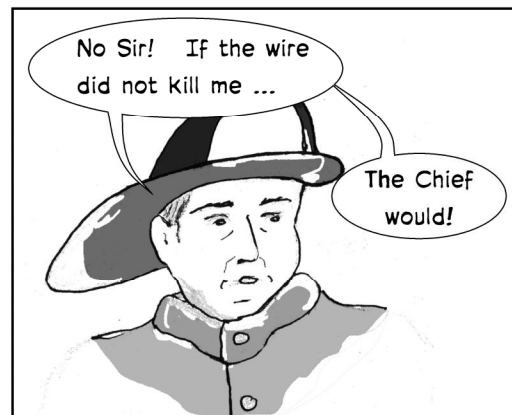
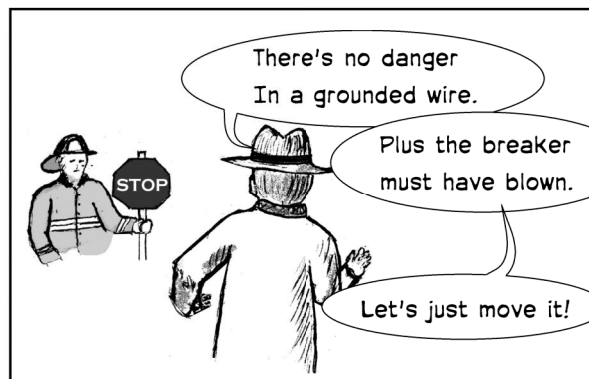
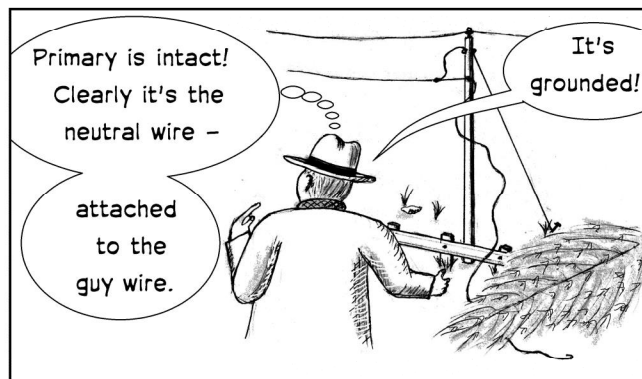
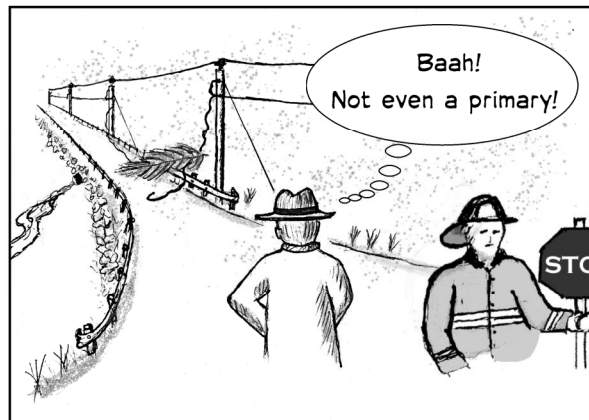
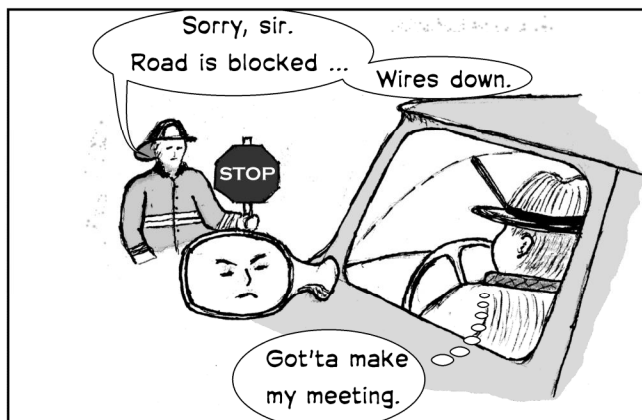
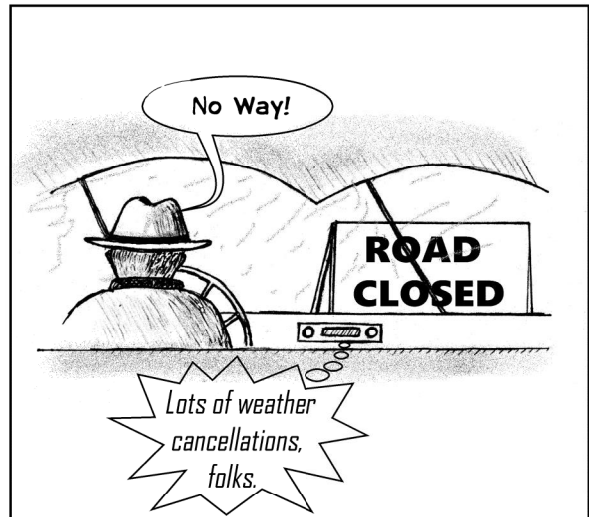


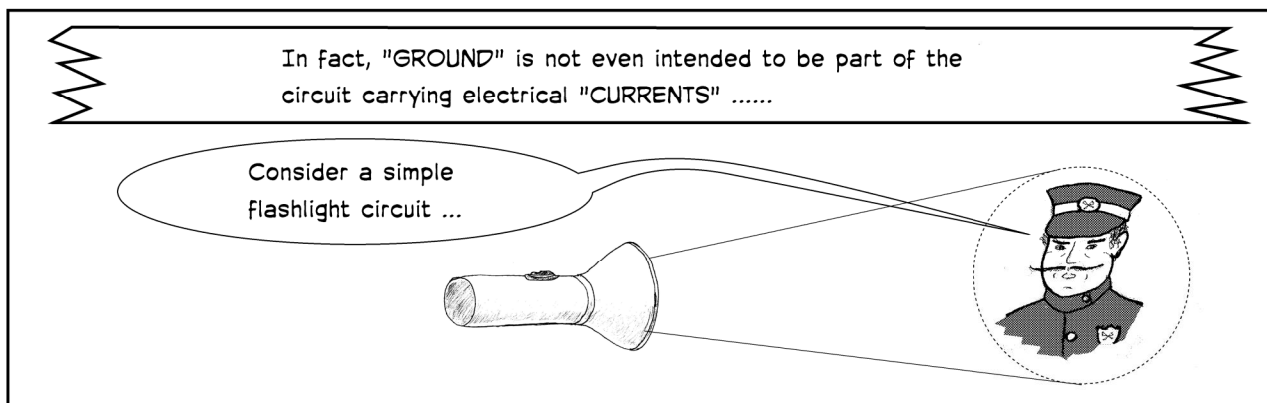
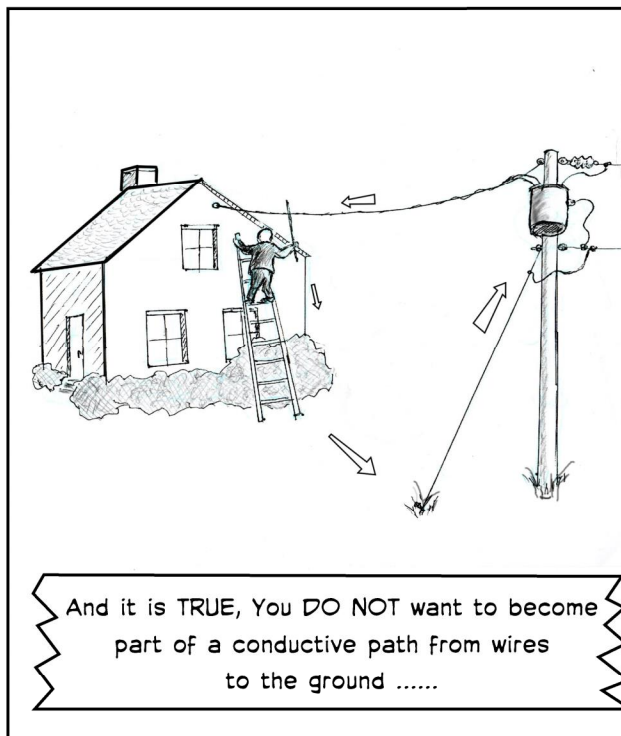
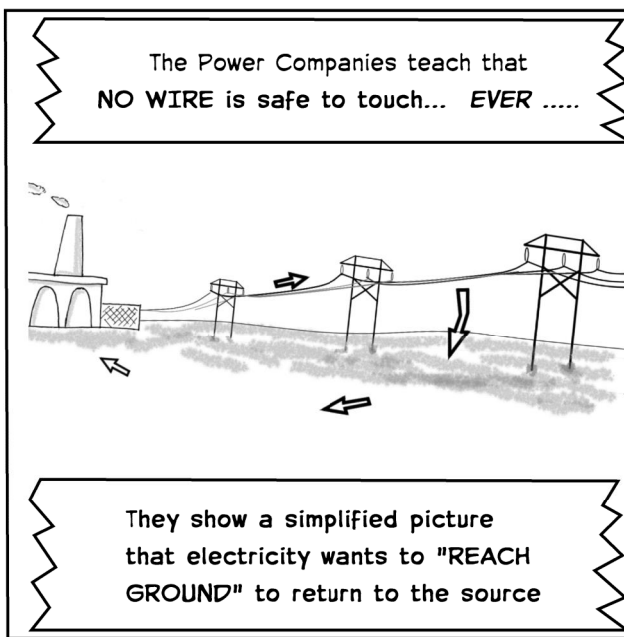
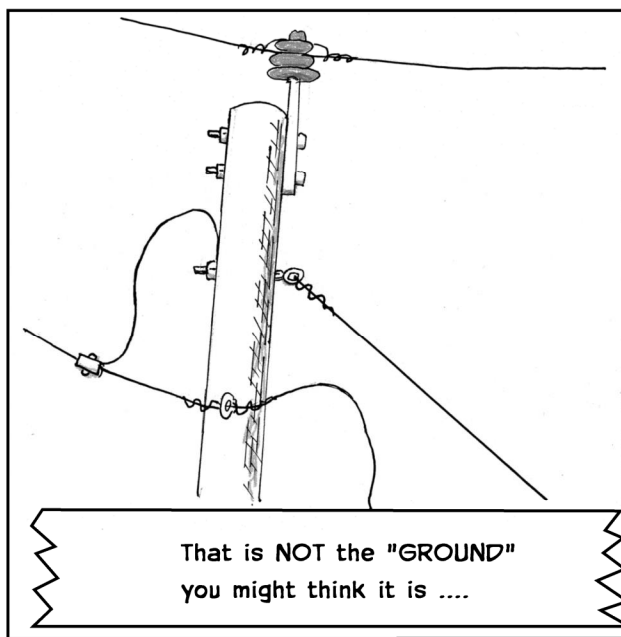
# WIRES DOWN!

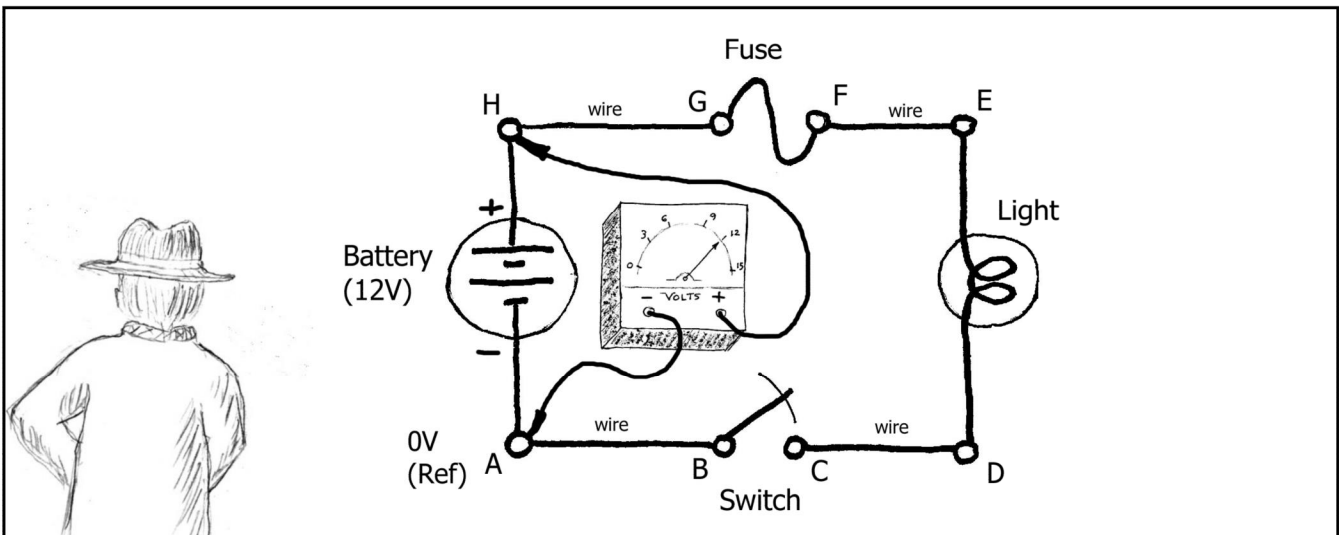
~ CHRIS TUPPER ~

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Download link: [dirigoresearch.com/wires-down/](http://dirigoresearch.com/wires-down/)

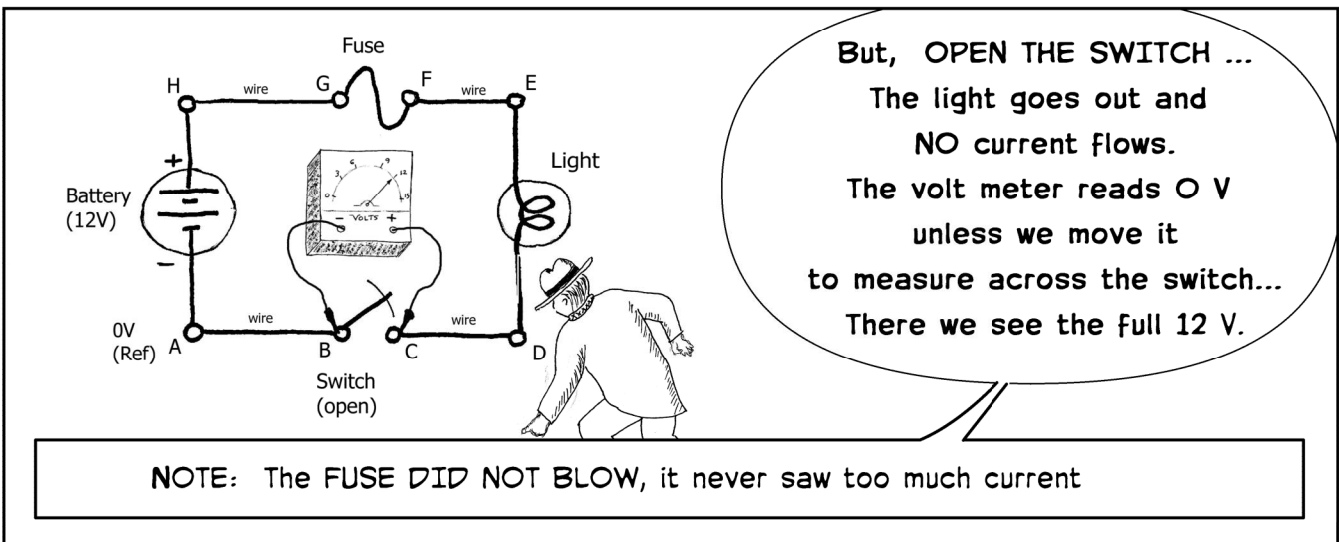
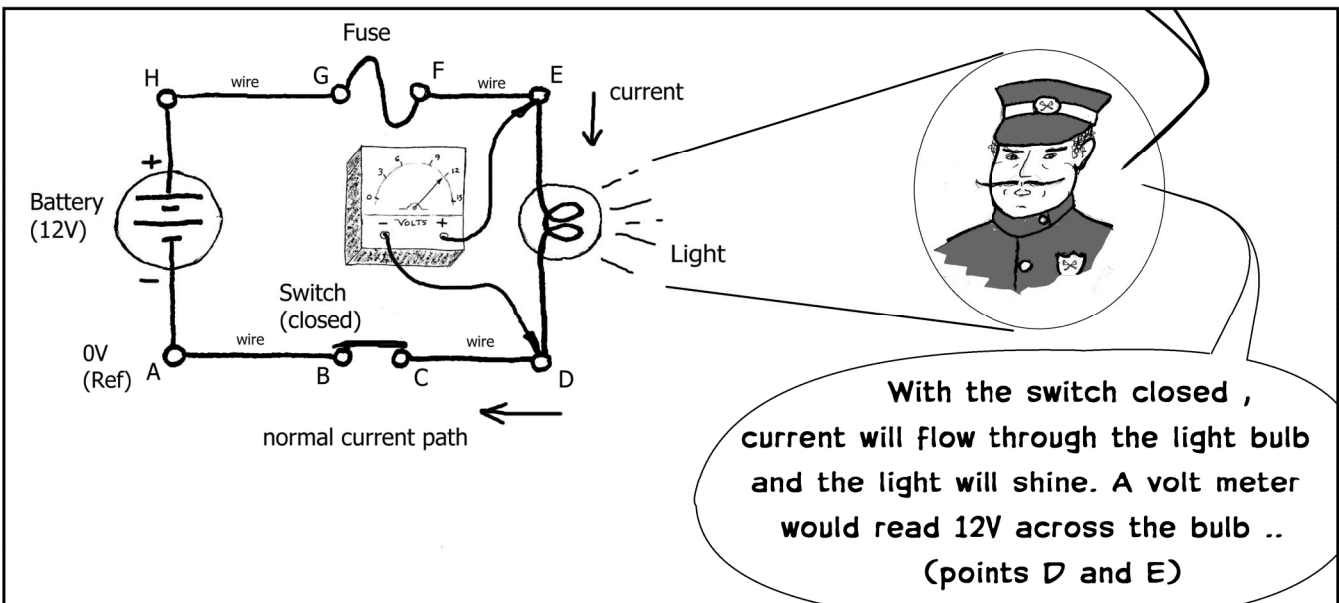
Dedicated, with appreciation, to all First Responders.







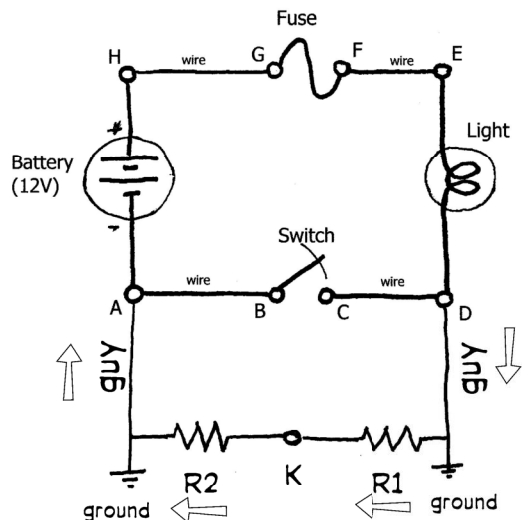
A simple flashlight circuit has wires connecting a battery, a light, switch, and maybe an optional fuse. NO GROUND IS INVOLVED.



Now let's connect the low voltage wires of the circuit \* to GROUND... Points A and D are like the grounding guy wires. The switch is our wire break...

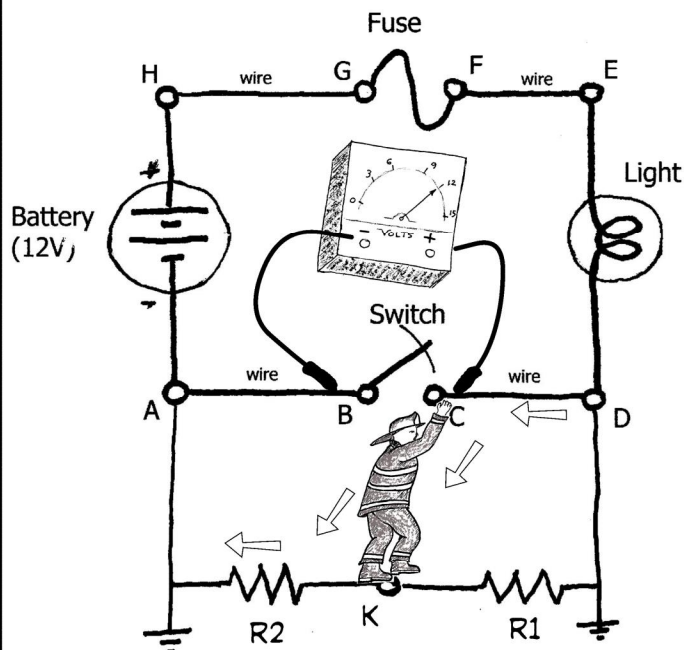
With the switch closed at point C, the flashlight operates normally ...

But with the switch open, the current tries to flow from point D to A through ground resistances R1 and R2.



\* Low voltage wires A-B and C-D might be called "neutral conductors."

Picture a Firefighter standing at point "K" anywhere along the ground path from points "D" to "A."



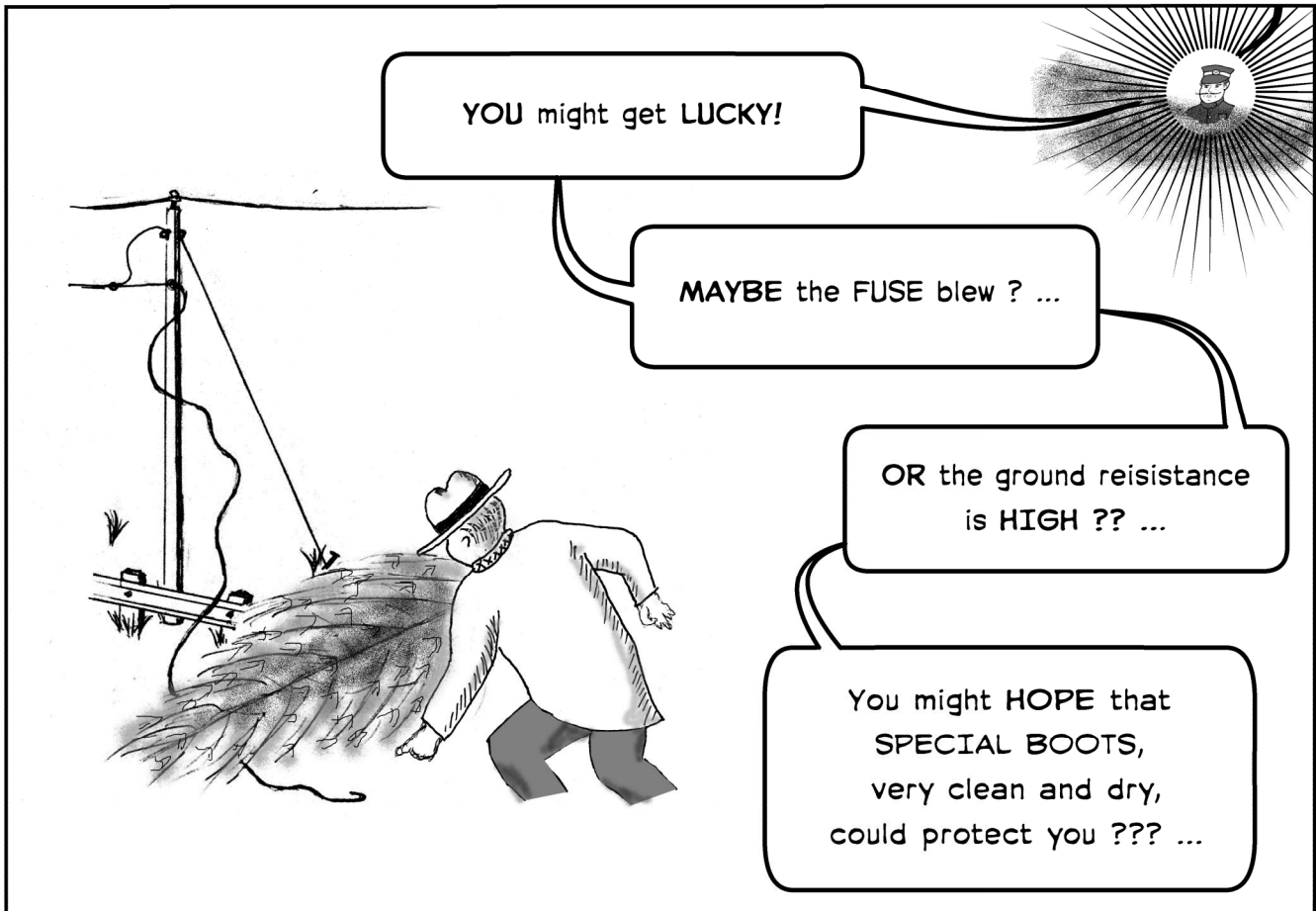
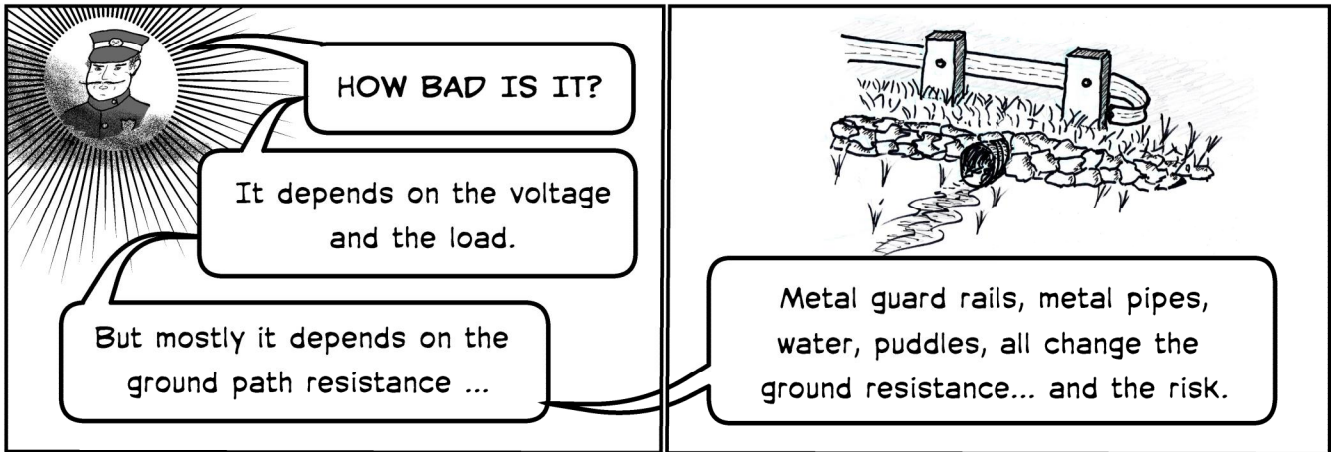
Anyone picking up a broken neutral at point C would provide an alternate path around R1 so current would try to flow through the person from Point C to point K and then through R2 to complete the circuit.



Why ground the system?  
What does it do?

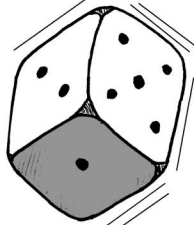
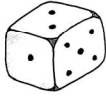
GOOD QUESTION !  
I'll discuss in the ENDNOTE.







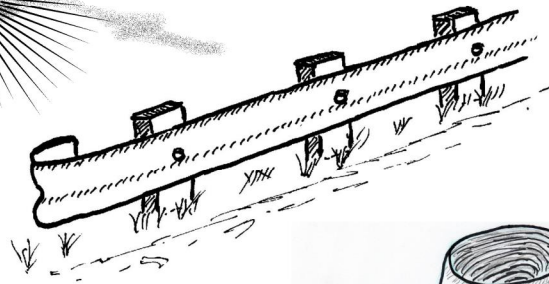
But the FUSE is a  
**BAD GAMBLE.**



It is unlikely to  
blow for a grounded  
neutral.



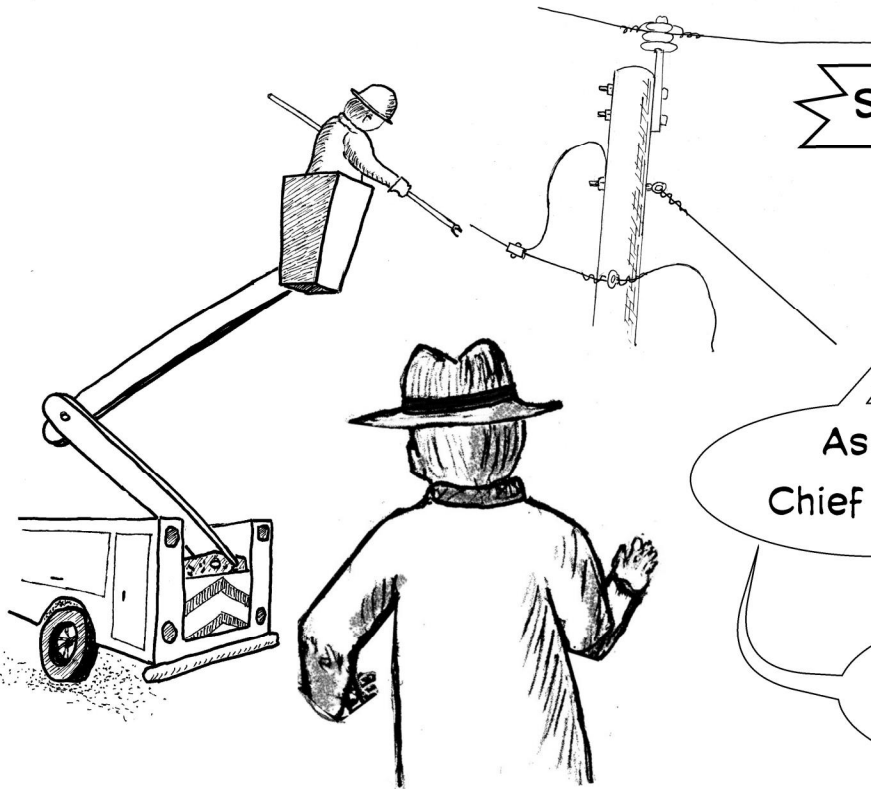
And it would **NEVER NOTICE**  
the 50 milli-Amps that could  
hurt a person.



Boots and ground resistance  
are  
**VERY UNRELIABLE.**

**WE DONT TAKE  
GAMBLING CHANCES  
WITH OUR FIREFIGHTERS !**

**SAFETY FIRST !**



As the  
Chief says ...



**EVERYONE  
GOES HOME...**

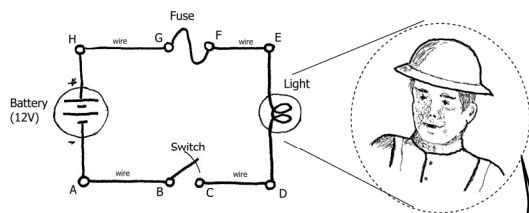
# - END NOTE -

## WHY GROUND THE UTILITY SYSTEM ??

Since the flashlight circuit works normally **WITHOUT** the ground – Why add the ground to the utility system?

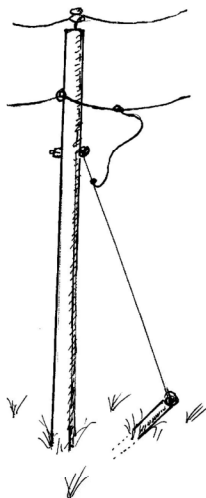


It **SEEMS** like it adds a **HAZARD** ...



**GREAT QUESTION !**

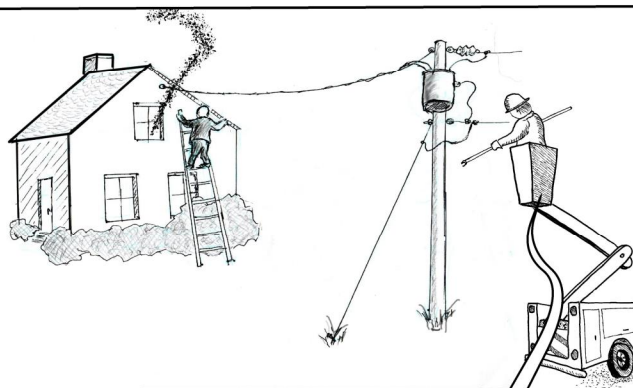
At almost every utility pole the low voltage (**NEUTRAL**) wire is connected to the local ground, often using the metal guy wire and a metal anchor driven into the earth.... Why is that important?



The **SHORT ANSWER** is that making that connection **FIXES** the Normal System Voltage relative to the Local Earth Voltage .... It is a safety precaution.

So, I hate to ask, but ... What happens if you **DON'T** do that ?

Well, a couple of things ...



Maybe you have been called to a smoke alarm problem where something happened to the house neutral connection ??

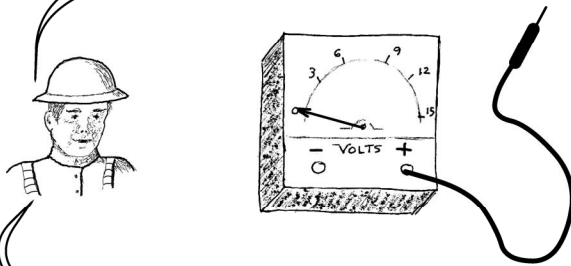
**YES!**  
On the last one an alarm clock started to smoulder and some other electronics were damaged.



**12:01 AM**

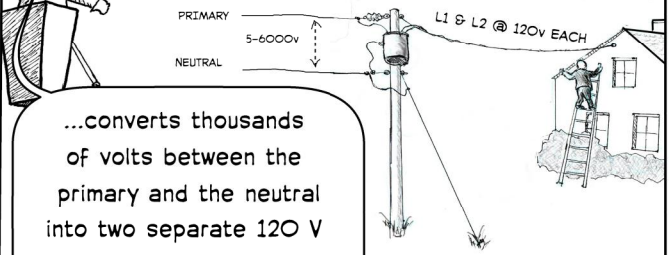
What was happening there?

Well, first we have to remember that "voltage" is a relative measurement



There is no absolute voltage, just the voltage difference between two points.  
That is why the voltmeter needs TWO leads ....

We have to also understand that by some Certified Magnetic Magic\* the transformer near your home ...

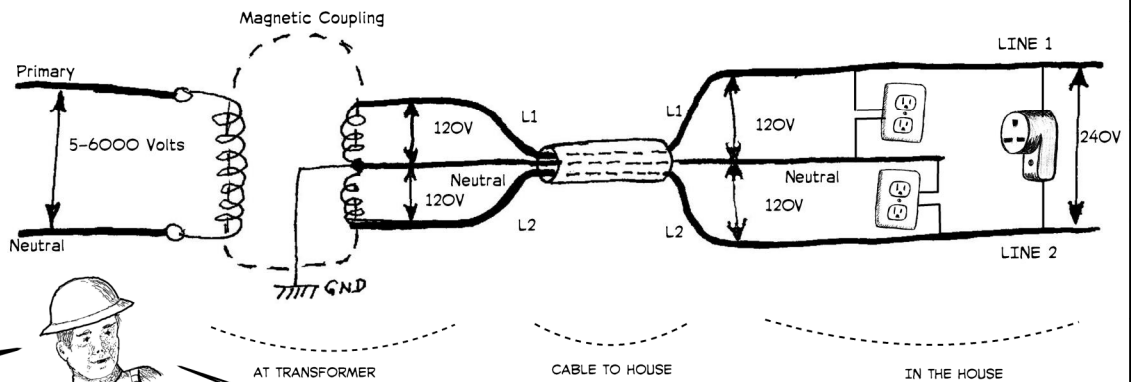


...converts thousands of volts between the primary and the neutral into two separate 120 V lines that run into your house with another neutral

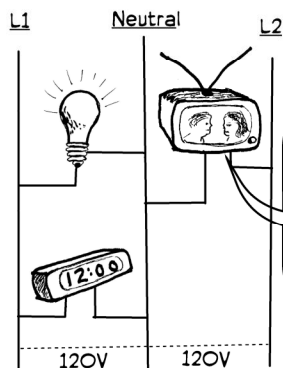
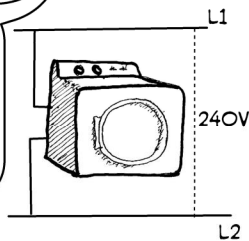
\* You might know that this "magic" requires "AC" - alternating current and shapes our utility system

**D  
O  
N'  
T  
P  
A  
N  
I  
C**

You Do NOT need to understand this schematic reference sketch of the Utility to House Circuit:

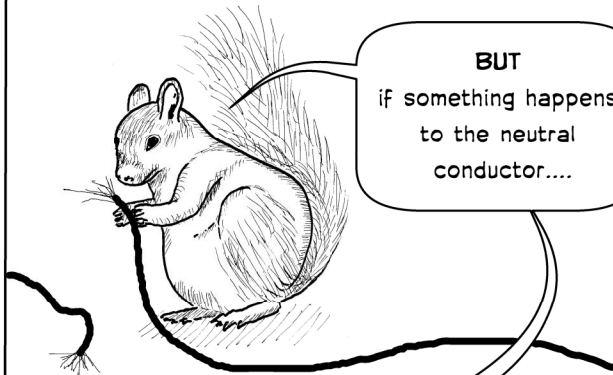


In the house big loads like the dryer, stove and water heater use both Line 1 (L1) and Line 2 (L2) to get 240 V



Smaller loads, like lights, clocks and electronics use the 120 V between Line 1 and Neutral Or Line 2 and Neutral

**BUT**  
if something happens to the neutral conductor....



... then the voltage of either Line 1 or Line 2 might drift much higher than 120V from the grounded neutral  
How much drift depends on the loads, **BUT ...**



## PROBLEM # 1:

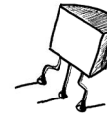
If the line voltage drifts too far above the nominal 120V, then the extra voltage drives extra current and power. The extra power causes heat which can lead to smoke and fire.



## PROBLEM # 2:

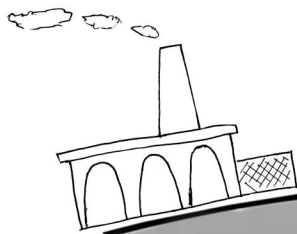


But even without the heat the extra voltage can exceed the insulator break down threshold, damaging components

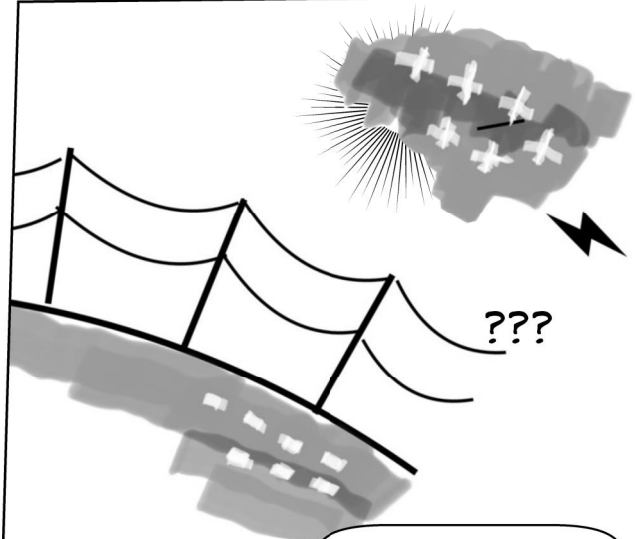


Often the damage is invisible !

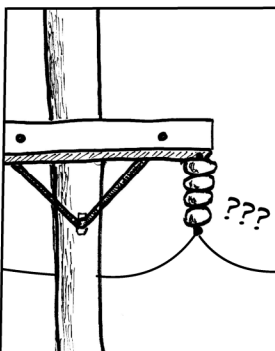
And in a related issue at Utility Scale:  
The Power Company can only control the voltage BETWEEN  
the primary and neutral conductors ...  
So, without the local ground connection .....



If negative charges in the ground gather under the positive charges of a thundercloud.... the atmosphere-to-ground voltage will rise. Sometimes lightning happens when the voltage exceeds the breakdown voltage of the insulating air.



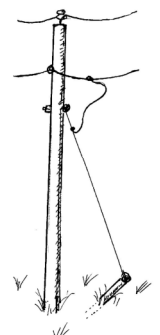
Who knows what the line-to-ground voltage might be ???

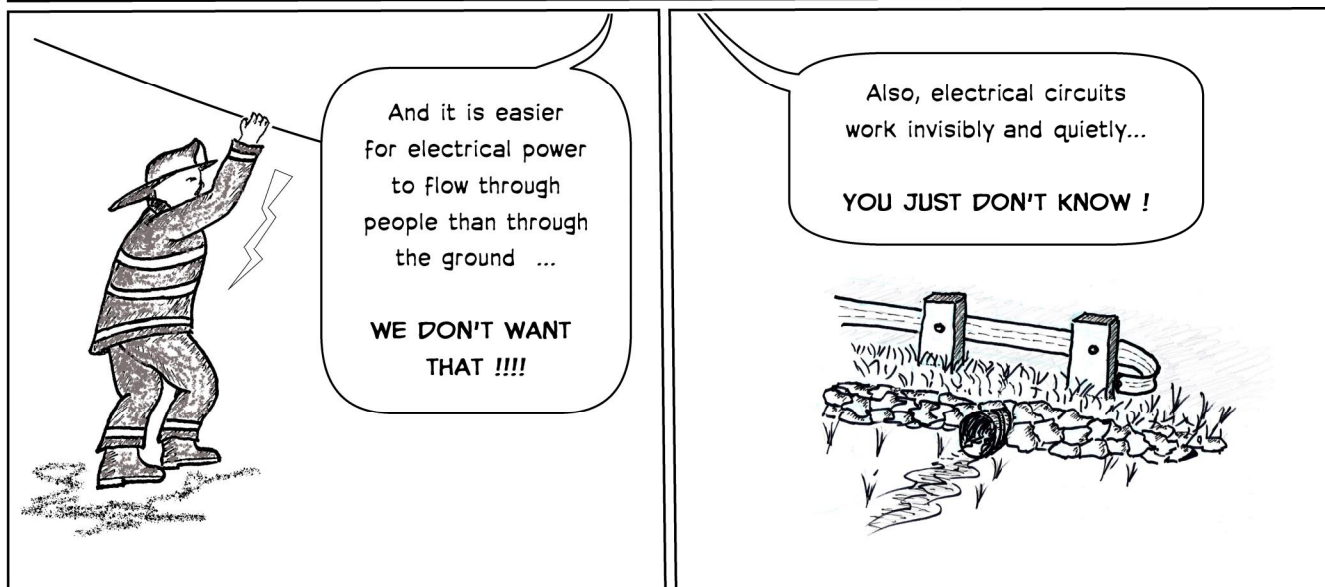
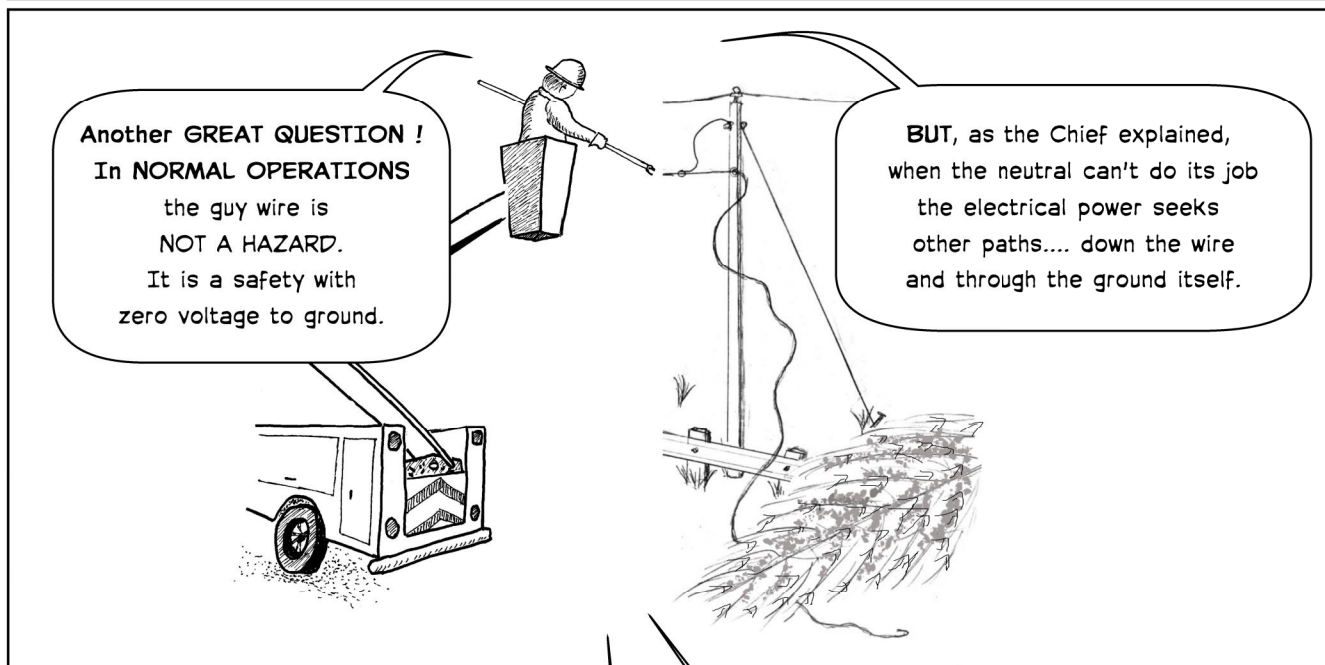
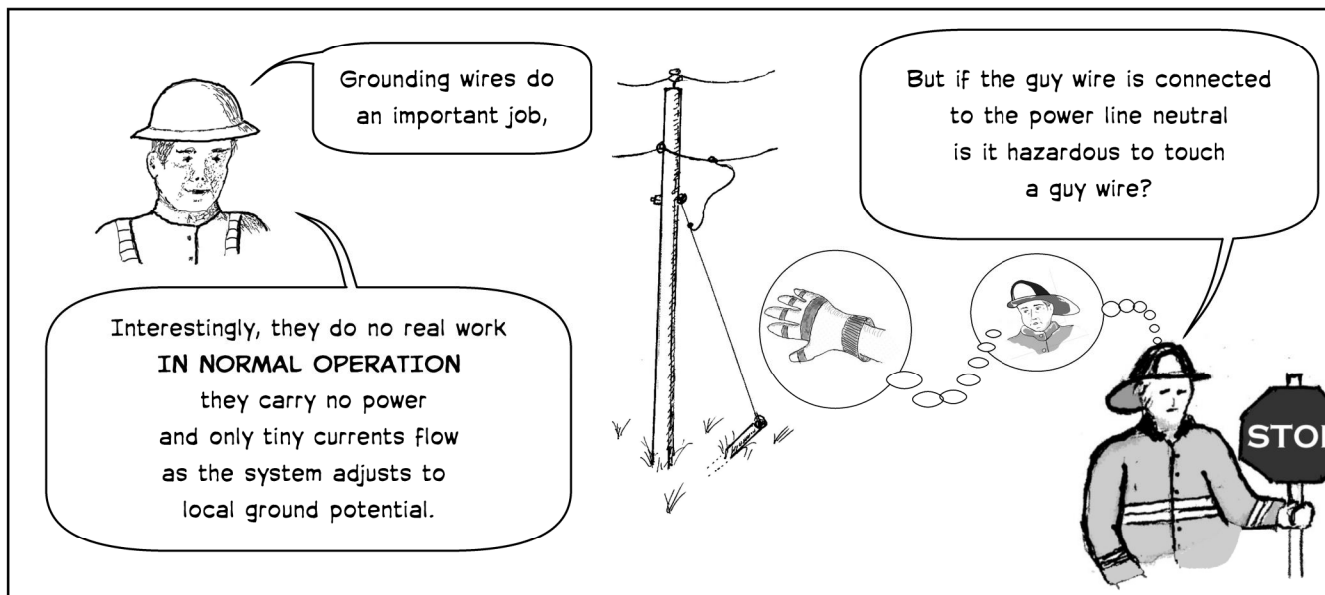


Again, we might exceed the insulator break down voltage on the transmission line,  
**NEVER MIND FRYING SOME DELICATE ELECTRONICS !**

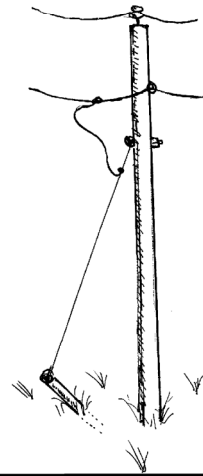
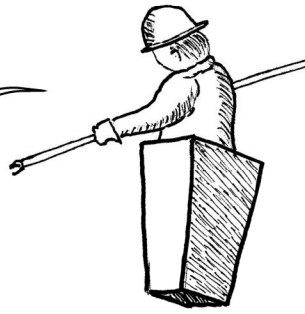


But tying the neutral to the local ground potential keeps the voltage differences within safe limits.





Maybe it sounds tricky ....  
The guy wires are not a hazard  
until there is a problem...  
One of those  
**"DON'T FEAR THEM,  
BUT RESPECT THEM"**  
situations.



Thanks for the  
explanation.



My pleasure.  
Just remember to assume...



**NO WIRE  
IS SAFE TO TOUCH-  
EVER !**

