



POTENTIAL SHOCK HAZARDS: HOT METERS, SERVICES AND OTHER ELECTRICAL HAZARDS ASSOCIATED WITH DISTRIBUTION SYSTEM MAINTENANCE

Presented By:

Mike Jacobs

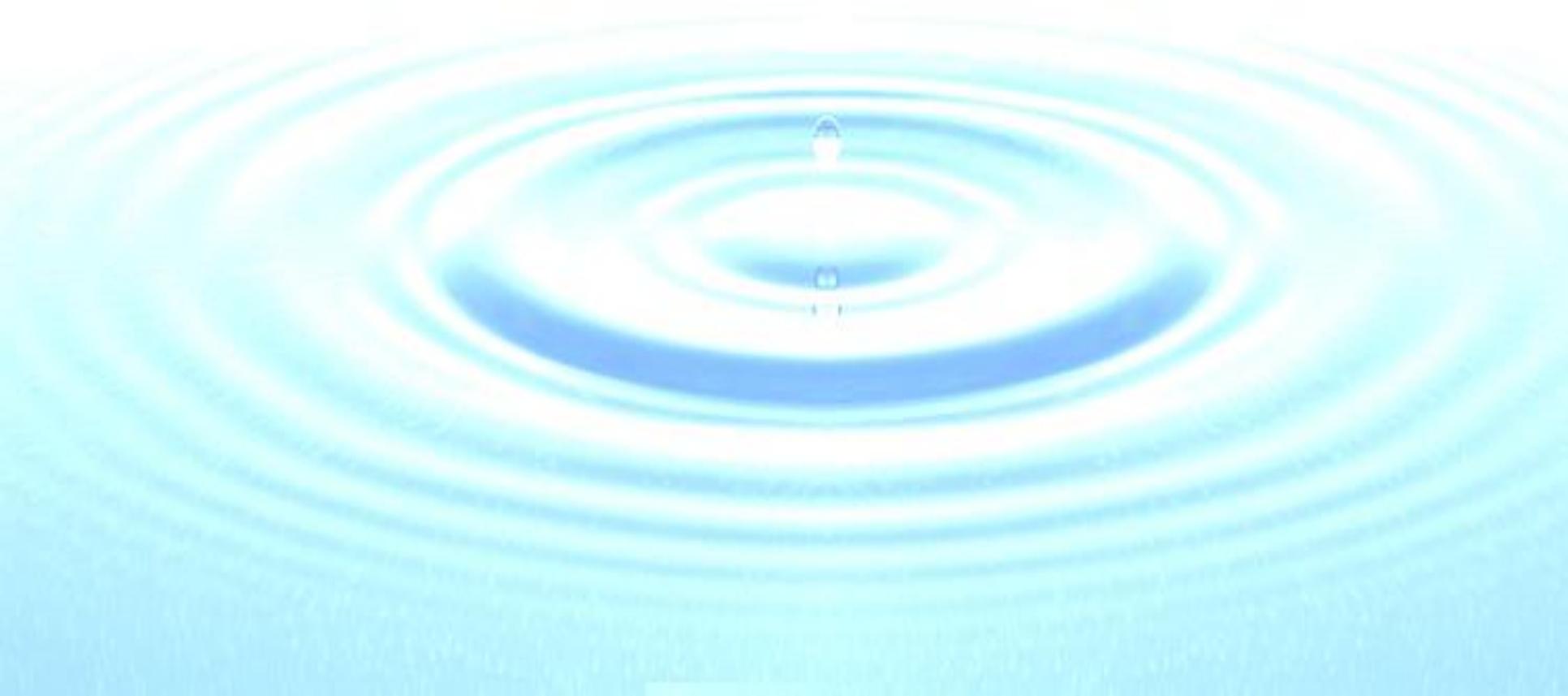
Safety Coordinator

Tualatin Valley Water District



Disclaimer

- I am not an electrician
- But, I know what it is like to get shocked.





So...Why are we here today???





Unless you can fly...





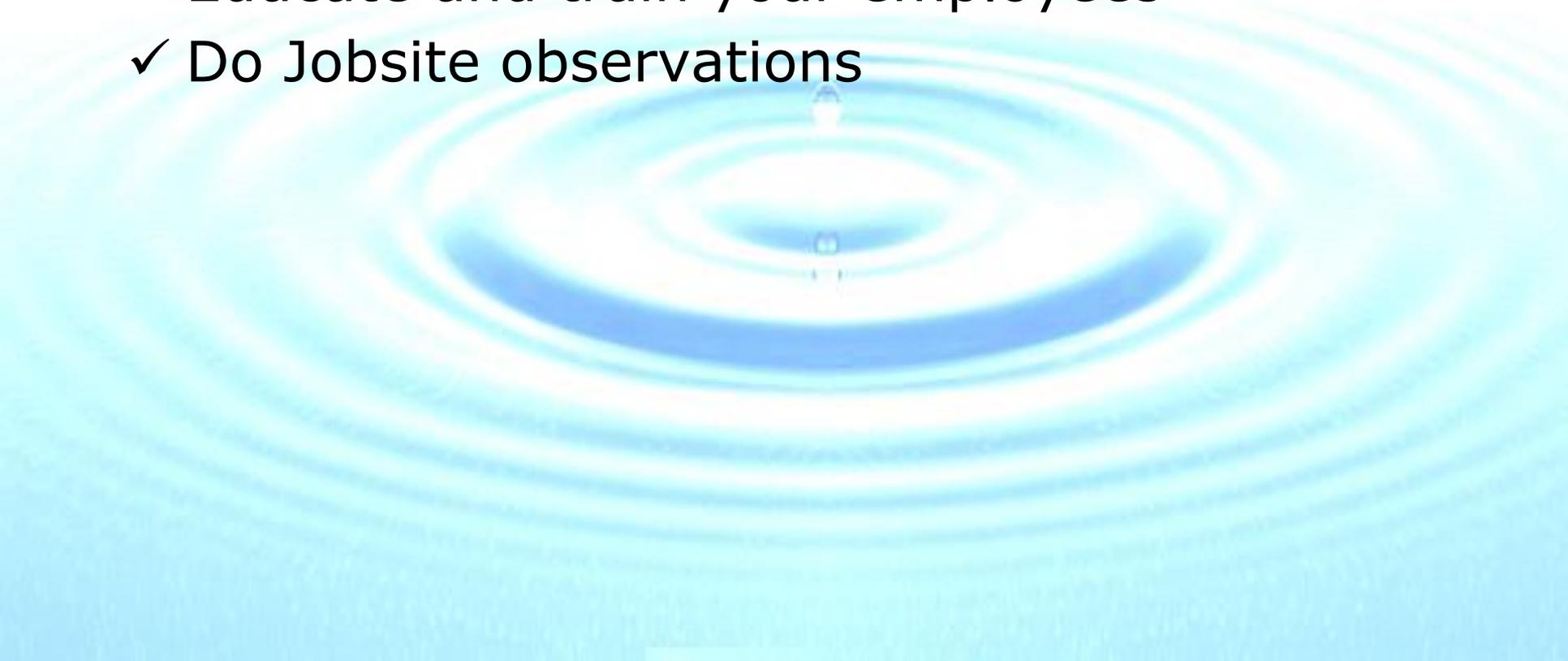
Overview

- According to The National Institute for Occupational Safety and Health (NIOSH), an average of 411 deaths occurs each year in the workplace due to contact with electrical energy.
- The Objective of this presentation is to increase an understanding of electrical hazards, and to reinforce awareness of the potentials that may be present in environments containing energized power equipment, and how to mitigate the hazards.



Planning

- ✓ Consider the Electrical facilities present in every work environment
- ✓ Educate and train your employees
- ✓ Do Jobsite observations



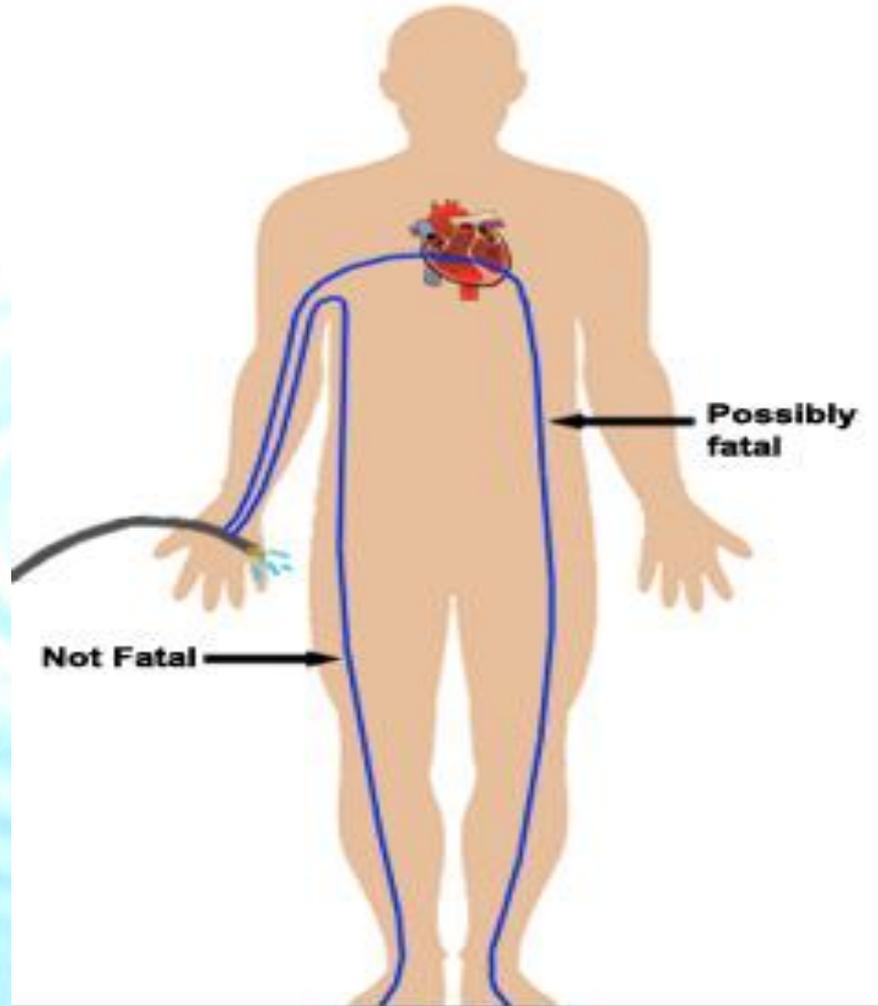
Effects on the Human Body

<u>Current</u>	<u>Effect</u>
1 Milliamp	Perception
5 to 9 Milliamps	Can't let go
20 to 50 Milliamps	Increasing pain
50 and above	Fibrillation

- Man's perception occurs at 1 milliamp. An individual can feel a tingling sensation.
- "Can't let go" occurs at about 9 milliamps. Muscles have contracted around the object.
- Effects of 50 milliamps are temporary if duration is short. Body returns to normal functions.
- 100 or more milliamps can completely stop the heart and inhibit breathing by contracting the chest muscles and blocking the nerve center of the brain that controls breathing.



Greatest Danger: Current Flow Resulting from Electrical Contact





Electrocutions

- The potential damage to the heart can send it into ventricular fibrillation.
- The diaphragm may seize up , constricting the lungs, and suffocating the victim
- The injury can cause other arrhythmia's that can prove fatal, hours after contact.

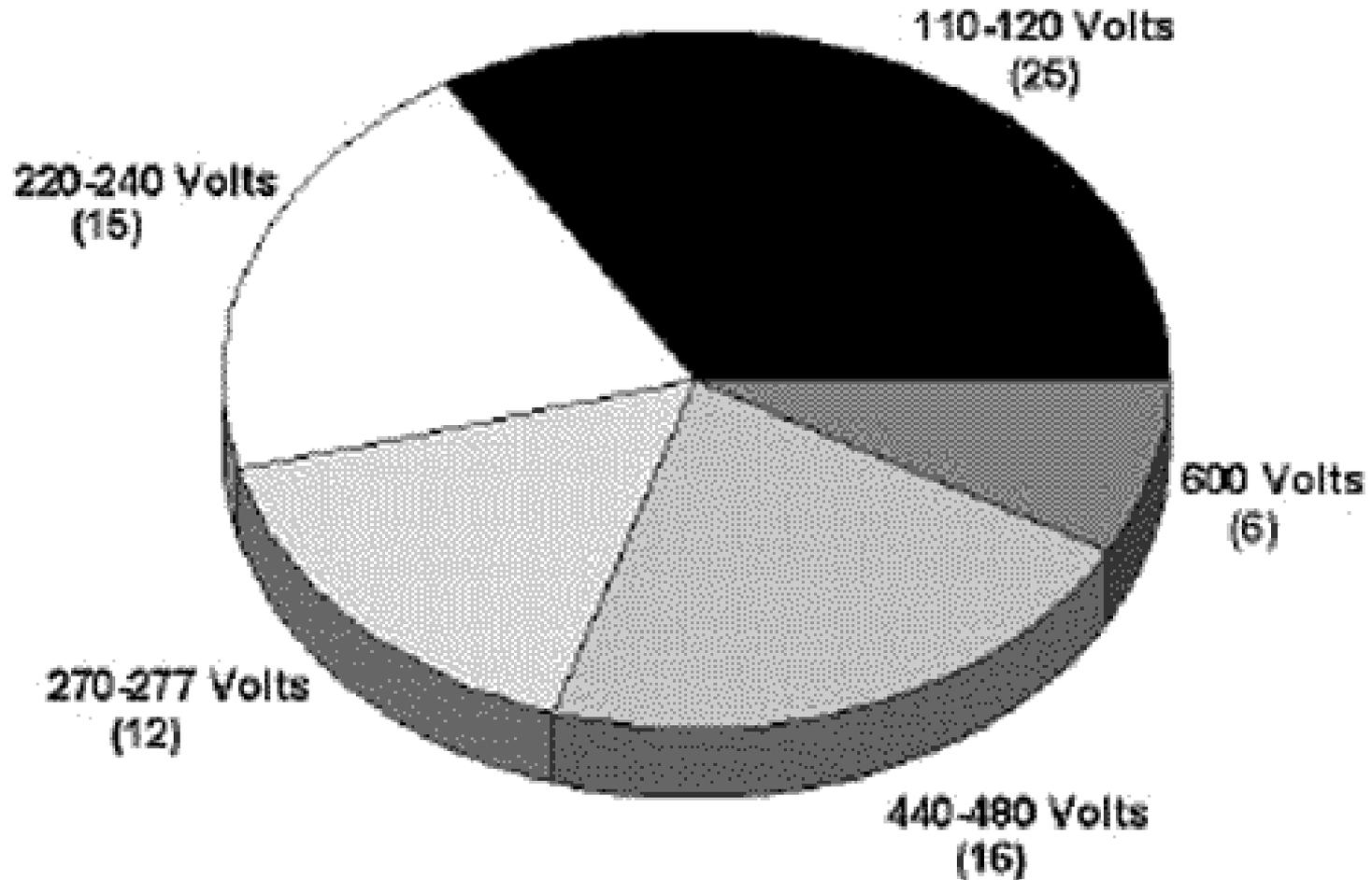


Electrical burn on hand and arm.





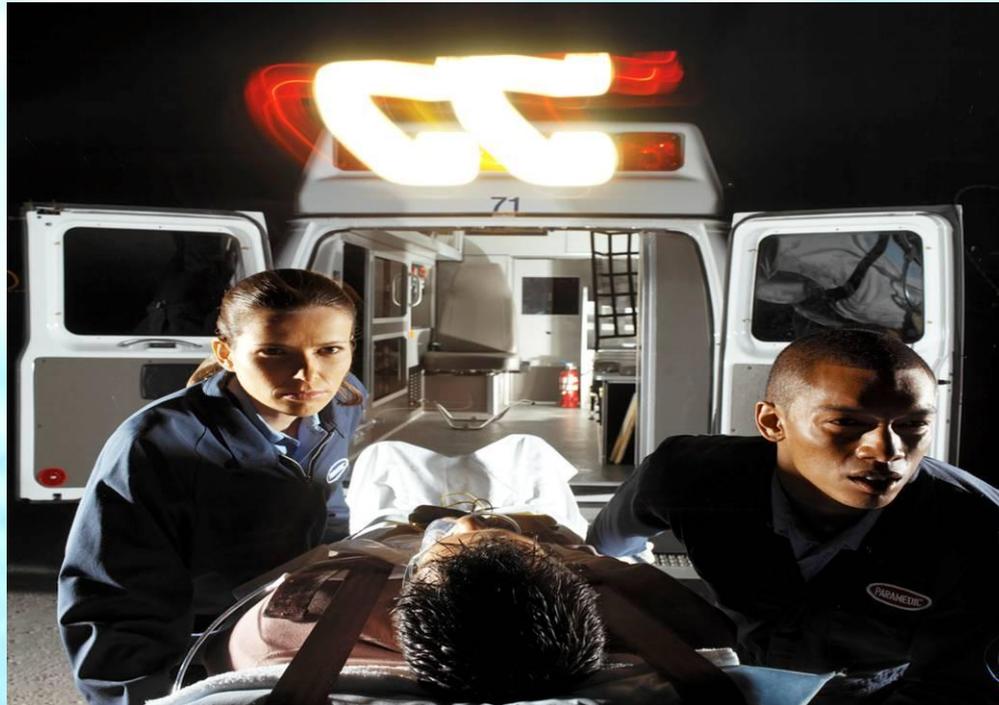
Figure 10. Frequencies of Electrocution Incidents Identified by FACE by Low Voltage Level (<600 Volts), 1982-1994





Electrical Injuries

- Every Electrical contact regardless of severity or appearance, should be taken seriously.
- After any electrical contact, seek medical attention as soon as possible.

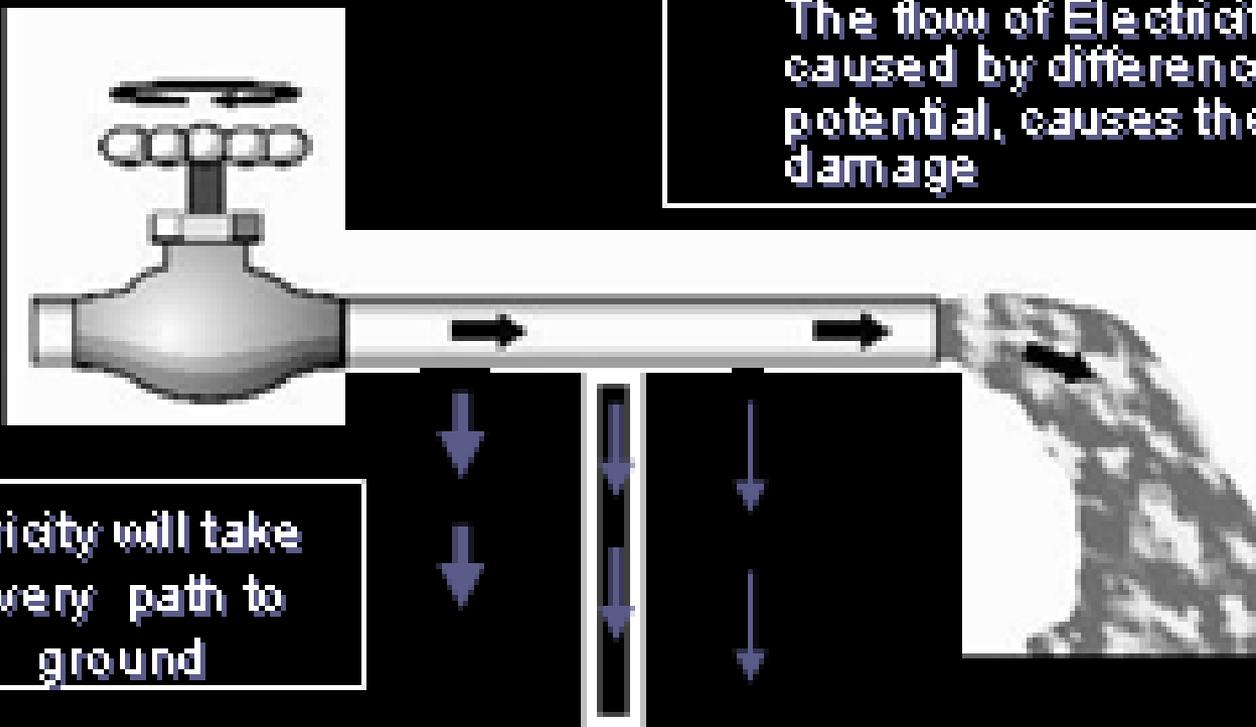


Electricity

The Free Flow of Electrons in a Closed Circuit

Electricity follows the path to ground (earth) that offers the least resistance.

The flow of Electricity, caused by difference of potential, causes the most damage



Electricity will take every path to ground



Water system analogy of Electricity

Water System	Electrical system	Function/Notes
Pump	Generator	The prime mover, supplies energy to the system to move electrons, Converts other energy to electrical energy
Pipe	Conductor (wire)	Object on which the electrical current flows, the larger the conductor the less the resistance, the less the resistance the more the flow
Water Pressure	Voltage (E)	The pushing force/electrical pressure
Water Flow	Current (I)	Amount of electricity flowing, Like gallons per minute
Restriction of the Water pipe	Resistance R	Property that restricts current flow. Increase resistance (i.e. reduction in pipe size) reduce current flow
Rate of work of the water pump	Power (P)	Rate at which electrical energy is changed into another form of energy

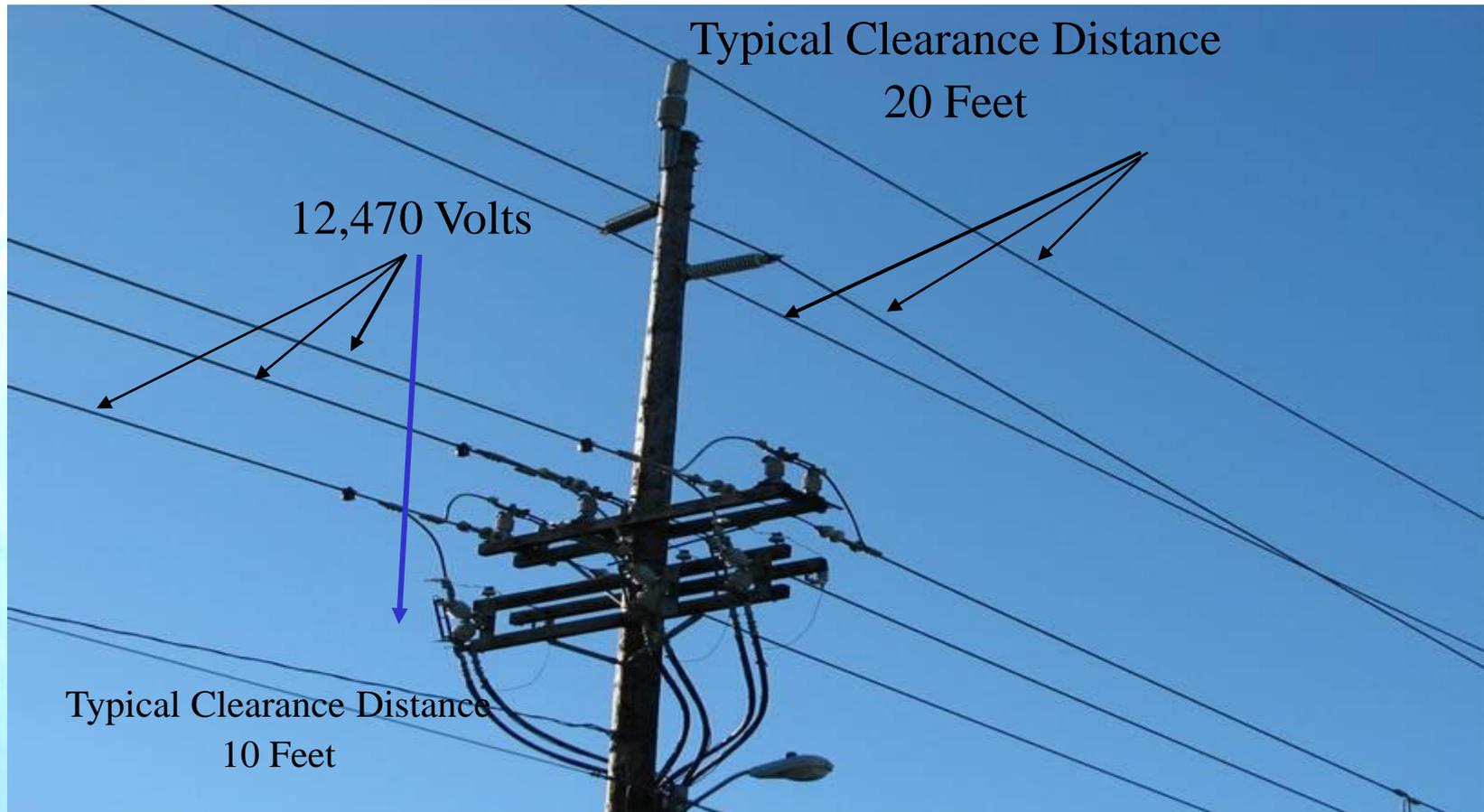


ARC-FLASH





Multiple Circuit Transmission and Distribution







12470 Volt UG Vault





UG Pad Mount Single Phase Transformer 120v,208v,240v,277v,480v





Deception

PROBLEMS OF COMMUNICATION CABLES HAVING THE SAME JACKET COLORS AS POWER CABLES IN TRENCHES

For the last number of years we have been trying to interest the Oregon PUC Safety Committee in developing rules which would define the acceptable colors which could be used by power utilities, telephone companies, cable-TV companies and fiberoptic companies to easily identify their cables and ducts after being installed underground. We are aware of an identification problem because a few line crews have randomly given us samples of telephone or cable-TV ducts which look very much like our #2 jacketed primary cable with the red stripes. An examples of these ducts are shown below.



Cable-TV cable

PGE #2 primary cable

Telephone duct with drop wire

Which items above are #2 primary cable and which items are communications cable or duct? (Check out the color photo on the Std. webpage to get a better idea of the problem.)

Since we are trying to build a case and get the PUC's attention as well as the cooperation of the other utilities in the state, we would appreciate more examples of these black with red stripe communication cables/ducts when you see them in the field. If possible we would like a small sample (around 12") cut from the end of the run (not out of the middle!!). Tag the sample with the field location, the utility name if you know it and your name/crew # so that we can get back to you if needed. Send the sample to Ken Prier, 3WTC0406.

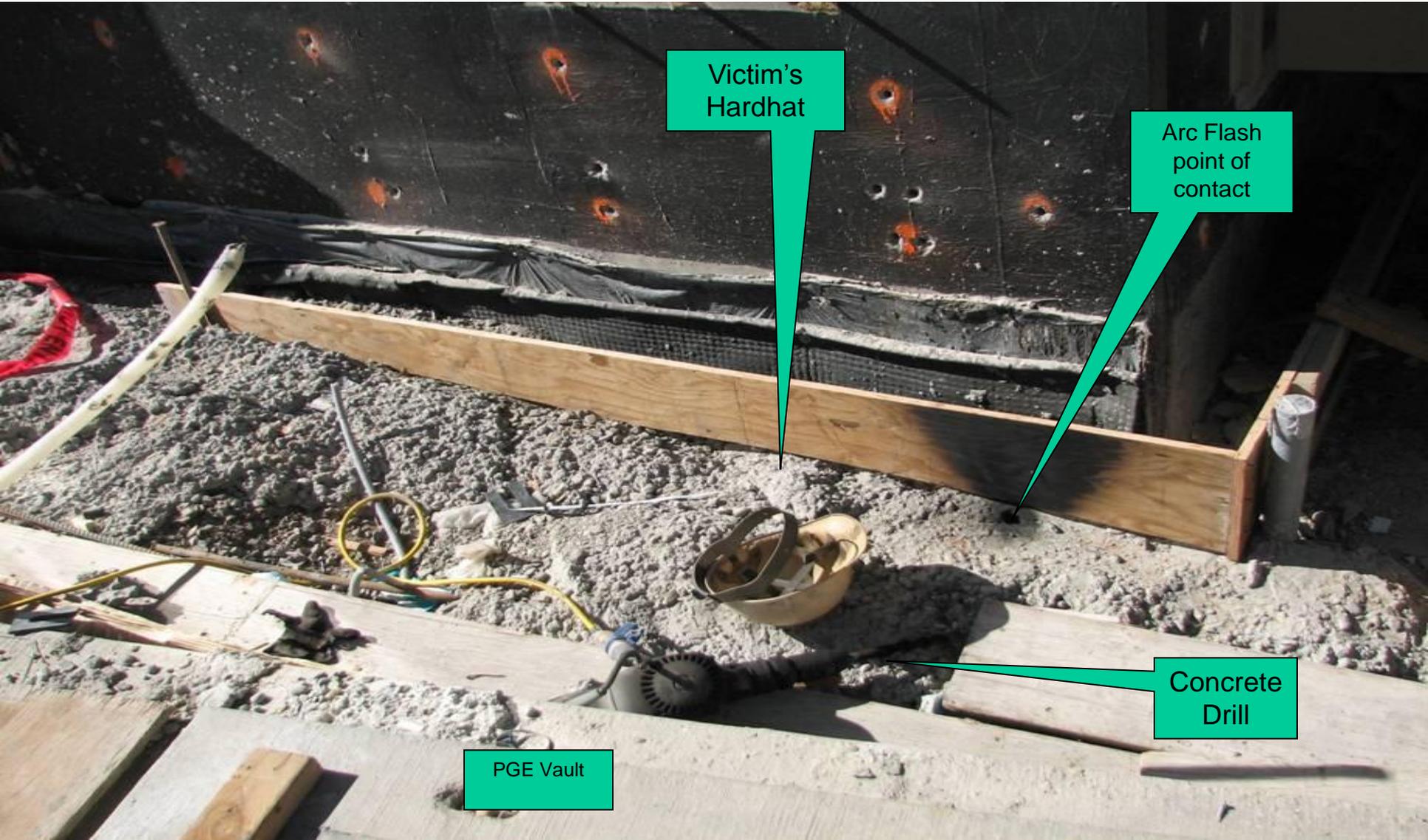
With your help we hope to have the Oregon PUC support a rule which restricts the use of the black solid color with red stripes on both cables and duct to electric utilities.

PGE PROPRIETARY MATERIAL - THIS INFO IS BASED ON ASSUMPTIONS & CRITERIA WHICH MAY NOT BE VALID OUTSIDE THE PGE ELECTRIC SYSTEM - FOR INTERNAL USE ONLY

P.G.E. CO. TECHNICAL NOTE	X	T&D	SUBSTATION	DATE	APRIL 2000
					L2000-01
					Page 5 of 7



Overton Incident



Victim's
Hardhat

Arc Flash
point of
contact

Concrete
Drill

PGE Vault



**Know what's below.
Call before you dig.**

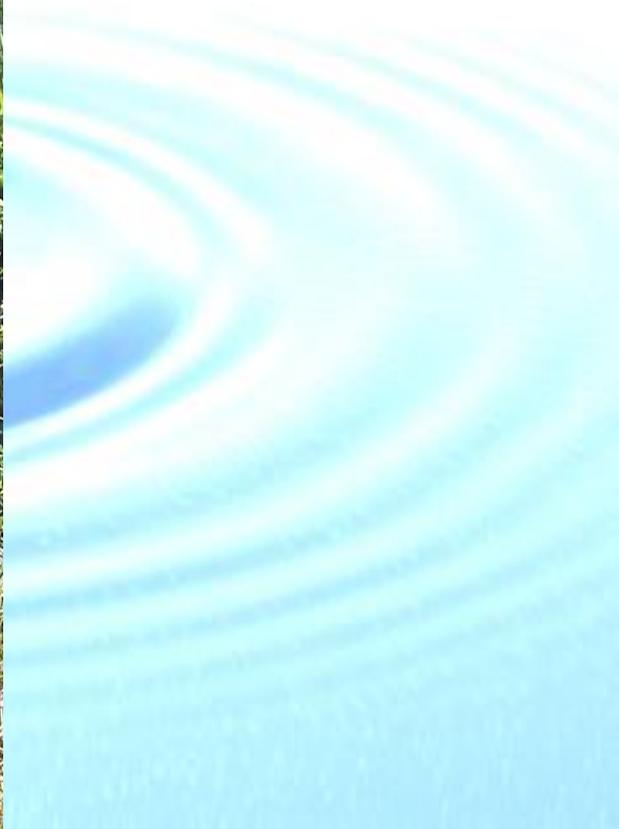
115,000 Volt – 500,000 Volt Steel Lattice Towers



Typical Clearance Distance
25 Feet











A water utility maintenance worker from New South Wales was electrocuted while repairing a water service that involved cutting the pipe at a private residence.



A Safety Alert issued on March 18, 2005 from New South Wales, reminds utility workers and plumbers, that a fatal shock can occur when removing a water meter, and cutting through or disconnecting metallic water pipes or services.



Hot Meters/Services

The potential for electrical shock always exists when the electric service for a building has been grounded to a water service line



The main factor in these types of incidents is a fault in the electrical system in the area.

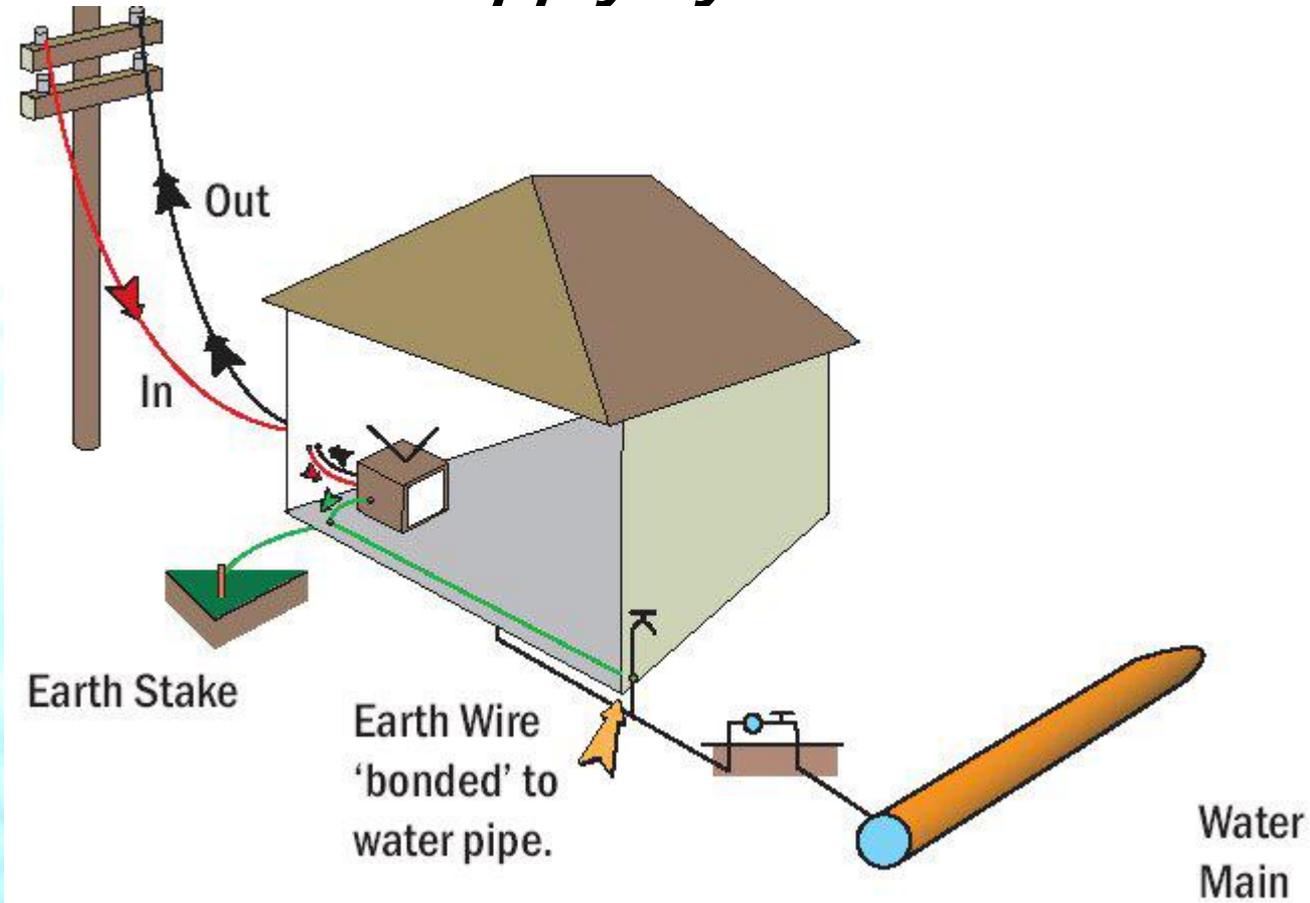
The fault may occur on the premises or in the street, causing the metallic piping of the water supply to become “live”.

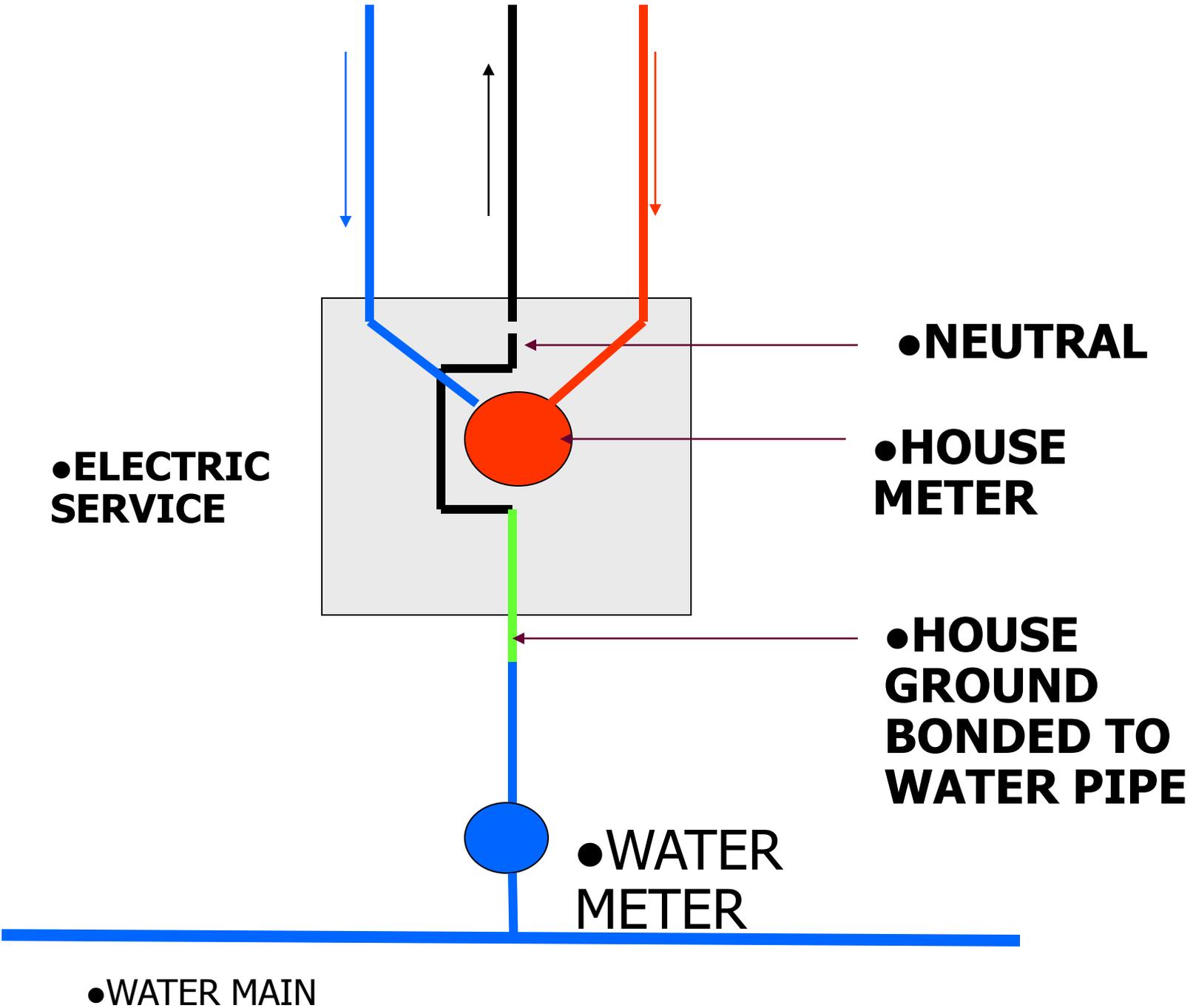


Local Code, which is based on the National Electric Code Article 250.30(4), requires that a buried cold water pipe be used as an electrical ground. The code also requires that a supplemental grounding rod to be used in addition to the cold water plumbing.



Link between the electricity system and the water supply system

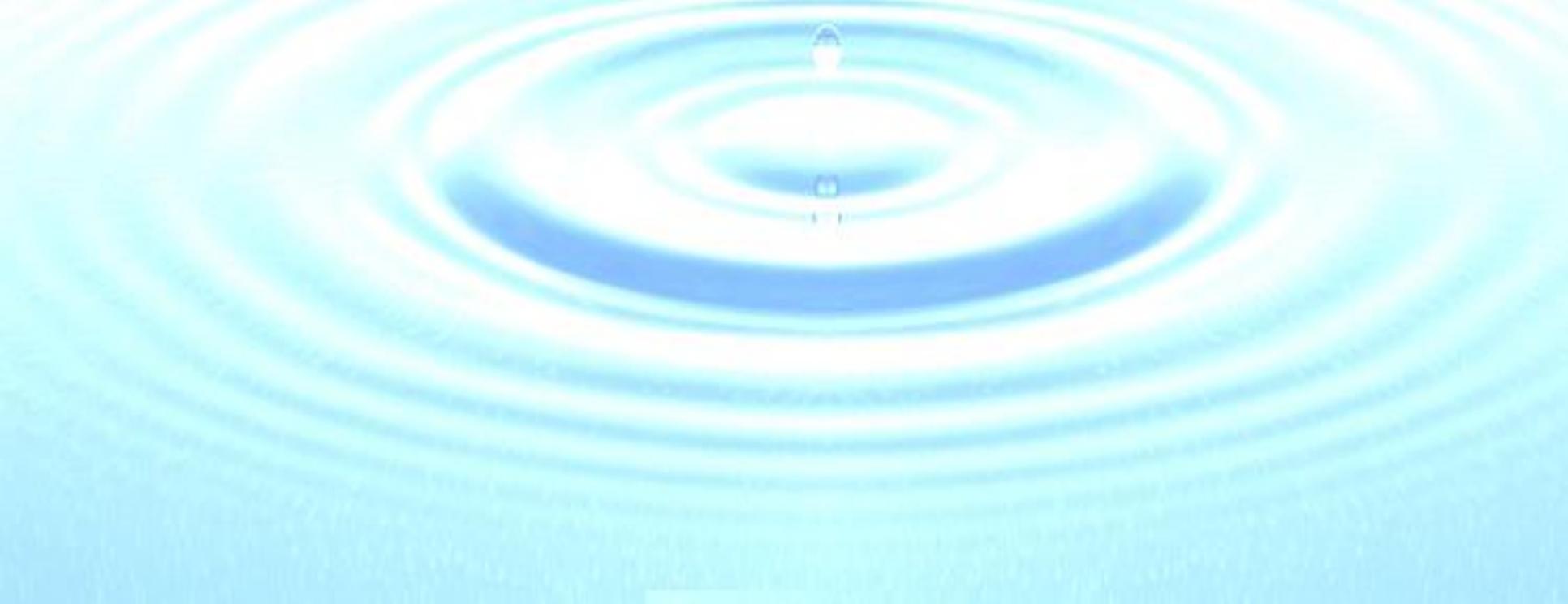






Identifying Hazardous Properties

To determine the need to take precautions you must check the composition of the service line at the location of work as well as adjacent properties.

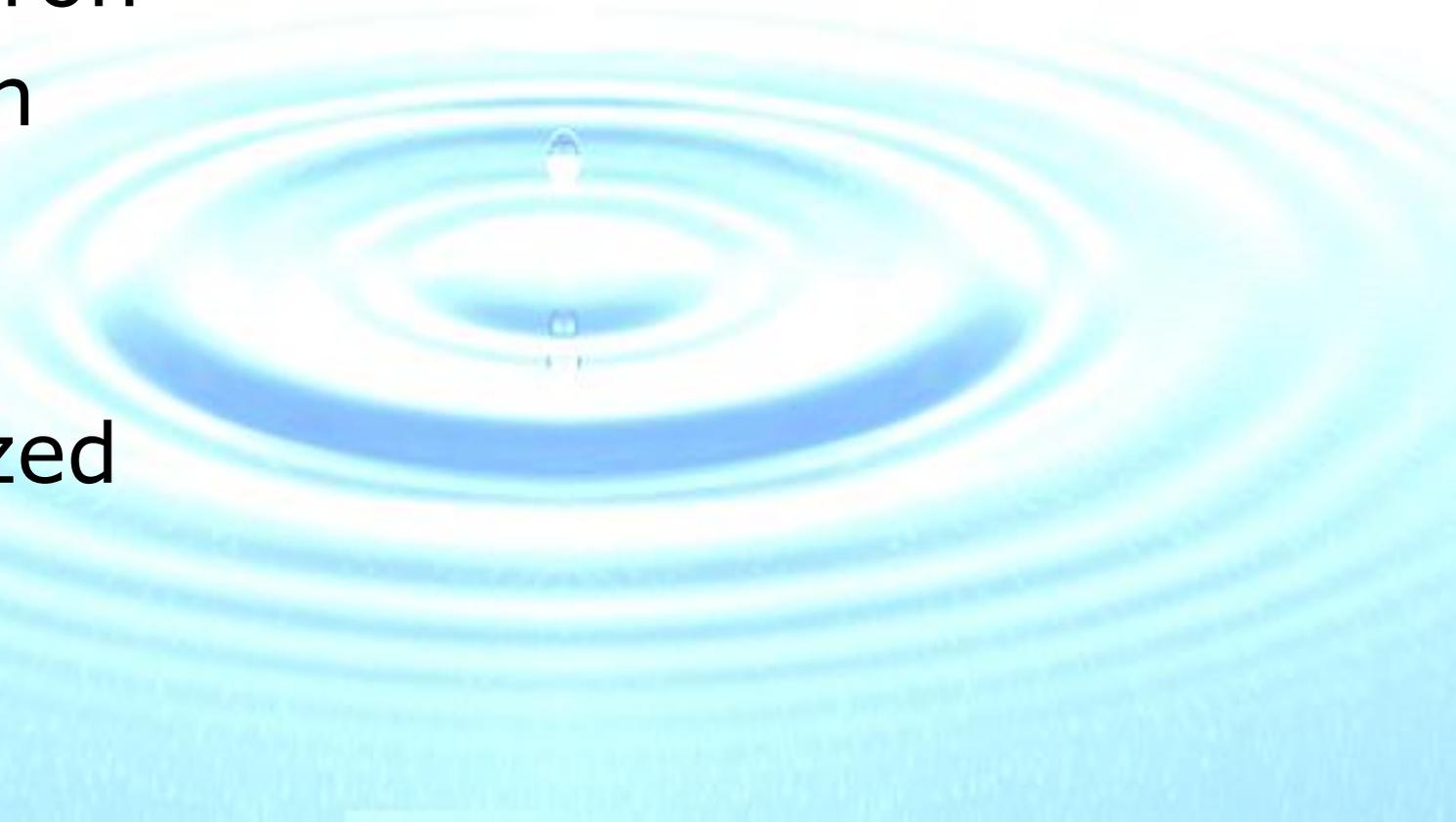




Identifying Hazardous Properties

Types of pipes that act as conductors

- Ductile iron
- Cast iron
- Steel
- Copper
- Galvanized





When performing the following tasks at hazardous locations:

Meter exchange

Cutting metallic pipe for repairs

Connecting existing services back to the main

Replacing curb stops

The following precautions should be taken:



**Jumpers are a common device used but,
they are not always effective.**

Commonly used

Better Jumper





If you use jumpers, clean the pipe





Attach securely





Wear Approved Gloves

•Glove Keepers

•Class 00
•Glove



•Never wear rubber gloves without the keepers



Rubber Gloves Care & Storage

- **VISUAL INSPECTION** -CHECK FOR DEFECTS SUCH AS CUTS, NICKS AND CRACKS
- **AIR TEST** – CAPTURE AIR AND CHECK FOR PINHOLES
- **GLOVE PROTECTORS (KEEPERS)** – INSPECT FOR TEARS CUTS AND ANY OTHER DAMAGE
- **RUBBER GLOVES SHALL BE STORED IN A COOL DRY LOCATION WITH GAUNTLETS DOWN**
- **REPLACE GLOVES AND OR PROTECTORS IF THEY FAIL INSPECTION OR TEST**



● **A THOROUGH VISUAL INSPECTION IS A MUST**

A close-up photograph of a blue nitrile glove being inflated by a hand. The glove is held open, and the hand is blowing into it from the bottom. The background is a light-colored surface, possibly a table. The text is overlaid on a yellow rectangular background at the bottom left of the image.

● INFLATION OF GLOVE WILL REVEAL SMALL HOLES



Check service line with ampere meter



●07.0 Read



AMPERE METER USE

- TURN METER ON AC AMPERE SCALE 20A SETTING. (**Make a permanent mark on the Ampere Meter indicating the desired position.**)
- OBSERVE READOUT SCREEN- SHOULD READ 0
- CHECK SCREEN FOR LOW BATTERY INDICATION (**LOW BATTERY WILL GIVE FALSE READS**)
- TEST METER TO ENSURE IT IS READING ACCURATELY



AMPERE METER USE

- Observe screen readout to make sure hold button is not activated
- With one hand on tester, attach around water pipe and depress hold button (**Gloves that have been properly inspected and tested must be used**)
- Observe meter read- if you have a reading note the work order and notify your supervisor/Safety Coordinator
- The source of the current may not be constant and therefore a 0 reading does not mean there is no hazard.



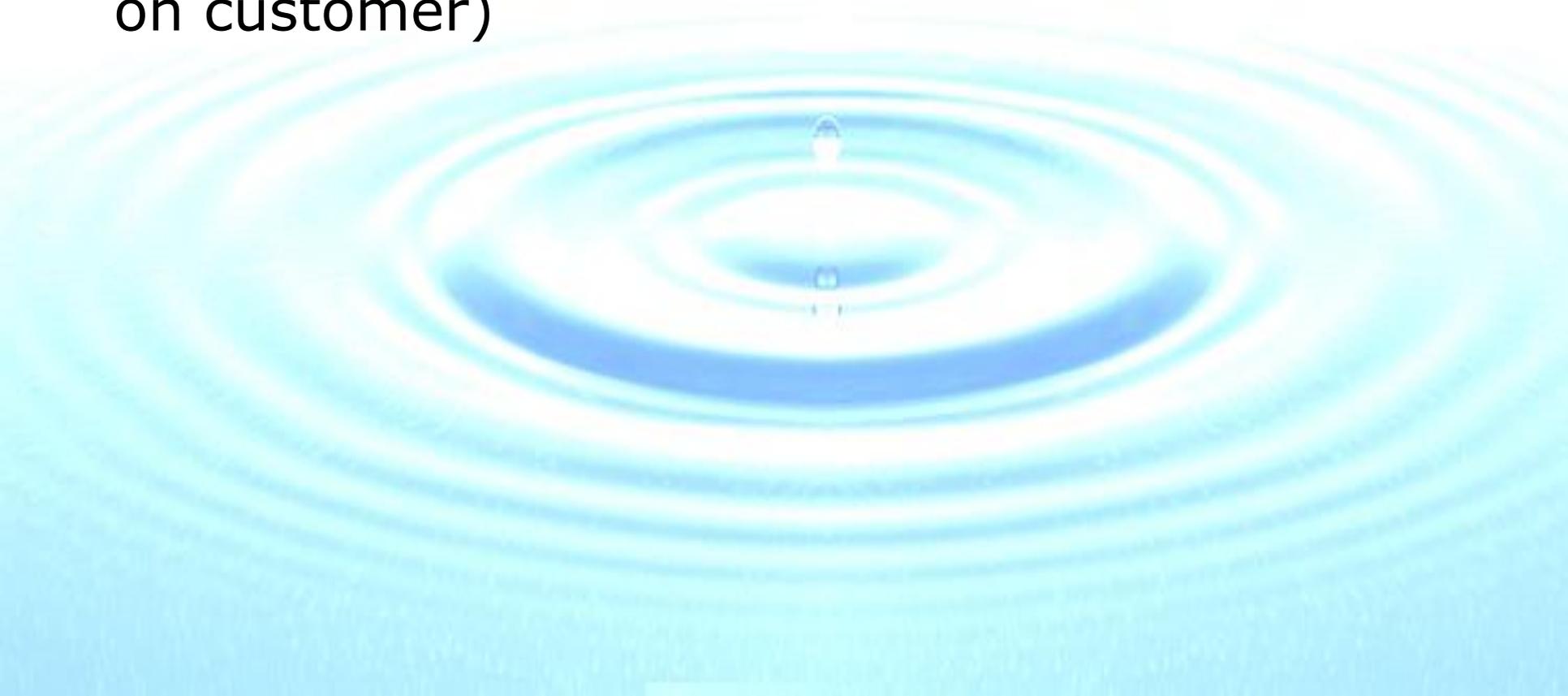
Service / Main line Repair

- All of the precautions described above are required when cutting service or main lines.
- Jumper may be installed around area to be repaired. If this is not possible remove meter/s with in the affected length of pipe.
- Other considerations



Other Options?

- Permanent jumpers
- Insulating water services (must consider effect on customer)





**“NO JOB IS SO IMPORTANT,
OR SERVICE SO URGENT,
THAT WE CANNOT TAKE THE
TIME
TO PERFORM OUR JOB
SAFELY”**