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Data Bulletin

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Electrical Injuries and Citations in Construction

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OVERVIEW

Construction has a disproportionately high number of fatal *electrical injuries* compared to other U.S. industries. In 2019, almost half (47.6%) of all work-related electrocutions occurred among U.S. construction workers, who make up only 7% of the country's workforce. In addition, electrocutions were one of the industry's leading causes of occupational fatalities, accounting for 7.1% of all fatal occupational injuries. This high number explains why the Occupational Safety and Health Administration (OSHA) identified electrocutions as one of the "Construction Focus Four" hazards. To better understand electrical injuries in construction, this Data Bulletin provides fatal and nonfatal injury trends, as well as information on OSHA *citations* and *penalties* resulting from violations of electrical standards. The number of fatal injuries were obtained from the U.S. Bureau of Labor Statistics (BLS) Census of Fatal Occupational Injuries (CFOI), which is a complete count of reported fatal injuries. Numbers of *nonfatal injuries* resulting in *days away from work (DAFW)* for private, *wage-and-salary* construction workers are from the BLS Survey of Occupational Injuries and Illnesses (SOII), which is based on employer logs. SOII does not represent a complete count of nonfatal injuries, which may influence year-to-year changes. Injury estimates presented are considered to be an undercount. Employment data for rate calculations per 100,000 *full-time equivalent workers (FTEs)* came from the Current Population Survey (CPS).[3] The number of citations and their corresponding penalties for violations of *electrical standards* were obtained from OSHA Enforcement data. The number of *establishments* came from the U.S. Census Bureau County Business Patterns.

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[3]The CPS is conducted by the U.S. Census Bureau for BLS.

THIS ISSUE

This issue examines fatal and nonfatal electrical injuries in the construction industry, as well as OSHA citations and penalties resulting from violations of electrical standards.

KEY FINDINGS

Roughly half (49%) of all fatal and nearly a quarter (24%) of nonfatal electrical injuries from 2011 to 2020 occurred in construction.
Charts 1, 5

Specialty trade contractors (NAICS 238) accounted for 71% of fatal electrical injuries and OSHA electrical citations in construction.
Charts 2, 10

Exposures to voltage greater than 220 volts accounted for a majority of both direct (65%) and indirect (87%) fatal injuries.
Chart 3

OSHA citations issued for violations of federal electrical standards decreased 74% from 2011 to 2021.
Chart 9

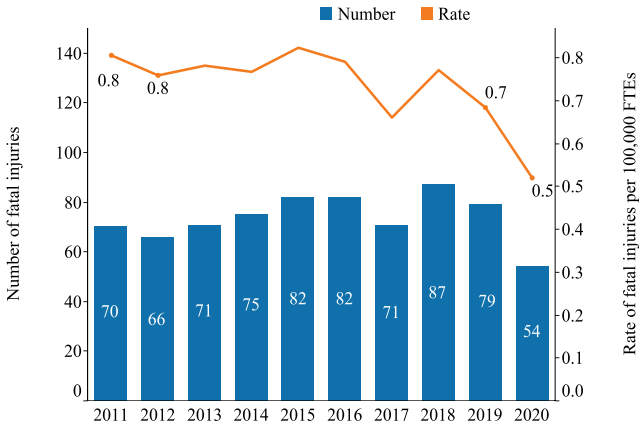
Small establishments (fewer than 10 employees) accounted for 72% of citations for violations of electrical standards, but 81% of establishments in 2020.
Chart 11

NEXT DATA BULLETIN

Leading Causes of Death in the Construction Industry

From 2011 to 2020, there were 1,501 fatal occupational electrical injuries in the U.S. (data not shown). Of these, 49.1% (n=737) were in the construction industry. From 2011 to 2019, the number of fatal electrical injuries increased 12.9% (70 to 79), while the rate of these injuries decreased 12.5% (0.8 to 0.7 per 100,000 FTEs; chart 1). The number (n=54) and rate (0.5 per 100,000 FTEs) of fatal electrical injuries in 2020 fell sharply from the previous year, decreasing 31.6% and 28.6%, respectively. In contrast, the rate of fatal construction injuries overall during the first year of the COVID-19 pandemic increased 4.2%.

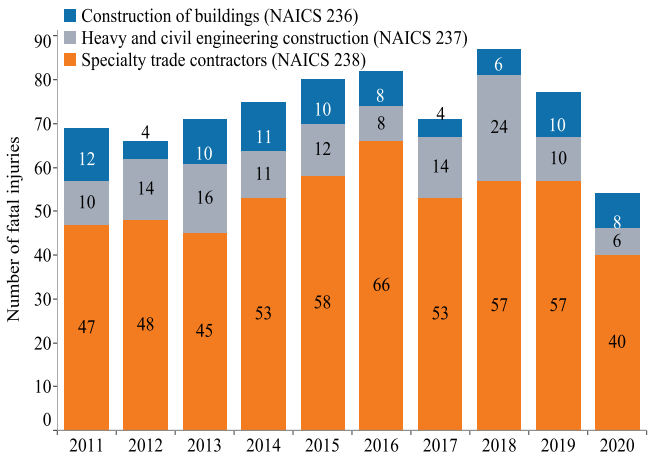
1. Number and rate of fatal electrical injuries in construction, 2011-2020



Source: *U.S. Bureau of Labor Statistics, 2011-2020 Census of Fatal Occupational Injuries and 2011-2020 Current Population Survey.*

Specialty Trade Contractors (NAICS 238) were the major subsector that had the highest number of fatal electrical injuries (n=524, 71.1%) from 2011 to 2020 (Chart 2). Heavy and Civil Engineering Construction (NAICS 237) accounted for an additional 125 deaths (17.0%) during this period, followed by 83 fatal electrical injuries (11.3%) in Construction of Buildings (NAICS 236).

2. Fatal electrical injuries, by major subsector, 2011-2020*

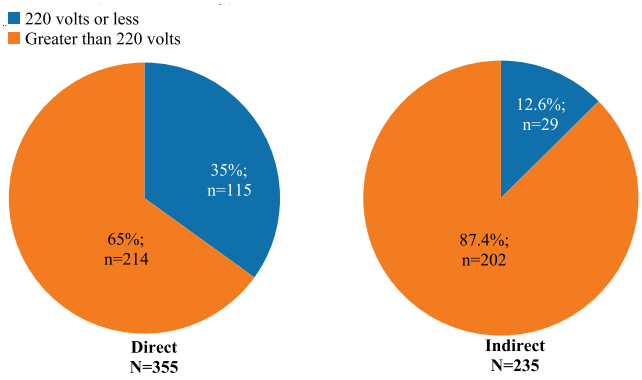


Source: *U.S. Bureau of Labor Statistics, 2011-2020 Census of Fatal Occupational Injuries.*

** Totals may not match chart 1 due to available subsector data.*

Next, the detailed *event or exposure* (e.g., the manner in which the injury was caused) was examined for fatal electrical injuries from 2011 to 2018 (chart 3). Fatal injuries were more often caused by *direct exposure* (e.g., touching a live wire; 58.8%) than by *indirect exposure* (e.g., operating a crane that touches a power line; 38.9%). Most direct (65.0%) and indirect (87.4%) electrical injuries resulted from *exposures* to *greater than 220 volts* (e.g., overhead wire voltage).

3. Fatal electrical injuries in construction by detailed event or exposure, 2011-2018 (Private Industry)*

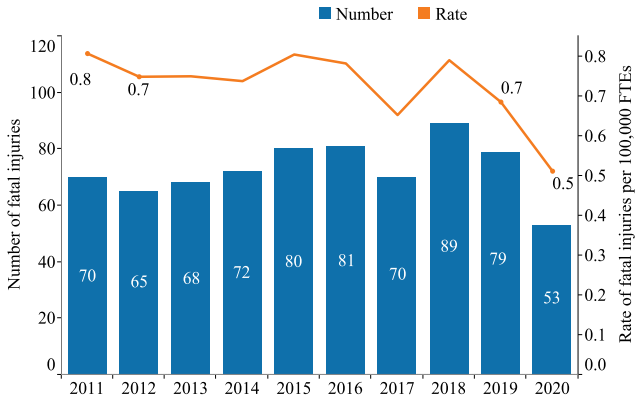


Source: *U.S. Bureau of Labor Statistics, 2011-2018 Survey of Occupational Injuries and Illnesses.*

** Due to reporting changes,data for 2019 and 2020 are not shown. Categories do not sum to totals shown due to missing data.*

Relevant *nature* codes were then examined to understand the physical characteristics of injuries associated electricity (chart 4). From 2011 to 2019 (excluding 2020 due to the pandemic), there was a 12.9% increase in *electrocutions or electric shocks* (70 to 79), while their rate decreased 12.5% (0.8 to 0.7 per 100,000 FTEs). During the first year of the pandemic (from 2019 to 2020), the number of injuries resulting from electrocutions or electric shocks decreased by 32.9%, while the rate decreased 28.6% (0.7 to 0.5 per 100,000 FTEs). These changes are consistent with the overall trends for all fatal electrical injuries presented in chart 1.

4. Fatal injuries involving electrocutions or electric shocks in construction, 2011-2020*

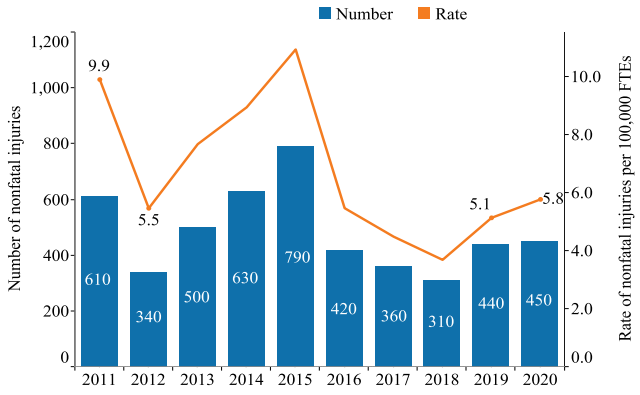


Source: *U.S. Bureau of Labor Statistics, 2011-2020 Census of Fatal Occupational Injuries.*

** This chart is based on reported nature code for all injuries, it is not specific to electrical injuries. (defined as injuries resulting from exposure to electricity).*

Nonfatal electrical injuries were then examined. From 2011 to 2020, there were 19.9 thousand (K) nonfatal electrical injuries in all industries (data not shown). Of these, 24.4% (n=4.9K) were in construction (chart 5). From 2011 to 2019, the number of nonfatal electrical injuries in construction decreased 27.9% (610 to 440), while the rate decreased 48.5% (9.9 to 5.1 per 100,000 FTEs). During the first year of the pandemic, the number of injuries rose 2.3% (440 to 450) and the rate increased 13.7% (5.1 to 5.8). The increase in the rate of injuries is consistent with all nonfatal injuries.

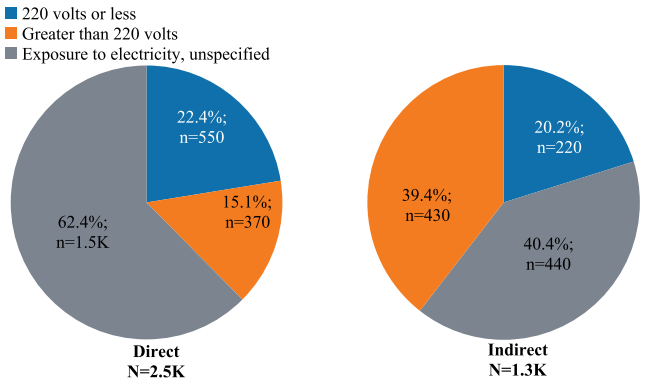
5. Number and rate of nonfatal electrical injuries in construction, 2011-2020 (Private Wage-and-Salary)



Source: *U.S. Bureau of Labor Statistics, 2011-2020 Survey of Occupational Injuries and Illnesses and 2011-2020 Current Population Survey.*

Next, the detailed event or exposure (e.g., the manner in which the injury was caused) were examined. Of nonfatal electrical injuries in construction (n=4.4K), 56.8% were direct exposures and 29.5% were indirect exposures (chart 6). Indirect exposures (39.4%) were more likely to involve exposures to more than 220 volts (e.g., overhead wire voltage) compared to direct exposures (15.1%).

6. Nonfatal electrical injuries in construction by detailed event or exposure, 2011-2019 (Private Wage-and-Salary)*

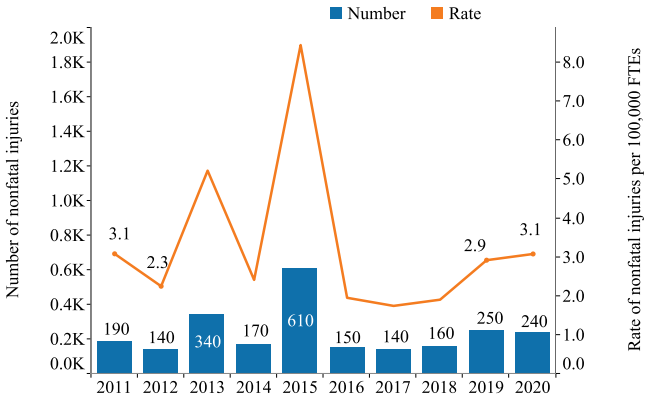


Source: *U.S. Bureau of Labor Statistics, 2011-2019 Survey of Occupational Injuries and Illnesses.*

**Due to reporting changes,data for 2020 are not shown. Categories do not sum to totals shown due to missing data.*

Nature categories involving electricity were then examined (charts 7 and 8). From 2011 to 2019 there was a 31.6% increase in nonfatal electrical injuries in construction (190 to 250). During the first year of the pandemic, these injuries dropped 4.0% in construction (250 to 240). *Electrical burns* declined 55.8% (430 to 190) from 2011 to 2019 in construction. In 2020, there was a 15.8% increase of electrical burns in construction compared to 2019 (190 to 220).

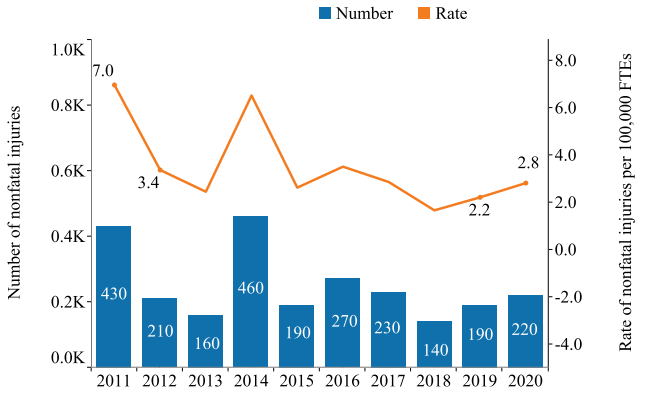
7. Nonfatal injuries involving electrocutions or electric shocks in construction, 2011-2020* (Private Wage-and-Salary)



Source: *U.S. Bureau of Labor Statistics, 2011-2020 Survey of Occupational Injuries and Illnesses.*

**This chart is based on reported nature code for all injuries, it is not specific to electrical injuries (defined as injuries resulting from exposure to electricity).*

8. Nonfatal injuries involving electrical burns in construction, 2011-2020* (Private Wage-and-Salary)

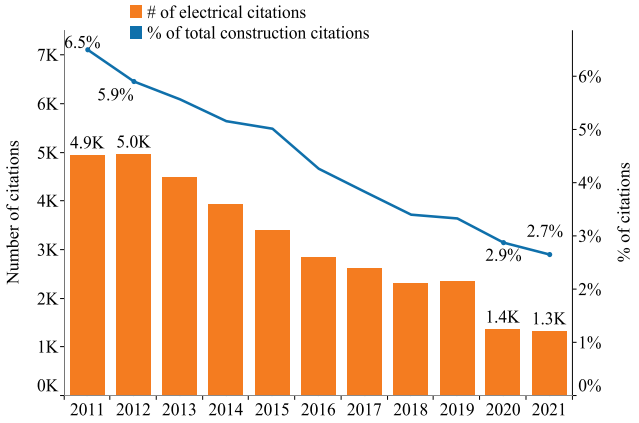


Source: *U.S. Bureau of Labor Statistics, 2011-2020 Survey of Occupational Injuries and Illnesses.*

**This chart is based on reported nature code for all injuries, it is not specific to electrical injuries (defined as injuries resulting from exposure to electricity).*

OSHA enforcement data was then examined for citations issued for violations of electrical standards and the associated penalties. From 2011 to 2021, there was a 73.5% decrease (4.9K to 1.3K) in the number of citations issued for electrical standards, which also became a significantly smaller proportion (6.5% to 2.7%; chart 9) of all construction citations. The decrease in electrical standard citations is consistent with declines for all and the number of total inspectors.

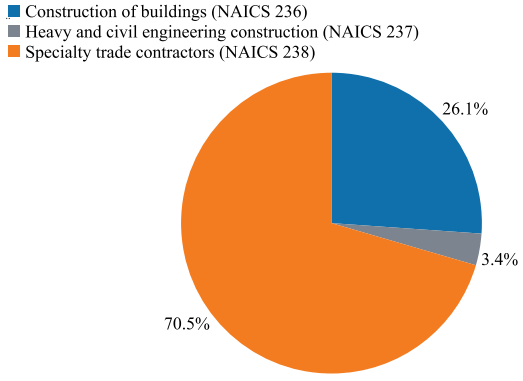
9. Number and percentage of OSHA electrical citations in construction, 2011-2021



Source: *Occupational Safety and Health Administration, 2011-2021 Federal and State Inspections Data.*

The majority (70.5%) of citations for electrical standards from 2011 to 2021 occurred among Specialty Trade Contractors (NAICS 238; chart 10) followed by Construction of Buildings (NAICS 236; 26.1%) and Heavy and Civil Engineering Construction (NAICS 237; 3.4%).

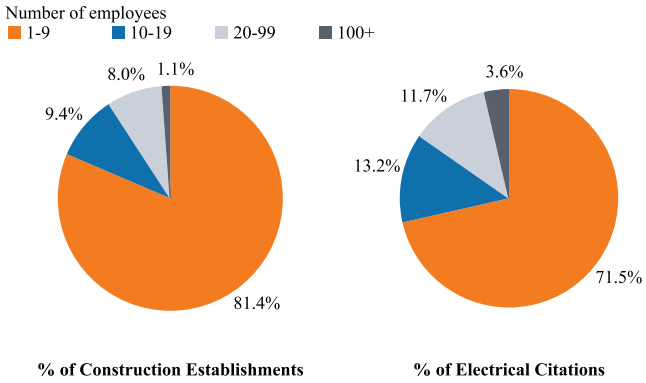
10. OSHA electrical citations in construction by major subsector, 2011-2021



Source: *Occupational Safety and Health Administration, 2011-2021 Federal and State Inspections Data.*

Medium to large firms (more than 10 employees) were disproportionately more likely to be cited for violations of electrical standards. they comprised 18.5% of establishments but received 28.5% of electrical citations. (chart 11). Small establishments (fewer than 10 employees) accounted for 81.4% of establishments in 2020 but only 71.5% of citations for electrical standard violations.

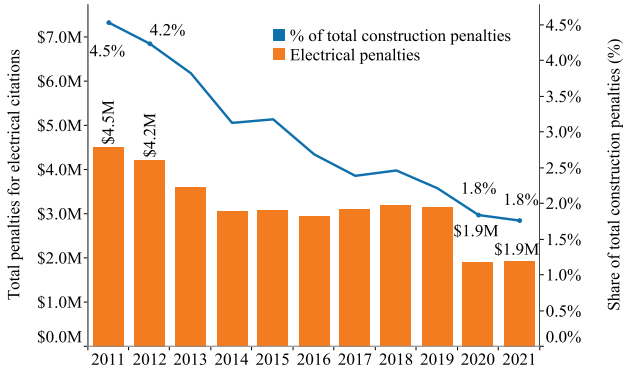
11. Distribution of establishments and electrical citations by size in construction, 2020



Source: *U.S. Census Bureau 2020 County Business Patterns and Occupational Safety and Health Administration 2020 Federal and State Inspections Data.*

On average, OSHA penalized the construction industry for $3.2 million annually from 2011 to 2021 for violations of electrical standards (chart 12). Total penalty amounts decreased 57.8% from $4.5 million in 2011 to $1.9 million in 2021.

12. Total and percentage of OSHA electrical penalties in construction, 2011-2021



Source: *Occupational Safety and Health Administration, 2011-2021 Federal and State Inspections Data.*

Electrocutions—a construction Focus Four hazard—continue to pose significant risks to construction workers, with the industry accounting for almost half (49.1%) of all fatal and a quarter (24.4%) of nonfatal on-the-job electrical injuries. Annually, there are almost 75 fatal and at least 500 nonfatal injuries of this type in construction.

A majority of fatal direct (60.3%) and indirect (86.0%) electrical injuries resulted from exposure to 220 volts or greater (e.g., overhead wire voltage). In addition, a majority of fatal electrical injuries and citations for electrical standards occurred among Specialty Trade Contractors (NAICS 238). Electrical citations were overrepresented in medium to large establishments relative to the proportion of construction establishments that they represent.

CPWR's Exposure Control Technologies Research group recently conducted a study to identify high-risk electrical tasks, contributing factors, and effective controls to address various hazards. It identified 10 high-risk tasks, including pulling cables and wires, performing maintenance, producing openings for conduit and electrical lines, as well as working on energized electrical equipment. Work factors associated with these high-risk tasks included complex lockout/tagout procedures, missing drawings, improper labels, improper ergonomic techniques, striking concealed live lines, and inadequate insulation. Solutions to identify and mitigate electrical hazards included permanent electrical safety devices, handheld cable locating devices, and proximity warning devices. However, lockout/tag-out remains the leading risk control method for electrical work.

CPWR also provides multiple resources for the construction industry on electrical hazards. CPWR's Construction Solutions Database provides information about job site hazards and exposures, as well as commercially available evidence-based controls. There are currently 23 "solutions" related to electrical shocks, burns, and/or electrocutions. In addition, CPWR offers other resources that address specific hazards, including the Construction Safety & Health Network, Hazard Alert Cards, and Toolbox Talks. OSHA and NIOSH also provide resources to help contractors, supervisors, workers, researchers, and other stakeholders to reduce occupational injuries and illnesses in the construction industry.

ACCESS THE CHARTS & MORE

View the charts in PowerPoint and the data underlying the charts in Excel. Downloading will start when you click on each link. These files can also be found under the Data Bulletin at: https://www.cpwr.com/research/data-center/data-reports/. Chart 11 establishment data plus more is included in the updated Construction Payroll Establishments and Employees dashboard which now includes 2020 data. The Fatality Map and Severe Injury dashboards have also been updated.

DEFINITIONS

Citation *– Violation of an OSHA standard resulting from an inspection in the construction industry (NAICS 23).*

Days Away from Work *– Nonfatal injury cases resulting in at least one day away from work beyond the day of injury or illness onset. DAFW may be capped at 180 calendar days which may result in underestimate of the median days. A full definition with an example can be found in the Survey of Occupational Injuries and Illnesses Handbook of Methods.*

Electrical Standard *– Citation in the construction industry for violating any one of the following electrical standards:*

- *Subpart I (Tools - Hand and Power)*
  - *1926.302(a)- Electric power-operated tools*
- *Subpart K (Electrical)*
  - *1926.400-449*
- *Subpart L*
  - *1926.451(f)(6)-Clearance between scaffolds and power line*
- *Subpart O (Motor Vehicles, Mechanized Equipment, and Marine Operations)*
  - *1926.600(a)(6)- Covers regulations when working or being moved in the vicinity of power lines or energized transmitters.*
- *Subpart V (Electric Power Transmission and Distribution)*
  - *1926.950-968*
- *Subpart CC (Cranes and Derricks in Construction)*
  - *1926.1407-1411 - Power Line Safety*

Establishment *– A single physical location occupied by a relatively permanent main or branch office. When multiple activities occur in one place under one ownership, a single establishment is counted by its major activity. The individual construction sites and projects of such dispersed activities are not considered to be establishments.*

Event/Exposure *– The manner in which the injury or illness was produced or inflicted, such as a fall, heat-related illness, etc. For example, a worker was using a hand-held electric auger which struck a powerline would have a reported event or exposure of "Exposure to electricity," with their reported primary source being "Tools, instruments, and equipment: Handtools-powered." Full definitions for categories can be found in the Occupational Injury and Illness Classification Manual. Events mentioned in this Data Bulletin are:*

> ***Direct Exposure*** *– Contact made directly touching the power source, such as touching a live wire.*

Electrical injuries *– The injury or illness resulted from contact with electricity, including electric shock and electrocutions.*

Exposures greater than 220 volts *– Overhead voltage (e.g., power lines and industrial transformers) may operate at 220 volts or greater.*

Exposures less than 220 volts *– Household voltage should be at 220 volts or less.*

Indirect Exposure *– Contact made by a conductive material touches an electricity source, such as a crane touching a power line.*

Full-time equivalent worker (FTEs) *– Determined by the hours worked per employee on a full-time basis, defined as working 2,000 hours (40 hours x 50 weeks) per year.*

Major subsector *– 3-digit NAICS codes within construction, including Construction of Buildings (NAICS 236), Heavy and Civil Engineering Construction (NAICS 237), and Specialty Trade Contractors (NAICS 238).*

Nature *– The physical characteristics of the work-related injury or illnesses. Full definitions for categories can be found in the Occupational Injury and Illness Classification Manual. Nature categories mentioned in this Data Bulletin are:*

Electrical burns *– Burns resulting from electricity.*

Electrocutions, electric shocks *– Injuries resulting from contact with electric current.*

Nonfatal injury *– Nonfatal injuries include injuries or illnesses that resulted in days away from work (DAFW).*

Penalty *– Current penalty assessed for a citation, adjusted for inflation to December 2018 dollars.*

Wage-and-salary *– Workers who receive wages, salaries, commissions, tips, or pay from their employer.*

DATA SOURCES

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Besides cpwr.com, visit CPWR's other online resources to help reduce construction safety and health hazards:

- Choose Hand Safety
  https://choosehandsafety.org/
- Construction Safety and Health Network
  https://safeconstructionnetwork.org/
- Construction Solutions
  https://www.cpwrconstructionsolutions.org/
- Construction Solutions ROI Calculator
  https://www.safecalc.org/
- COVID-19 Construction Clearinghouse
  https://covid.elcosh.org/index.php
- COVID-19 Exposure Control Planning Tool
  https://www.covidcpwr.org
- Electronic Library of Construction Occupational Safety and Health
  https://www.elcosh.org/index.php
- Exposure Control Database
  https://ecd.cpwrconstructionsolutions.org/
- Nano Safety Data Sheet Improvement Tool
  http://nanosds.elcosh.org/
- Safety Climate - Safety Management Information System (SC-SMIS)
  www.scsmis.com
- Stop Construction Falls
  https://stopconstructionfalls.com/
- Work Safely with Silica
  https://www.silica-safe.org/

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