Electrical



INCIDENT

The Occupational Safety and Health Administration (OSHA) cited tank railcar cleaning and repair provider Dana Railcare for workplace safety and health violations at its facility in Wilmington, Delaware. The company faces $371,276 in penalties.

OSHA cited Dana Railcare and proposed more than $550,000 in penalties for safety and health violations following a May 2019 employee fatality at the company's facility in Pittston, Pennsylvania. Also last year, the agency placed Dana Railcare into the agency's Severe Violators Enforcement Program (SVEP). The company is contesting the citations and proposed penalties stemming from the May 2019 incident.

OSHA issued new citations following a pair of inspections conducted after receiving a complaint of numerous safety and health hazards at the Wilmington facility.

On February 20, OSHA issued citations for 23 violations overall. Agency inspectors cited the company for **Electrical and Explosion Hazards**, improper use of respirators and inadequate secondary air supply, insufficient means of egress, lack of medical clearance for respiratory protection use, lack of signage in a silica-regulated area, and use of defective powered industrial trucks.

On November 25, 2019, OSHA cited Dana Railcare for 13 violations related to the May 2019 worker fatality. **An Employee was Asphyxiated While Servicing a Railcar Containing Crude Oil Sludge**. OSHA cited the company for 4 willful and 3 serious violations for failing to protect employees from the hazards of entering permit-required confined spaces and for inadequate respiratory protection procedures.

In the latest set of citations, OSHA cited Dana Railcare for 1 willful, 2 repeat, 19 serious, and 1 other-than-serious violations. The agency issued a willful citation for 19 separate instances of employees entering tank cars for cleaning and maintenance without an auxiliary air supply.

"Failure to comply with OSHA standards leaves employees vulnerable to dangers that can cause serious and potentially fatal injuries," OSHA Area Director Erin Gilmore said in an agency statement.

The agency also issued citations for repeat violations of the respiratory protection and wiring methods, components, and equipment standards. Dana Railcare previously was cited on July 25, 2016, for lack of medical clearance for respiratory protection use at its Nitro, West Virginia, facility. The company previously was cited on February 8, 2017, for using flexible cables and/or cords as a substitute for fixed wiring at the Wilmington facility.

Citations for serious violations included:

- Failing to conduct annual respirator fit testing;
- Failing to cover a junction box that housed the connection for a ceiling fan;
- Failing to Ensure Electrical Equipment Feeding a Distribution Panel was Approved by a Nationally Recognized Testing Laboratory and Marked with the Manufacturer's Name, Trademark, and other information;
- Failing to ensure a flexible cord was of a continuous length without splicing;
- Hazardous chemicals present along an exit route and obstructed exit routes, as well as emergency exits lacking "Exit" signs;
- Use of powered industrial trucks with damaged tires and failing to inspect powered industrial trucks; *and*
- Several violations related to the company's paint booth and sandblasting operations.

Severe violators are subject to mandatory follow-up inspections. Other steps the agency takes with severe violators include issuing regional or national news releases and sending letters to corporate officers about the company's obligations under the Occupational Safety and Health Act (OSH Act).

NEED TO KNOW

Workers in almost every work environment are exposed to electrical currents powerful enough to cause death by electrocution. Yet many workers are unaware of the potential hazards, which makes them even more vulnerable to the dangers.

There are four main types of injuries that can result from electrical currents. These are:

1. Electrocution, which is fatal;
2. Electric shock;
3. Burns; and
4. Falls, which may occur when a worker contacts electrical energy.

Hazards / Dangers associated with electricity affect the majority of workplaces. In general industry, construction, or farming electrical hazards / dangers are present. The task is to have the ability to identify and recognize electrical hazards around you and then to reduce / mitigate and eliminate them.

The dangers of negligent use and non-diagnosed electrical equipment problems is manifold. Electricity kills!!!

- The current of a 60-watt light bulb can kill you.
- Between 1992 and 2010 there were 5,096 fatalities in the United States due to fatal contact with electricity. There was a total of 66,748 injuries that required days away from work in the same time period due to

electricity. **The construction industry experiences the** majority of injuries and fatalities due to electricity**.** These statistics do not include injuries caused by secondary events. For example, an individual falling from a ladder due to getting shocked. If these types of injuries were included, the statistics would be higher.

Everyday there are workers who suffer some type of shock, but do not seek or require treatment for their injuries. Because of this, it is difficult to fully track the occurrence of electrical shock in the workplace.

Causes of electrical shocks

Electricity travels in closed circuits, normally through a conductor. But sometimes a person's body—an efficient conductor of electricity—mistakenly becomes part of the electric circuit. This can cause an electrical shock. Shocks occur when a person's body completes the current path with:

- Both wires of an electric circuit
- One wire of an energized circuit and the ground
- A metal part that accidentally becomes energized
- Another "conductor" that is carrying a current

When a worker receives a shock on the job, electricity flows between parts of the body or through the body to a ground or the earth.

Effect of shocks on the body

An electric shock can result in anything from a slight tingling sensation to immediate cardiac arrest. The severity depends on:

- Amount of current flowing through the body
- Current's path through the body
- Length of time the body remains in the circuit
- Current's frequency

How can workers tell if a shock is serious?

A severe shock can cause considerably more damage than meets the eye. A victim may suffer internal hemorrhages and destruction of tissues, nerves, and muscles that aren't readily visible. Renal damage also can occur. If an employee receives a shock, he or she should seek emergency medical help immediately.

What kind of burns can a shock cause?

Burns are the most common shock-related injury. An electrical accident can result in an electrical burn, arc burn, thermal contact burn, or a combination of burns.

- *Electrical burns*are among the most serious burns and require immediate medical attention. They occur when electric current flows through tissues or bone, generating heat that causes tissue damage.
- *Arc or flash burns*result from high temperatures caused by an electric arc or explosion near the body. These burns should be treated promptly.
- *Thermal contact burns*are caused when the skin touches hot surfaces of overheated electric conductors, conduits, or other energized equipment.

Thermal burns also can be caused when clothing catches on fire, as may occur when an electric arc is produced.

Why do people sometimes “freeze” when they are shocked?

When a person receives an electrical shock, sometimes the electrical stimulation causes the muscles to contract. This “freezing” effect makes the person unable to pull free of the circuit. It is extremely dangerous because it increases the length of exposure to electricity and because the current causes blisters, which reduce the body’s resistance and increases the current.

The longer the exposure, the greater the risk of serious injury. Longer exposures at even relatively low voltages can be just as dangerous as short exposures at higher voltages. Low voltage does not imply low hazard.

In addition to muscle contractions that cause “freezing,” electrical shocks also can cause involuntary muscle reactions. These reactions can result in a wide range of other injuries from collisions or falls, including bruises, bone fractures, and even death.

What should employees do if a co-worker “freezes” to a live electrical contact?

If a co-worker is “frozen” to a live electrical contact, employees should shut off the current immediately. If this is not possible, they can use boards, poles, or sticks made of wood or any other nonconducting materials and safely push or pull the person away from the contact. It’s important to act quickly, but employees should remember to protect themselves as well from electrocution or shock.

S**tatic electricity is hazardous**

Static electricity also can cause a shock, though in a different way and generally not as potentially severe as the type of shock described previously. Static electricity can build up on the surface of an object and, under the right conditions, can discharge to a person, causing a shock. The most familiar example of this is when a person reaches for a door knob or other metal object on a cold, relatively dry day and receives a shock.

However, static electricity also can cause shocks or can just discharge to an object with much more serious consequences, as when friction causes a high level of static electricity to build up at a specific spot on an object. This can happen simply through handling plastic pipes and materials or during normal operation of rubberized drive or machine belts found in many worksites.

In these cases, for example, static electricity can potentially discharge when sufficient amounts of flammable or combustible substances are located nearby and cause an explosion. Grounding or other measures may be necessary to prevent this static electricity buildup and the results.

What’s Arc Flash?

Arc flash, a release of heat energy that includes molten metals, hot metallic oxides and toxic burning smoke, is often violent, and deadly. Arc flash temperatures exceed 35,000 degrees Fahrenheit, hotter than the sun’s surface, with 700 miles per hour projectile-producing pressure, which can throw a person

across a room.

An estimated five to 10 arc flashes occur each day in the United States, according to a report from the National Institute for Occupational Safety and Health.

Arc flashes pose a particular risk **offshore**, where lower voltage machinery with between 480 and 600 voltages while not recommended is frequently worked on without the machinery being shut down. While no work is or should be done live on medium voltage machinery in general, work done on low voltage motor control centers and distribution boards cannot typically be shut down in a critical operation. Never work on live equipment but the reality is that people sometimes do.

A stumble by a worker or a dropped tool may cause conductors to be crossed, creating a blast. Damaged or overheated equipment, particularly **offshore**, are other factors that can lead to an arc flash.

One arc flash incident can cost up to $15 million, including healthcare costs, workers compensation, replacing equipment, increased insurance premium, and lost production time.

A 2010 report from the International Oil & Gas Producers Association found that 16.1 percent of all fatalities at oil fields were caused by an **electrical accident, explosion or burn.**

Fires and explosions are the third most common cause of worker death in the **oil and gas industry**. One out of seven occupational fatalities in the **oil and gas industry** results from a fire or explosion. From 2004 to 2008, fires and explosions caused 18.7 percent of worker deaths in the **oil and gas industry**, according to the U.S. Bureau of Labor Statistics.

BUSINESS / REGULATIONS

Common hazards, legal duties and precautions to take when working with electricity.

Electrical safety at work should be a concern to all organizations.

Electricity at Work Regulations

The **ELECTRICITY AT WORK REGULATIONS** apply to all aspects of the use of electricity within the workplace. They place duties on employers, employees and the self-employed to prevent danger.

Duty holders must

- have the electrical systems constructed in a way that prevents danger
- maintain the electrical systems as necessary to prevent danger (including a 5 year fixed installation inspection)
- carry out work on electrical systems carried out in a way that prevents danger.

Electrical equipment used in hazardous environments must be constructed or protected to prevent it becoming dangerous. This includes

- extremes of weather
- extremes of temperature
- corrosive conditions.

Employees should only work on or with electrical equipment if they have suitable

- training
- knowledge
- experience

The **Health and Safety Executive (HSE)** have guidance you can download on the **Electricity at Work Regulations.**

Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013

The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) advise that the following incidents must be reported.

- Electrical short circuit or overload causing fire or explosion.
- Plant or equipment coming into contact with overhead power lines.

You should also report injury to staff due to an electric shock or electrical burn that leads to

- unconsciousness
- requiring resuscitation
- admittance to hospital.

Safety Signs and Signals Regulations

The Health and Safety (Safety Signs and Signals) Regulations place duties on employers, duty holders and others who have responsibility for the control of work sites and premises, and provide guidance on correct signage and nonverbal communication methods.

STATISTICS

The **Electrical Safety Foundation International (ESFI)** uses the U.S. Bureau of Labor Statistics' (BLS) Census of Fatal Occupational Injuries (CFOI) and Survey of Occupational Injuries (SOII) to distill information specifically pertaining to fatal and nonfatal occupational electrical injuries. The most recent data covers the 24 year period from 1992-2017, but mainly focuses on 2003-2017 data.

Fatal Electrical Injuries

- There were 136 electrical fatalities in 2017. An 11.6% drop from 2016, returning to 2015 levels.
- Contact with / Exposure to electric current accounted for 2.6% of all workplace fatalities. In 2016, they accounted for 2.9%, in 2015 2.7% and 3.1% in 2014.
- Contact with / Exposure to electric current maintained its position as sixth most common type of workplace fatality.
- Electrocutions accounted for all but one of the workplace electrical fatalities.

- 54% of all fatal electrical injuries occurred in the construction industry compared to 53% in 2016. The second leading industry in electrical fatalities in professional and business services with 20 fatalities (15%).
- The utility industry had the highest *rate*of fatal electrical injuries (0.74 / 100,000) followed by construction (0.70/ 100,000)
- Electrical fatalities account for 5.7% of all electrical injuries.
- Good producing private industries (natural resources and mining, construction, manufacturing) accounted for 64.9% of fatal electrical injuries compared to 35.1% fatal injuries from service-providing private industries maintaining 2016 numbers
- Younger workers are more likely to experience electrical injuries:
- Workers 16 to 17 years of age experienced electrical fatalities at 5.4 times the average for all age groups;
- 18 to 19 age group – 2.4 times;
- 20 – 24 age group – 1.8 times;
- 25 – 34 age group – 1.5 times;
- 35 – 44 age group – 1.1 times;
- Those 45 years and up are at or below the average

Nonfatal Electrical Injuries

- There were 2,210 nonfatal electrical injuries in 2017, an increase of 35% over 2016, and a decrease of 10% over 2015.
- 25% of all nonfatal injuries resulting in days away from work could be attributed to electricity during 2017.
- The median number of days away from work for nonfatal electrical injuries was 10, double that of 2016 and the highest number since 2013.
- The industries with the leading number of nonfatal electrical injuries:
- Construction – 360 (16%)
- Real Estate and Rental and Leasing – 330 (15%)
- Professional, Scientific, and Technical Services – 290 (13%)
- Manufacturing – 260 (12%)
- Shocks accounted for 1,330 nonfatal electrical injuries, while burns accounted for 900.
- 140 shocks and 230 burns occurred in the construction industry.
- 40 shocks and 60 burns occurred in the utility industry
- Utilities had the highest *rate*of electrical injuries with 1.8 /10,000 workers. Construction only had 0.6 / 10,000 workers.
- Real estate and rental and leasing had the second highest rate with 1.7 / 10,000 workers.
- The highest *rate*of nonfatal electrical shock was in the Arts, entertainment, and recreation industry with 1.1 / 10,000 workers. Utilities had 0.7 / 10,000 workers while construction had 0.2 / 10,000.
- The highest *rate*of nonfatal electrical burns was in the Real estate and rental industry with 1.6 / 10,000 workers. Utilities had 1.1 / 10,000 workers while construction had 0.4 / 10,000.

PREVENTION

Electricity is always trying to find its way to the ground. When electricity flows, it takes the path of least resistance. Materials with a low resistance to electricity are known as conductors. Moisture is a good conductor of electrical current. Unfortunately, so is the human body.

When you touch a live electrical component, you can provide the electricity with an easy route to the ground. This is especially true if your hands are moist, or if you're touching something metal which is touching the ground, such as a metal ladder, another wire or plumbing.

When the electricity passes through your body, you receive an electrical shock. If you're extremely lucky it could be a mild shock. But sometimes even a small flow of electrical current can cause heart failure, brain damage or severe internal burns leading to death.

Here are Ten General Safety Tips for Working With or Near Electricity.

1. Don't stand in wet areas when using electrical tools.
2. Inspect cords for damage or wear prior to each use.
3. Unplug machinery, power tools and appliances before cleaning, inspecting, repairing or removing something from them.
4. When unplugging a cord from an outlet, pull on the plug, not the cord. Pulling on the cord causes wear and may lead to a shock.
5. If outlets or switches feel unusually warm, don't use them and get a qualified electrician to check the wiring.
6. Plug power tools into grounded outlets installed with Ground Fault Circuit Interrupters.
7. If it's necessary to affix cords to a wall or floor, use tape. Nails and staples can damage cords and cause fire and shock hazards.
8. Don't tie power cords in a knot, as knots can cause short circuits and shocks. Instead, loop the cords or use a twist lock plug.
9. When working outdoors, watch for overhead power lines and buried power line indicators. Always assume overhead power lines are energized and stay at least 10 feet (3 meters) away from them.
10. Use "C" rated extinguishers for electrical fires. Never use water.

All electrical equipment on construction sites is potentially deadly.

Electrical extension cords on construction sites are numerous.

Inspect to ensure that:

- All extension cords are three-wire cords.
- The ground pin is on a male plug.
- There is no unbroken insulation on the cord.
- End appliances (plug and receptacle) are gripped to insulation.
- All wires are continuous and unbroken.
- All cords are protected from damage, likely to occur when passing through a door or window.
- Metal boxes with knockouts are not used on extension cords.
- Plugs are dead-front (molded or screwed in place).
- Romex (non-metallic sheathed cable) is not used as flexible cord.
- Cords are not stapled or hung from nails.
- Bushing is passing through holes in covers or outlet boxes.

Check these items:

- Temporary lights are not supported by cords.
- Bulb guards are used on temporary lights.
- Electrical power tools with non-dead man switches have a magnetic restart

(when injury to the operator might result if motors were to restart following power failures).
- Provisions are made to prevent machines from automatically restarting upon restoration of power in place.
- Outlets do not have reversed polarity.
- Power tools are double insulated or have a ground pin.

Guard all of exposed electric of more than 50 volts so no one can come in contact (receptacles, light-bulb sockets, bare wires, load center, switches).

1. Using approved enclosures.
2. Locating them in a room, vault or similar enclosure accessible only to qualified persons.
3. Arranging suitable permanent, substantial partitions or screens so only qualified persons have access to the space within reach of live parts.
4. Locating them on a suitable balcony or platform that is elevated and arranged to exclude unqualified persons.
5. Elevating them 8 feet or more above the working surface.

It’s important to take the time prior to beginning work at construction sites each day. The fluid nature of the activities, along with the changing environment and high potential for damage can let these items become a hazard quickly.

Electrical “Ground” Rules

1. **The risk of shock or electrocution is greatest around metal objects and in damp conditions.**
   - make sure all electric equipment, switch enclosures, and conduit systems are properly grounded and that all external or damp operations are wired for wet conditions.
   - When working in damp areas, wear personal protective equipment such as rubber gloves and boots; use rubber mats, insulated tools, and rubber sheets to protect you from exposed metal.
2. **Keep your electrical system in good operating condition.**
   - Damage and injuries can occur when equipment is defective. So, inspect your electrical equipment, outlets, plugs, and cords before each use.
   - Remove, tag, and have repaired any faulty equipment. Make sure outlets and cords are of adequate size and length to prevent electric overload.
   - If cords must cross a traffic area, protect them with planks or other means.
3. **Make sure you and other workers follow lockout and tagout procedures.**
   - Treat every electric wire as if it were a live one.
   - Stop using a tool or appliance if a slight shock or tingling is felt.
   - Turn off the power if the smell of hot or burning substance is detected or if smoke, sparks, or flickering lights are noticed.
4. **Contact with overhead power supply lines is a frequent electrical-related killer.**
   - Workers using high clearance devices should continually be aware of the dangers and take sensible precautions to avoid contact with overhead lines.

- If an overhead line breaks, keep away from the wire and everything it touches then call the power company to shut off the electricity.
- Only qualified electricians should repair electrical equipment or work on energized lines.

ARC FLASH – THE STORY

1. Awareness of the risk of arc flashes began to grow significantly as videos of incidents began to be posted online, and studies of security camera footage on offshore and other facilities showed arc flash incidents. The public videos really accelerated the market demand for arc flash safety information. Administration and industry standards groups began seeking to quantify the risk and drive change.

Government-backed research efforts, particularly in **the United States (IEEE standards)** and **Europe (IEC standards)** to investigate arc flashes, also led to the release of technical information and specific videos showing the damage that arc flashes pose. Once the manufacturing community and industry standards bodies and customers became more aware of equipment dangers, they recognized the need to quantify the risks.

To quantify the risk, manufacturers have begun labeling equipment showing the arc flash energy that could be released at a particular distance. Customers have also begun training employees to understand the labels. If a piece of equipment could emit a certain level of calories per centimeter squared, they have to wear a certain level of protection equipment or deem the equipment non-approachable.

While workers wearing the right protective equipment can still sustain injury, the risk of arc flash associated with new equipment manufactured has been lowered thanks to information now available. **The lowered risk has been made possible by arc-resistant Personal Protective Equipment.**

2. **Prevention of arc flashes really comes down to education**, and helping workers better understand the risks, as well as identifying risk areas for arc flashes and identifying tools that can mitigate this risk. Operators should have an **arc flash mitigation plan** in place both for existing equipment and new projects.

To Prevent Arc Flashes, companies should evaluate their systems for hazards, determine incident energy exposure and arc flash boundaries, and use warning labels to indicate arc flash hazards.

Other steps to take:

- Minimize or preferably eliminate the amount of work done around live equipment.
- Use remote diagnostic and maintenance tools.
- Install devices to reduce energy rather or in addition to containing energy.
- Utilize properly designed and installed equipment for new and existing installations are also critical in mitigating arc flash hazards.

3. As the awareness of arc flash dangers has grown, customers and contractors are standing up and demand change. **North American oil and gas companies** are leading to focus on more awareness of arc flash safety, implementing

efforts to address arc flash throughout their operations from workplace safety to the types of equipment they purchase.