

WHY DO ELECTRICAL FATALITIES OCCUR ON THE JOB?

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Online Evaluation



Objectives

1. Determine which occupations have the most electrical fatalities
2. Determine commonalities between electrical fatalities
3. Determine the human factors in electrical occupation fatalities
4. Determine how to prevent electrical fatalities



Data Sources



Data Sources

Occupational Safety and Health Administration Accident Investigation Summaries (OSHA 170 form)

Fatality and Catastrophe Investigation Summaries are developed after OSHA conducts an inspection in response to a fatality or catastrophe. The summaries provide a complete description of the incident, generally including events leading to the incident and causal factors. It must have resulted from a traumatic injury.

- Summaries must undergo a process for screening personal information and adding keywords that may cause some additional delays in posting.



Data Sources

Bureau of Labor Statistics: Census of Fatal Occupational Injuries (CFOI)

“The Census of Fatal Occupational Injuries is the most complete count of fatal work injuries in the United States. A workplace fatality must meet the following criteria to be included in CFOI

- It must have resulted from a traumatic injury;
- The incident that led to the death must have occurred in the United States, its territories, or its territorial waters or airspace;
- It must be related to work.”



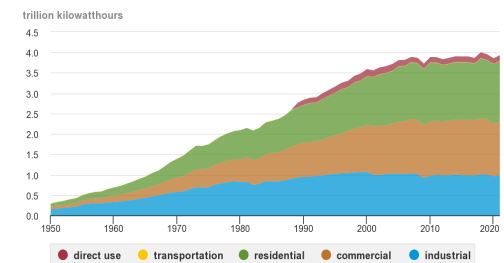
Electrical Fatalities in the Workplace



Electrification is on the Rise

According to the U.S. Energy Information Administration, the United States used a total of 3.93 trillion kilowatt hours of electricity in 2021, which is 13 times higher than electricity use in 1950

U.S. electricity retail sales to major end-use sectors and electricity direct use by all sectors, 1950-2021



Data source: U.S. Energy Information Administration, Monthly Energy Review, Table 7.6, March 2022, preliminary data for 2021



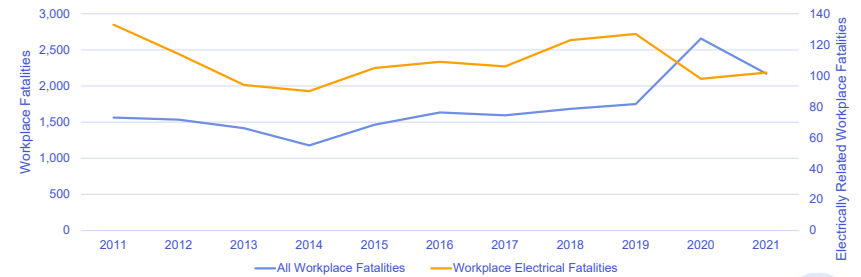
Electrical Fatalities in the Workplace

- Contact with or exposure to electricity continues to be one of the leading causes of workplace fatalities and injuries
- 1,201 workplace electrical fatalities between 2011 – 2021
- 6% of all workplace fatalities were caused by electricity
- 69% of fatalities occurred in non-electrical occupations



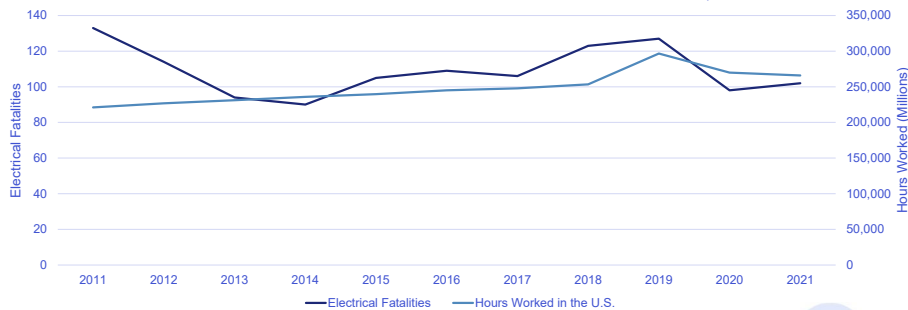
Electrical Fatalities in the Workplace

Workplace Fatalities and Electrical Workplace Fatalities Reported in OSHA 170 Form, 2011 - 2021



Electrical Fatalities in the Workplace

Total Hours Worked in The United States And Rate Of Electrical Fatalities, 2011 - 2021



Electrical Fatalities in the Workplace

- 2% drop in the number of electrically related deaths in the U.S., 5% increase in the total number of workplace fatalities
- Between 2019 and 2020:
 - 6% drop in the total number of hours worked
 - 23% drop in the total number of electrical fatalities
- Between 2020 and 2021:
 - 4% increase in the number of hours worked
 - 4% increase in the number of electrical fatalities
- Between 2011 and 2019, there was an average growth of 2% in the total hours worked in the United States, and an average growth of 0.1% in electrical fatalities



Occupations Involved in Electrical Fatalities



Occupations Involved in Electrical Fatalities

ELECTRICAL OCCUPATIONS

- Electrical and electronic engineers
- Electrical and electronic equipment assemblers
- Electrical and electronic technicians
- Electric power installers and repairers
- Electricians
- Electricians' apprentices
- Electronic repairers, communications, and industrial equipment
- Supervisors in above fields



Occupations Involved in Electrical Fatalities

OSHA 170 form categorizes occupations into one of 573 recognized occupations, including occupations listed as "not applicable," "occupation not reported," or "occupation not listed."

- A total of 118 occupations were involved in electrical fatalities
- 31% of fatalities were in electrical occupations
- 69% of fatalities were in non-electrical occupations
- Non-electrical occupations fatalities decreased an average of 1.2%
- Electrical occupations fatalities decreased an average of 0.89%
- Ten occupations account for 60% of all electrical fatalities in the workplace, with three being electrical occupations

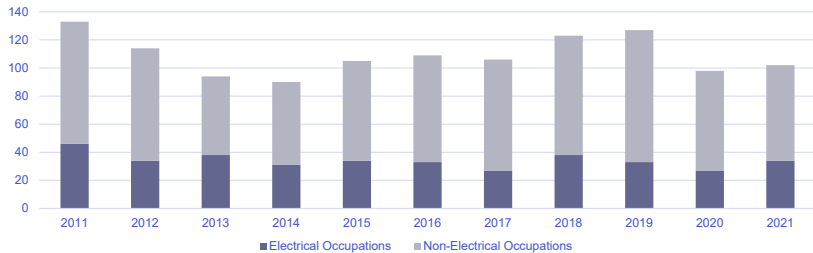
Occupations Involved in Electrical Fatalities

Occupation	Fatalities	Occupation	Fatalities
Electricians	182	Electrical and electronic engineers	21
Laborers, except construction	121	Telecomm: line installers and repairers	21
Construction laborers	108	Installers and repairers	20
Electrical power installers & repairers	102	Carpenters	17
Occupations not reported	70	Technicians, not elsewhere classified	13
Tree trimming occupations	64	Electrical and electronic technicians	13
Electricians' apprentices	39	Construction trades, not elsewhere classified	12
Heating, air conditioning, and refrigeration mechanics	34	Helpers, construction trades	11
Painters, construction and maintenance	33	Groundskeepers and gardeners, except farm	11
Roofers	26	Farm workers	11
Machinery maintenance occupations	23	Welders and cutters	11
Truck drivers, heavy	23	Plumbers, pipefitters and steamfitter apprentices	10



Occupations Involved in Electrical Fatalities

Electrical Fatalities By Occupation Type,
2011 - 2021



Actions Leading to Electrical Fatalities

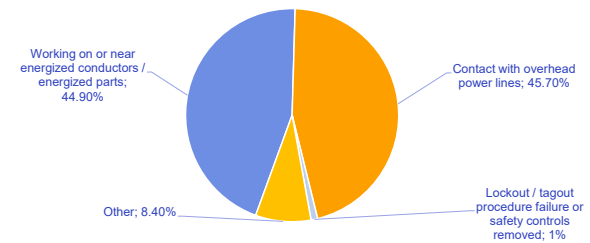


Actions Leading to Electrical Fatalities

- A. Working on or near energized conductors / energized parts:** The fatal injury occurred due to contact with energized conductors or equipment. This occurred from the equipment being worked on or nearby equipment or wires, excluding overhead power lines.
- B. Contact with overhead power lines:** The fatal injury occurred from contact with overhead power lines. This excludes contact with other energized equipment or wires. This also includes arcing events caused by overhead power lines.
- C. Lockout / tagout procedure failure or safety controls removed:** The fatal injury narrative mentions the removal of safety devices or a failure of a lockout / tagout procedure.
- D. Lack of personal protection equipment (PPE):** The narrative mentions the lack of personal protective equipment when the fatal injury occurred.
- E. Electrical fire:** The fatal injury occurred due to an electrical fire that ignited due to the type of work the worker was completing.

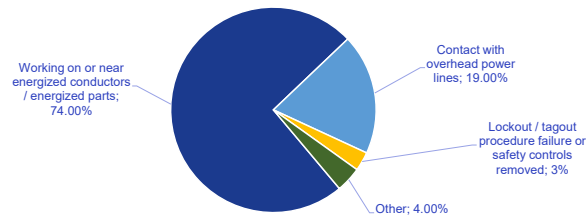
Actions Leading to Electrical Fatalities

Cause Of Electrical Fatality, All Workers,
2011 – 2021



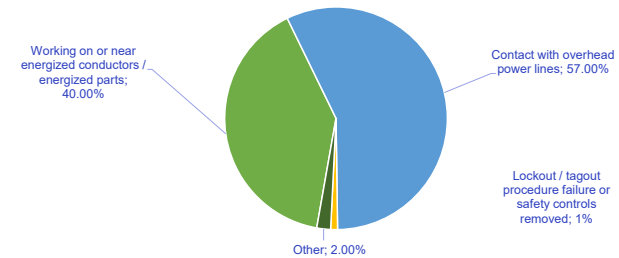
Actions Leading to Electrical Fatalities

Cause Of Electrical Fatality, Electrical Occupations,
2011 – 2021



Actions Leading to Electrical Fatalities

Cause Of Electrical Fatality, Non-Electrical Occupations,
2011 – 2021



How to Prevent Electrical Fatalities

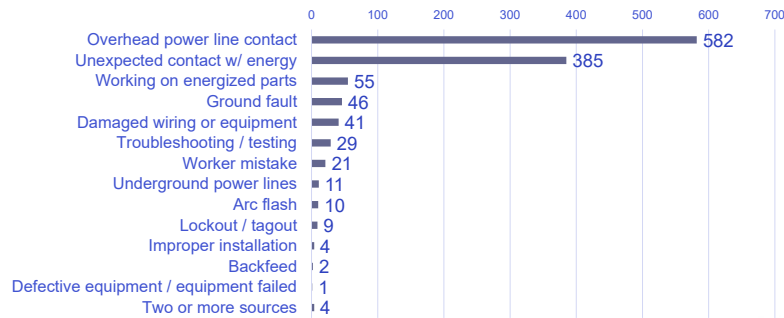
How to Prevent Electrical Fatalities

- **Overhead power line contact (583 events):** Direct or indirect contact with overhead power lines, including arcing events from overhead power lines. Categorized as a “non-preventable” death.
- **Unexpected contact with energy (385 events):** Worker came in direct or indirect contact with energized equipment, devices, or parts, excluding overhead power lines and arcing events.
- **Working on energized parts (55 events):** Worker specifically decided to work on energized parts.
- **Ground Faults (46 events):** A ground fault was specifically mentioned as a cause of the fatality.
- **Damaged wiring, parts, or equipment (41 events):** Worker was working on or with damaged wiring, parts, or equipment that specifically led to the fatality.
- **Troubleshooting / testing (29 events):** Worker was conducting either troubleshooting or testing when the fatality occurred.
- **Worker mistake (21 events):** Worker made a mistake by either not following proper procedure, not wearing proper PPE, or using incorrect tools / equipment that led to the fatality.
- **Contact with underground power lines (11 events):** Worker made fatal contact with underground power lines.
- **Arc flash (10 events):** Fatality was specifically caused by either an arc flash or arc blast.



How to Prevent Electrical Fatalities

Source of Electrical Fatality, All Workers, 2011 - 2021



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How to Prevent Electrical Fatalities

Overhead Power Line Contact:

- Non-electrical workers accounted for 81.6% of fatalities
- Occupations with 10 or more fatalities:
 - Electrical power installers and repairers – 13.04%
 - Construction laborers - 11.66%
 - Laborers except construction - 11.66%
 - Tree trimming occupations - 10.63%
 - Painters, construction and maintenance - 4.8%
 - Truck drivers, heavy - 3.77%
 - Roofers - 3.6%
 - Electricians - 3.09%
 - Telecomm: line installers and repairers - 3.09%
 - Carpenters - 1.89%
- Workers who were not part of a union accounted for 88% of the fatalities

582
Overhead
Power Line
Contact
Fatalities

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How to Prevent Electrical Fatalities

Unexpected Contact with Energy

- Non-electrical workers accounted for 57.66% of fatalities
- Occupations with 10 or more fatalities:
 - Electricians - 25.19%
 - Laborers except construction - 8.57%
 - Construction laborers - 5.71%
 - Electricians' apprentices - 5.45%
 - Heating, air conditioning, and refrigeration mechanics - 5.19%
 - Electrical power installers and repairers - 4.42%
 - Electrical and electronics engineers - 3.12%
- 62% of the fatalities could have been prevented by safety devices
- Workers who were not part of a union accounted for 85.45% of the fatalities

385
Unexpected
Contact with
Energy
Fatalities

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How to Prevent Electrical Fatalities

Working on Energized Parts

- Electrical workers accounted for 65.45% of fatalities
- Occupations with 10 or more fatalities:
 - Electricians - 47.27%
 - Heating, air conditioning, and refrigeration mechanics - 5.45%
 - Laborers, except construction - 5.45%
 - Construction laborers - 5.45%
 - Electricians' apprentices - 5.45%
 - Electrical and electronics technicians - 3.64%
- 98% of the fatalities could have been prevented by safety devices
- Workers who were not part of a union accounted for 78.18% of the fatalities

55
Working on
Energized
Parts
Fatalities

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How to Prevent Electrical Fatalities

Ground Faults

- Non-electrical workers accounted for 86.96% of fatalities
- Occupations with 10 or more fatalities:
 - Laborers, except construction – 19.57%
 - Construction laborers - 8.70%
 - Plumber, pipefitter and steamfitter apprentices - 6.52%
 - Plumbers, pipefitters and steamfitters - 6.52%
 - Electricians - 6.52%
 - Installers and repairers - 6.52%
 - Machinery maintenance occupations - 4.35%
 - Carpenters - 4.35%
 - Electricians' apprentices - 4.35%
 - Farm workers - 4.35%
 - Heating, air conditioning, and refrigeration mechanics - 4.35%
- 98% of the fatalities could have been prevented by safety devices
- Workers who were not part of a union accounted for 97.83% of the fatalities

46

Ground Fault
Fatalities



How to Prevent Electrical Fatalities

Damaged Wiring or Equipment

- Non-electrical workers accounted for 82.93% of fatalities
- Occupations with 10 or more fatalities:
 - Electricians – 14.63%
 - Laborers, except construction - 12.20%
 - Construction laborers - 9.76%
 - Heating, air conditioning, and refrigeration mechanics - 7.32%
 - Drywall installers - 4.88%
 - Plumbers, pipefitter, and steamfitter apprentices - 4.88%
 - Groundskeepers and gardeners, except farm - 4.88%
 - Machinery maintenance occupations - 4.88%
- 100% of the fatalities could have been prevented by safety devices
- Workers who were not part of a union accounted for 95.12% of the fatalities

41

Damaged
Wiring or
Equipment
Fatalities



How to Prevent Electrical Fatalities

All Other Sources

- Non-electrical workers accounted for 61.54% of fatalities
- Occupations with 10 or more fatalities:
 - Electricians – 35.16%
 - Electrical power installers and repairers - 8.79%
 - Electricians' apprentices - 8.79%
 - Construction laborers - 7.69%
 - Installers and repairers - 4.40%
- 98% of the fatalities could have been prevented by safety devices.
- Workers who were not part of a union accounted for 97.83% of the fatalities

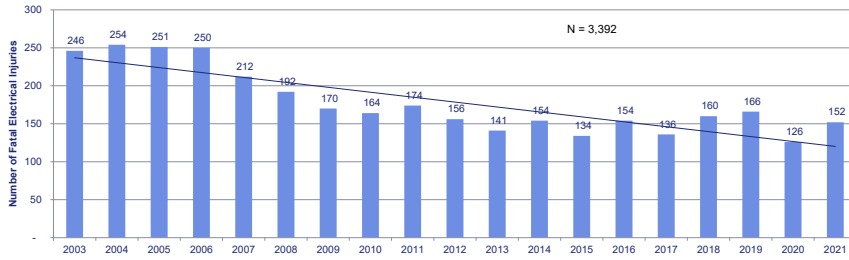


New Data – Bureau of Labor Statistics



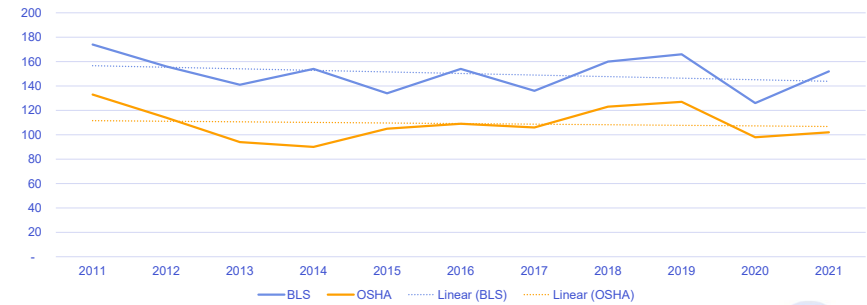
Workplace Fatalities: Bureau of Labor Statistics

Number of Fatal Electrical Injuries, by Event Code, All Ownerships, 2003 - 2021



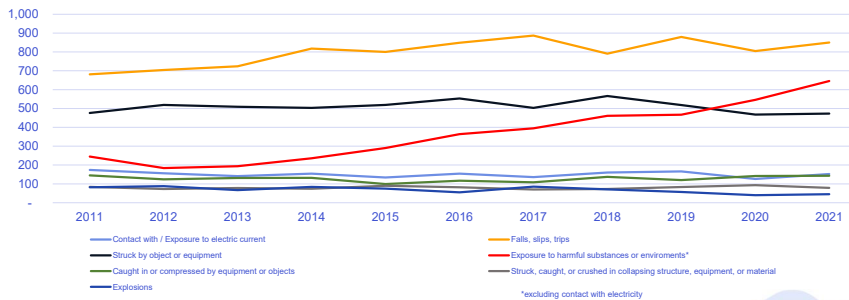
Workplace Fatalities: Bureau of Labor Statistics

Contact with / Exposure to Electric Current – Fatal Injury



Workplace Fatalities: Bureau of Labor Statistics

Workplace Fatalities – Select Events, 2011 - 2021



Workplace Fatalities: Bureau of Labor Statistics

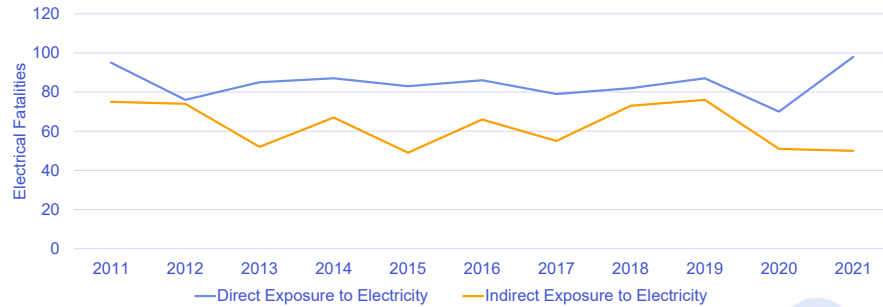
Electrical Fatalities by Event and Nature of Injury, All Ownerships, 2011 - 2021

Event	Exposure to electricity										
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Exposure to Electricity	171	154	141	154	134	154	136	160	166	126	152
Direct Exposure to Electricity	95	76	85	87	83	86	79	82	87	70	98
Direct Exposure to Electricity, 220 Volts or less	26	18	26	24	27	29	30	19	21	-	16
Direct Exposure to Electricity, Greater than 220 Volts	56	53	50	60	54	41	49	50	56	56	65
Indirect Exposure to Electricity	75	74	52	67	49	66	55	73	76	51	50
Indirect Exposure to Electricity, 220 Volts or Less	11	5	5	7	7	5	8	7	4	-	-
Indirect Exposure to Electricity, Greater than 220 Volts	62	67	44	60	42	60	47	65	69	43	41



Workplace Fatalities: Bureau of Labor Statistics

Electrical Fatalities by Event and Nature of Injury, All Ownerships, 2011 - 2021



Workplace Fatalities: Bureau of Labor Statistics

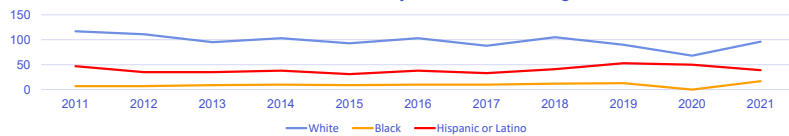
Number of Electrical Fatalities in Selected Industries, by EVENT, Private Industry, 2003 - 2021

Industry Sector	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Construction	69	66	71	74	81	82	71	86	-	53	74	727
Professional and Business Services	23	30	20	19	18	28	20	29	-	-	25	212
Trade, Transportation, and Utilities	16	16	13	16	9	9	12	6	15	-	19	131
Natural Resources and Mining	24	21	14	15	9	11	7	16	-	13	-	130
Manufacturing	20	11	9	12	7	8	7	11	-	10	11	106
Other Services	5	-	5	-	-	4	4	5	-	3	-	26
Leisure and Hospitality	4	-	3	6	-	5	7	-	-	-	5	30
Information	3	1	-	-	-	-	-	-	-	-	1	5
Financial Activities	1	3	-	3	-	-	-	1	1	4	-	13
Total	174	156	141	156	134	151	131	157	154	118	145	1,617



Workplace Fatalities: Bureau of Labor Statistics

Electrical Fatalities by Race or Ethnic Origin



Race or Ethnic Origin:	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
White non-Hispanic	117	111	95	103	93	103	88	105	90	68	96
Black or African-American Non-Hispanic	7	7	9	10	9	10	10	12	13	-	17
Hispanic or Latino	47	35	35	38	31	38	33	41	53	50	39



Workplace Fatalities: Bureau of Labor Statistics

White

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Electrical Fatalities	117	111	95	103	93	103	88	105	90	68	96
Pct. Of Electrical Fatalities	67%	71%	67%	67%	69%	67%	65%	66%	54%	54%	63%
Pct. Of Workforce	82%	81%	80%	81%	79%	80%	78%	78%	78%	78%	78%

Black

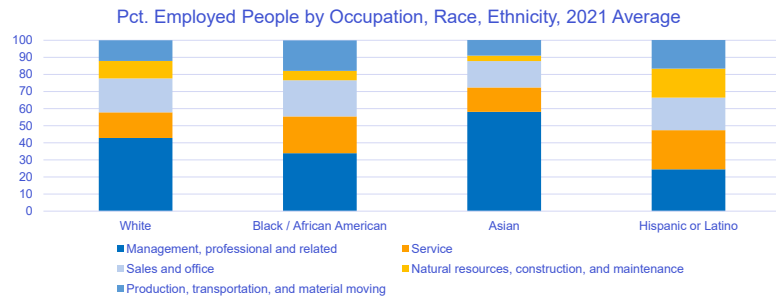
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Electrical Fatalities	7	7	9	10	9	10	10	12	13	-	17
Pct. Of Electrical Fatalities	4%	4%	6%	6%	7%	6%	7%	8%	8%	-	11%
Pct. Of Workforce	11%	11%	11%	11%	12%	12%	12%	12%	12%	12%	12%

Hispanic / Latino

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Electrical Fatalities	47	35	35	38	31	38	33	41	53	50	39
Pct. Of Electrical Fatalities	27%	22%	25%	25%	23%	25%	24%	26%	32%	40%	26%
Pct. Of Workforce	15%	15%	16%	16%	16%	17%	17%	17%	18%	18%	18%



Workplace Fatalities: Bureau of Labor Statistics



Conclusions



Conclusions

- Contact with electricity continues to be a leading cause of fatalities in the workplace, accounting for 6% of all fatalities
 - Rate of electrical fatalities has only dropped an average of 3% every year
- 69% of all fatalities were in non-electrical occupations
 - Non-electrical fatalities dropped 1.2% per year
 - Electrical occupation fatalities dropped 0.89%
- Two actions led to the overwhelming majority of fatalities
 - Contact with overhead power lines - 45.7%
 - Working on or near energized parts - 44.9%
- Both hazards can be avoided by workers being alert and recognizing the potential hazards around them on the worksite and by staying away from areas and equipment they are not trained to work on or nearby

Conclusions

- There were five sources of contact with electricity that accounted for 92% of fatalities:
 - Overhead power lines
 - Unexpected contact with electricity
 - Working on energized parts
 - Ground faults
 - Damaged wiring
- All sources, with the exception of working on energized parts, affected non-electrical workers more than electrical workers
- In instances where the worker specifically decided to work on energized parts, 65.45% of the fatalities occurred in electrical occupations



Conclusions

- 39% of electrical fatalities could have been prevented by safety devices, such as voltage detectors or permanently installed electrical safety devices, or engineering controls
- These preventable fatalities mostly occurred from unexpected contact with energy, working on energized parts, ground faults, and damaged wiring or equipment
- 7% of all fatalities could have been prevented with ground fault circuit interrupters
- Most of the electrical fatalities that occurred between 2011 and 2021 came from sources that could directly be seen or could be detected with safety devices
- Overhead power line fatalities could be prevented by educating all workers on the dangers of overhead power line contact and reminding workers to always be aware of their surroundings and to always look up in all ways when working on any job site



Conclusions

- Unexpected contact with electricity could be prevented by reminding qualified workers to always test before they touch or to always check to see if parts are energized before work is completed
- Non-electrical workers should be trained how to understand normal operating conditions and recognize damaged wiring. Safety devices, such as permanently installed safety devices, could also prevent injuries by notifying workers of present voltage



Thank You

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Please complete the Online Evaluation

