Electrical Risk Hazard Analysis

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Question: Why conduct a Risk Hazard Analysis (RHA) when working on or near live parts?

Answer: When a risk hazard analysis is properly performed there is a substantially reduced chance of injury. Also, NFPA 70E orders you to perform the analysis.

For the purpose of this article, there are two types of Risk Hazard Analysis:

1. These are the guidelines in NFPA 70E. Each company is required to develop formal written documents. (If you did not write it down, you did not do it).

a. Hazard/Risk Evaluation Procedure 110.7 (F) states a procedure *shall* be used before starting work. Annex F has an example of a procedure.

b. Job Briefing 110.7 (G) states you *shall* conduct a job briefing that includes all hazards. Annex I gives an example of a written checklist.

c. Energized Work Permit (EWP) 130.1 (A) states you *shall* perform energized work by written permit only. Annex J provides a sample.

JOB HAZARD ANALYSIS (JHA) ❑ General ❑ Job Specific

Job:_____ Location:_____ Job#_____ Date:_____

Check in w/ operations Operator(s) Name(s)_____ Phone#_____

All personnel to be informed of daily work scope _____ Cell#_____

_____ Radio Ch _____ Permit # _____

Job involves energized work as defined by the policy? (a, b, & c below) If yes complete energized worked procedure ❑ Y ❑ N

a. Direct or indirect contact with bare energized conductors. b. Within reaching, stumbling, or falling distance of bare energized conductors.
c. Near enough to exposed bare conductors to be exposed to the hazard they present.

Will the job require LOTO? ❑ Y ❑ N **Work greater than 600V? ❑ Y ❑ N**

TASK – WORK DESCRIPTION	HAZARDS – INCLUDING ENVIRONMENTAL INCLUDING – WHAT WILL THIS CIRCUIT TRIP?	ELIMANTE/MINIMIZE – DETAILED DESCRIPTION

Fill out job safety inspections sheet if necesary (On large jobs). ❑ Y ❑ N By:_____

❑ Hard Hat ❑ Safety Glasses ❑ Face Shield ❑ Hearing Protection ❑ Fire Retardant Coverfalls

❑ Gloves ❑ Flash Suit ❑ Steel Toed Boots ❑ Floor Mat ❑ Insulated tools ❑ _____

Special safety equipment_____ Review evacuation plan_____

Location of first aid kit _____ Location of nearest hospital _____

Cell phones allowed to be used at job site? ❑ Y ❑ N EXPLAIN:_____ EXEMPTIONS:_____

Near misses during the day _____

Spot-check safety audit during the day. @____ ❑ AM ❑ PM By: _____

TECHNICIAN _____ SUPERVISOR _____

Figure 1 — Sample of a Job Hazard Analysis (JHA)

2. A field experienced, qualified trained person, carefully observes the job site conditions and evaluates the hazards associated with that day's work tasks. This person is then alert throughout the day, thus avoiding and/or eliminating hazards.

In regard to number one above, the practice of conducting a Risk Hazard Analysis and a Job Briefing is well documented in NFPA 70E. Some companies have adopted the use of a written Job Hazard Analysis (JHA) to combine both of these (see figure 1). Injuries have been reduced for companies with comprehensive safety programs.

Figure 1 is provided as a sample of what a Risk Hazard Analysis, Job Briefing, and Work Permit document could look like. OSHA and 70E require that you have written documents. It is up to each company to develop its own. Please note the core of this JHA is the three columns. Write down the task. Identify any associated hazards. Mitigate or eliminate those hazards. This is where the crew would identify all the job hazards such as mechanical, environmental, and electrical. The concept of identifying and eliminating hazards is central to the JHA.

Another important item to identify on this JHA is whether or not the job involves energized work. If it does then go to the next step, the Energized Work Permit (EWP) 130.1, (figure 2). The EWP provides the platform to accomplish many tasks:

a. Identify and quantify the shock and blast hazards present.
b. Determine the appropriate PPE necessary to protect from those hazards.
c. Maybe the most important item, involve managers by requiring their signatures on energized work permits. Studies have shown that requiring management to sign off on energized work reduces the amount of that type of work being performed. After all, it is with management that life endangering decisions should reside.

ENERGIZED WORK PERMIT (EWP)

Job:_____ Location:_____ Job#_____ Date:_____
Equipment/circuit:_____Voltage_____
Justification of why the equipment/circuit cannot be de-energized:_____
_____
1) Shock Hazard Analysis 70E 130.2 (A) _____
_____
2) Shock Protection Boundaries 70E 130.2 (C), and TDE IPP M: _____
3) Flash Hazard Analysis: 70E 130.3, Buss/Circuit Rating Amps:_____Short Circuit Amps:_____
Fuses/C.B./Relay Clearing Time Cycles: _____ Working Distance _____ cal/cm^2 _____
4) Flash Protection Boundaries: 70E 130.3 (A) _____
5) Remember distance is your friend; use the longest hot stick available for applying grounds _____
6) What PPE is appropriate for this level of hazard _____

ELECTRICAL SUPERVISOR _____ OPERATIONS SUPERVISOR_____

SAFETY SUPERVISOR _____ GENERAL MANAGER _____

Figure 2 — Sample of an Energized Work Permit (EWP)

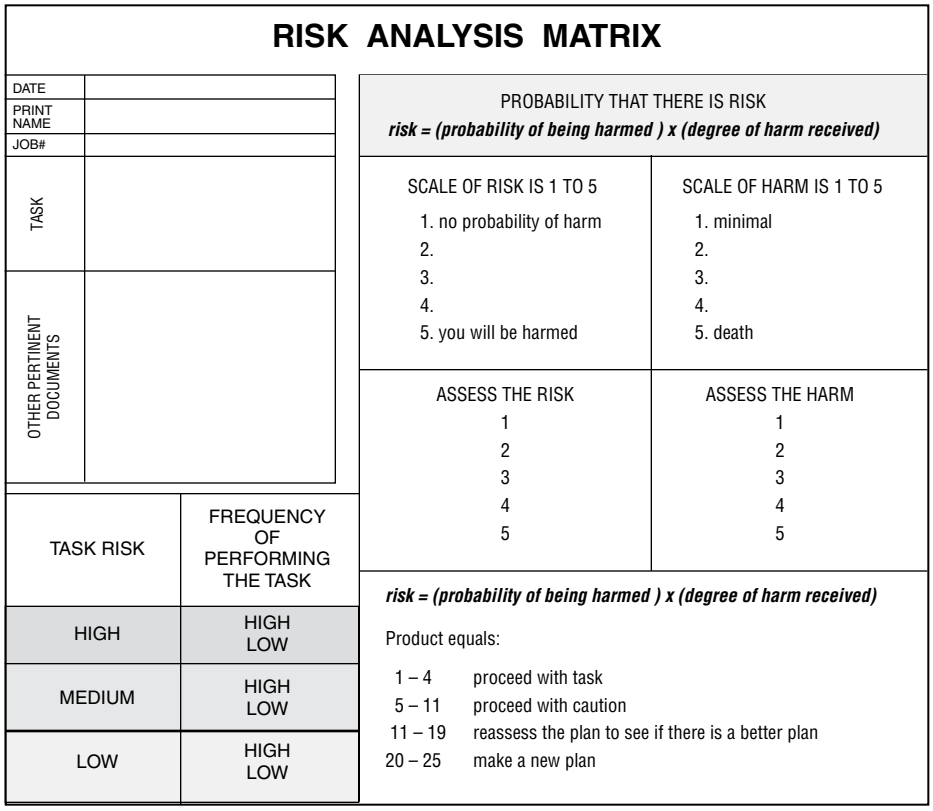
Adoption of the Energized Work Permit (EWP), has been slow to happen in several parts of the country. There are many reasons for this. With the diversity of companies and industries it is difficult to make generalizations, but for the sake of clarification it is attempted here. If the company is large, but not large enough to have a "high end" person on the safety committee, the safety committee may not understand electrical hazards and tends to leave the electricians alone. If the company is small- or medium-sized, all bets are off, as many do not have a comprehensive, enforced, electrical safety program. If the company is large, medium, or small in size and does have an informed, passionate, upper management person(s) in charge of electrical safety, there is a good chance that company has the major components of a complete safety program. The component discussed here is Risk Analysis and documentation.

With the companies that have adopted an EWP, there are some problems with implementation. First is the issue of change. It is very difficult to change human behavior. Getting a technician with 10-20 years experience to fill out complex paperwork, wear hot bulky PPE, and "slow down" the work has proved challenging even for the most enlightened management. Most agree that this is a delicate, time consuming task. Having the people in the field involved with the creation of policy and procedures will result in successful implementation of those policies and procedures. Workers in the field strongly care about their lives. You will have the start of a safety culture when workers realize that management also cares and is willing to spend the time and money on training, equipment, and safe work procedures.

The second problem with implementing the EPW is how to determine a way to quantify the arc-flash hazard per NFPA 70E, 130.3. Many papers have been written and seminars given on how to calculate incident energy at a given distance. It is well documented that using different software will give varying results, but all provide protection. The bigger issues are whether or not the upstream protection will operate and the condition of the equipment. These two potential problems could be so overwhelming that they render meaningless any calculations figured and protection worn. The reverse of this can also be true. The calculated figures from the analysis may not be appropriate for every situation. A 40 calorie suit may not be necessary for protection when performing a thermoscan with the covers already removed and there is no switching occurring.

It is no wonder that those in supervisory or engineering positions get nervous at times when asked to be responsible for arc-flash calculations. Someone's life may be dependent on the decisions and calculations. With so many variables in the field there is no formula that will insure an accurate, safe decision every time as to what PPE is correct for a specific task. NPFA 70E mentions this in its document. So what is one to do?

This brings us back to the very beginning of the article, the #2 way of performing a Risk Hazard Analysis. Use an experienced, qualified person. These people have been performing dangerous, energized work for over 100 years and recently have been doing it with few accidents. Many are aware that linemen working for Thomas Edison in the 1890s had a fatal accident rate of approximately 50 percent. Safety has improved dramatically since then. We, as a society, place a high value on human life. The goal is no injuries not less injuries.



RISK ANALYSIS MATRIX

DATE	
PRINT NAME	
JOB#	
TASK	
OTHER PERTINENT DOCUMENTS	

PROBABILITY THAT THERE IS RISK

risk = (probability of being harmed) x (degree of harm received)

SCALE OF RISK IS 1 TO 5	SCALE OF HARM IS 1 TO 5
1. no probability of harm	1. minimal
2.	2.
3.	3.
4.	4.
5. you will be harmed	5. death

ASSESS THE RISK	ASSESS THE HARM
1	1
2	2
3	3
4	4
5	5

TASK RISK	FREQUENCY OF PERFORMING THE TASK
HIGH	HIGH LOW
MEDIUM	HIGH LOW
LOW	HIGH LOW

risk = (probability of being harmed) x (degree of harm received)

Product equals:

1 – 4	proceed with task
5 – 11	proceed with caution
11 – 19	reassess the plan to see if there is a better plan
20 – 25	make a new plan

Figure 3 — Sample of a Risk Analysis Matrix (RAM)

In our journey to no injuries there is another tool available, the Risk Analysis Matrix shown in figure 3. Yes, it is another piece of paperwork that requires training. It must be filled out and turned in, but it empowers the experienced work force to think and use common sense. There are many types of risk matrixes, each with different components.

This basic sample of a risk matrix is very simple and has three major components.

a. Assign a number of 1 to 5 (5 being the highest) to the probability of harm occurring.

b. Assign a number of 1 to 5 (5 being the highest) to the degree of harm that could be received.

c. Multiply the two numbers, and the product equals a number relative to the level of risk a person would be exposed to. If the answer is 25 (5 times 5) you cannot perform the work. If the answer is 1 (1 times 1) you have the ideal safe work situation.

One problem with this method is that it is subjective. Different electricians will arrive at different numbers. That is the down side. The up side is it is a way to document a thought process for management review and to enable qualified, trained personnel to utilize their talents.

This is an example of some of the components that could be in your company's Risk Analysis Matrix. It is very basic. A more complex matrix to fit different needs would not be difficult to construct. Another item seen in a Risk Analysis Matrix is the ability to detect a hazard. How hard is it to foresee what is going to happen? What is behind that cubicle door? Is there complete detection of hazard (a value of 1), or is detection impossible (a value of 5)?

One more important component to add to the matrix is the frequency of performing the task (shown above). How often a person performs a task affects their ability to perform it safely. A task performed frequently enables workers to gain high skill levels. A task seldom performed might have a lot of uncertainty attached to it. The way to deal with low frequency, high risk tasks is to spend extra time evaluating the hazards. By spending the extra time, more resources such as expert help and additional PPE can be acquired. These extra resources can reduce the risk to an acceptable level.

Imagination and willingness to spend time is the only limit in creating a Risk Analysis Matrix that will reduce hazards and, therefore, injuries. A Risk Analysis Matrix is a valuable tool and addition to any company's safety program.

Tony Demaria worked for the Los Angeles Department of Water and Power in substation maintenance prior to starting his own company. He has owned and operated Tony Demaria Electric for over 25 years, specializing in maintenance and testing of switchgear and large motors for industrial facilities. Tony Demaria Electric is a NETA Accredited Company, and Tony serves as Chair of the NETA Safety Committee.