this happens, workers must still wear PPE.
- Ask participants: Without the results of the Flash and Shock Hazard Analyses, how will you know which PPE to wear?
- Get some responses, then point out that NFPA has provided some tables to help determine which PPE is required when calculations have not been done.
- Point out that the table on Page 5 is a short excerpt of the NFPA table.
- Use PPT 3-12 and PPT 3-13 as you review the content of this table.
- Emphasize that when these tables are used, ALL corresponding notes must be taken into consideration.
- Refer participants to Page 6. Tell them that the Shock Hazard Analysis and Flash Hazard Analysis are just one aspect of evaluating a job's hazards.
- In addition, they should also be performing a task analysis on the entire job to evaluate other potential risks.
- Show PPT 3-14 through PPT 3-16 as you review the steps of a task analysis.
- Refer participants to Page 7. Tell them that every time they perform a job or task that requires working on electricity, they should evaluate the fall hazards.
- Show PPT 3-17.
- Ask participants: Why is it important to consider falls when evaluating electrical safety?

- Get some responses, then make the following points if they haven't already been made.
 - Electric shock may cause muscles to contract, causing a worker to lose his or her balance and fall.
 - An explosion from an electrical incident can also cause a fall.
- Close the discussion by emphasizing that, by doing the evaluations discussed in this module, they can ensure that working around electricity at their worksites can be as safe as possible.

3. Case Study—Activity (30 minutes)

Cues	Content
	<ul style="list-style-type: none">■ This case study covers Pages 8 through 11. Allocate time as follows.<ul style="list-style-type: none">– 10 minutes to read the case study– 10 minutes for small groups to work on the case study– 10 minutes to debrief the case study
Facilitator Note	<ul style="list-style-type: none">■ The background summary for this case is fairly lengthy (two and a half pages). To avoid the problem created by the different reading speeds of participants, the case should be read out loud as a class. You can do all the reading yourself, or you can have different participants read the various paragraphs.■ Begin the segment by telling participants they will now be working on a case study.■ Tell them that this is a summary of a case that actually happened in New Jersey and was investigated by the NIOSH FACE (Facility Assessment and Control Evaluation) program.■ Refer participants to Page 8. Read out loud the background information on the case (Pages 8 through 10).■ Once the background has been read, ask participants if they have any questions.■ Break the large group into smaller groups of four to six participants each.■ Tell participants that they have 10 minutes to analyze this case and answer the questions on Page 11.
PPT 3-18	<ul style="list-style-type: none">■ While participants work, show PPT 3-18 to remind them of the questions they are answering.■ Walk around the room to answer any questions participants have and to get a sense of what they are discussing.

- Periodically call out the time to help participants pace themselves.
- When time is up, call the large group back together and lead a 10 minute debriefing.
- Following are some debriefing points for the case.
- Hazards
 - Exposed electrical bus bar
 - Improperly trained workers
- What management did wrong
 - Failed to properly train the workers in electrical hazards
 - Failed to have qualified people do the work
 - Failed to provide proper PPE.
 - Failed to have the work area inspected by a qualified person prior to permitting employees to work near the electrical equipment. An inspection may have revealed the missing electrical bus bar end-cap.
 - Allowed unauthorized employees access to electrical testing equipment.
- What the employee did wrong
 - Used the electrical testing equipment even though he was instructed not to
 - Ignored instruction that said not to do any electrical connections
- How to improve

- Develop, implement and enforce an electrical safety program including instruction in electrical safety practices, lockout/tagout, circuit testing (to ensure circuits are de-energized), and keeping electrical equipment away from unauthorized personnel.
- Conduct frequent inspections.
- Answer participant questions, then thank them for their insightful analysis.

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

Cues	Content
PPT 3-19	<ul style="list-style-type: none"><li data-bbox="535 336 1359 409">■ You will be covering Page 12 in this segment. Allow 5 minutes.<li data-bbox="535 451 1359 525">■ Refer participants to Page 12. Show PPT 3-19 as you point out that this is another planning page.<li data-bbox="535 567 1359 640">■ Allow participants a couple of minutes to write some ideas on Page 12.<li data-bbox="535 682 1359 745">■ As time permits, have participants share some of their ideas, barriers and ways to overcome the barriers.
10 Minute Break	Take a 10 minute break.