

Case Scenario: **Electrocution in an Amusement Park**

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Expert's Job Assignment: To defend an electrical contractor that had been working on the site.

I Case Synopsis:

A general maintenance worker who did all sorts of jobs, mechanical, electrical, janitorial, etc., at an amusement park was killed in early July 2005 when he came in contact with an energized car on a circular amusement ride. This car had given shocks to other individuals earlier in the day and he was attempting to determine the cause of the shocks so that the cause could be remedied.

This death happened in 2005. I was engaged in 2009 and worked from various case documents.

After reading all of the materials, and visiting the site twice, it is apparent to me that the parties to this action did not disagree that the death was caused by the deceased touching two items: one of the metal portions of an ungrounded, yet electrified, portion of the ride (the car in which the passengers ride), and a grounded metallic part of the ride.

The following is my analysis of this.

1. The ride had been purchased as a used device from its original manufacturer
2. The 24 ride cars were driven by 8 drive motors, positioned on every third car
3. Each car was connected to a central hub by a "Sweep Light Bar". This bar had red, white, and blue 120 volt lights that blink on and off as the ride operated. This bar also fed power to the cars to a step-down transformer on each one to power the 12 volt ac lights on the car.
4. I was given photographs of the sweep light bars. From those photographs there is no question the car was not properly grounded. The green grounding equipment grounding conductor was cut at the receptacle in the sweep light bar that would feed power to the car transformer.
5. There is disagreement as to whether the deceased was kneeling on the diamond plate walkway that extends around the cars, or whether he was touching the motor that was accessible between car #22 and the one in front of it, when he touched the lap bar that served to restrain the riders. His foreman claimed that he found the body with the left hand touching the motor. I found other claims that he had been kneeling on the walkway. Either scenario could have proven to be fatal since a lethal voltage difference was present between each item and the lap bar. The electrical contractor told me that the motors are (and were) solidly grounded through their wiring cables, and a state investigator told me that they had done some testing later in 2005 and found 117 volts AC between the passenger restraining bar and the walkway.
6. The step-down transformer on this car had been replaced in April 2005 with one that was not an exact duplicate, but was a proper electrical substitute. The major difference was that the original one had "screw-type" terminals for the high voltage connections. The new one had four high voltage wires for connection to (1) neutral, (2) 120V, (3) 208V, and (4) 240V supply wires, and a green grounding screw for the connection to the grounded frame of the ride. The instructions that came with the transformers were to insulate the unused high voltage wire after the connection was made for the proper voltage (in this case 120 volts)

7. There is no debate about the fact that the unused two wires of the transformer were not insulated as they should have been. Note that the primary winding of the transformer was designed and manufactured with three possible input voltages: 120, 208, or 240 volts. The customer has the option of using the set that would suit the available voltage. The primary, when connected to use 120 volts, would then act as an “autotransformer” and the other two leads would be energized at 208 and 240 volts, respectively. It has been claimed that one (or both) of the wires were “welded” to the metal framework of the car structure. This would have energized the structure to either 208 volts or 240 volts, depending on which wire was touching the structure. So the car, in this scenario, would have been at 208 or 240 volts above ground. This wiring error was made by the deceased.
8. The deceased had a poor scholastic record. He was in his mid-twenties. He had been diagnosed with some learning disabilities, but also had the history of being able to dismantle and repair simple mechanical devices.

II Expert Analysis

We can never know what did happen, but one thing seems to be clear: the steel structure of the car was not grounded. This caused the death. Yes the transformer was wired incorrectly, and had it not been, then again in my estimation, the death would not have occurred. The entire reason for the green equipment grounding conductor is to stop any “accidental” energizing of the frame of any equipment, such as broken or compromised insulation, or any such occurrence such as this one.

Thus, in my opinion, there were two mistakes that caused this death. Both of these were necessary for this event:

1. The cars were not grounded through the light bars.
2. The transformers were not installed correctly.

Responsibilities

There were five entities that I could identify that could have had a measure of responsibility for this accident. They are my client, the electrical contractor, the amusement park operator, the deceased, the ride manufacturer, and the state safety inspectors.

The Electrical Contractor

The plaintiff’s complaint named the contractor as one of the defendants. I find that to be a usual ploy in that any complainant would include any and all possible parties, so as not to find later that there were some that should have been parties to the action. In this case I can find no culpability of any kind from the client electrical contractor’s part in this occurrence. I have reached this conclusion from the following:

1. From all the statements and depositions of all parties I gleaned that there were never any written estimates, contract, statement of duties, job description, etc. that defined what my client was supposed to do. Whenever there was an electrical job that they felt that the deceased could not do, or one where they did need a “licensed electrician”, then my client was called to do the job on a “time & material” basis, with no responsibility to do anything more than what was asked for.
2. Never did I find any allusion to the idea that it was my client’s job to check up on the work that the deceased had done.
3. Never did I find any allusion to the idea that my client was supposed to inspect the ride, or any ride, to ensure that it was wired correctly or grounded correctly.
4. All my client was ever supposed to do is the exact thing that one of the amusement park managers told them to do, nothing more.
5. Inspection of my client’s invoice for the dates of 5/21/05, 5/23/05, and 5/24/05 show that they did the “usual” springtime work on the variable frequency drives and motors to get them running after the winter down time. Further inspection of the foreman’s “Daily Log” of May 21 & 24, 2005 show that

my client was there on the May 21st and shows that the transformers had been installed, with no intimation that my client had anything to do with them.

6. The plaintiff's expert, on page 7 of 11, identifies "The Amusement Park and its agents" as the parties at fault. My client was not identified as, nor have they ever been, one of these agents, and thus was not claimed to be at fault by this plaintiff's agent.
7. It was my opinion that the electrical contractor bore no responsibility for this death.

The Amusement Park Operator

It is my opinion that the party that should bear the greatest percentage of the fault, if not all of it, is this one: the amusement park operator. I find their operation to be fraught with management errors that are too many to enumerate. As the owners and operators of the ride they had full responsibility for its safe operation. The lack of proper care in the operation of the park created an environment that could only lead to a serious accident such as the one that caused this death. Those items that I feel to be the worst are as follows:

1. The deceased was expected to do work that was clearly beyond his abilities. As an Engineering Manager who has hired personnel to be welders, mechanics, pipefitters, and electricians, I have been very particular that I got people that were well qualified for the job. I have found that a mechanic can be somewhat "self-taught", but the other classes of workers need to be educated in order to be competent. The most education is needed by the electrician. The science, codes, dangers, specifications, etc. that go into the electrical trades are all very exacting and complicated; much more so than the other trades. I did not sense any of this concern from any testimony from the responsible park managers. I repeatedly understood them to say, "If 'Chuck' said he could do it, then he could do it." To me that kind of attitude on their part, with no electrical education of their own, could be, and was disastrous.
2. Given the above, there also was no training for the deceased to help him do his job well. He was expected to do work for which he was not trained.
3. NFPA 70, The National Electrical Code, Section 525.31 "Equipment Grounding" states, in part (with my notes in parentheses): "The grounded circuit conductor (the white wire) shall not be connected to the equipment grounding conductor (the green wire) on the load side of the service disconnecting means...". This rule was clearly violated, as evidenced by looking at the various photographs.
4. NFPA 70E, "Standard for Electrical Safety in the Workplace" states as its purpose, in section 110.2, "These practices and procedures are intended to provide for employee safety relative to electrical hazards in the workplace." In it Section 430.11(H) repeats, again with my comments in parentheses: "The grounded circuit conductor (the white wire) shall not be connected to the equipment grounding conductor (the green wire) on the load side of the service disconnecting means...". Again this rule was clearly violated.
5. Another accepted standard is the IEEE "National Electrical Safety Code". Its Section 010. states, in part: "These rules contain the basic provisions that are considered necessary for the safety of employees and the public...". Its Section 123. "Protective Grounding" states, in part, "All electrical equipment shall have the exposed non-current-carrying metal parts, such as frames....effectively grounded or physically isolated." The amusement park operators did not ensure that this required grounding did in fact exist.
6. In the OSHA rules, CFR 1910, section 147(c) (7) covers "Training and Communication". Subsection 1910.147(c)(7)(iv) states: "The employer shall certify that employee training has been accomplished and is being kept up to date. The certification shall contain each employee's name and dates of training." Obviously this was not done, and was another instance of poor operating practices. A copy of this section of the OSHA regulations is attached.
7. When the used ride was purchased from the ride manufacturer the park operators they should have checked for more than "did it run". For all the safety reasons listed above, they should have checked the grounding. In fact the foreman, on page 46 of his deposition, stated that there was no ground wire in the sweep light bar wiring assembly to connect to the ground wire in a receptacle that was to feed

120 volts to a car. On page 141 he shows that he knows the difference between the green equipment grounding wire and the neutral ground conductor. His repeated failure to remedy this acknowledged bad situation whenever the sweep light strips were open for maintenance is probably the most egregious failure that caused this death. The death occurred, I believe, because the park operators failed repeatedly to correct a bad situation that was known to be wrong. This badly protected ride did function for years without any problem. It did so because there was no second failure. This second failure had to be one of an energized wire or operating device. But the stage was set for this accident. When the deceased made his incorrect wiring on the replacement transformers, the second failure occurred and someone's death warrant was signed. When the energized wire touched the metal frame there was no grounding circuit to protect the ride. The whole reason for the equipment grounding conductor is to cause a protective device to interrupt the power when a failure occurs.

8. It was my opinion that the great preponderance of blame for this death should be assessed against the Amusement Park Operators. This is due to their lack of due diligence in the operation of the park and their failure to recognize that the deceased was not capable of doing the electrical work that he was asked to do.

The Deceased

1. The deceased was expected to do work that he clearly was not prepared to do. I am no psychologist, but I wonder whether, after his years as being identified as having learning problems, if he was overly eager to promote his abilities beyond reality in order to at last feel good about himself. I wonder if his reading ability was good enough to have read the instructions that came with the transformers and to have understood their requirements and the necessity to follow them.
2. The park owner says that he saw wire nuts on the ends of some of the transformer leads. No one else said that. Also, since the testing and forensic analysis of this event were so poor, I never saw any discussion of whether there were any marks that the wire nuts would have left on the insulation, had they been installed and subsequently fallen off. It is interesting to note that I purchased one of these transformers from McMaster Carr and all of the wires came with about ½" of insulation stripped off of each of them. In the pictures that I saw all of the un-used wires had the bare leads cut off. It is not unreasonable to assume that the deceased cut off these bare wires and felt that this was enough.
3. As I said above, there were two events that caused this accident, and both were necessary for it to happen. The deceased was responsible for one of them and he was the victim of his own error. This accusation could be tempered by the fact that had his employer trained him to do more he might have been a more capable electrician and probably would not have been killed.
4. It was my opinion that a portion of the blame could be laid on the deceased due to his lack of education and incorrect work.

The Ride Manufacturer

1. The amusement park purchased this used ride "As is, where is" from the original ride manufacturer. Testimony has claimed that new owner personnel did no wiring alterations inside the sweep light bars. If true, then the cutting of the outgoing green "equipment grounding conductor" at the receptacle for the car plug, and the cross-wiring between the incoming green "equipment grounding conductor" from the hub, and the white "grounded neutral conductor", must have existed when the ride manufacturer purchased the ride from the previous owner.
2. In my opinion the Ride Manufacturer contributed to this death by their lack of rudimentary inspection of the used ride that they sold.

The State Safety Inspectors

1. Evidently the yearly inspection was done after the transformer installation. I believe that this inspection had to be deficient in that the grounding efficacy was not tested. It seems to me that equipment ground tests should always be a part of any inspection of this sort.

2. In my opinion the state safety inspectors contributed to this death by their lack of rudimentary inspection of the ride.

III Expert Opinion and Results

In my written opinion and deposition I gave the opinions as noted above:

1. It was my opinion that the electrical contractor bore no responsibility for this death.
2. It was my opinion that the great preponderance of blame for this death should be assessed against the Amusement Park Operators. This is due to their lack of due diligence in the operation of the park and their failure to recognize that the deceased was not capable of doing the electrical work that he was asked to do.
3. It was my opinion that a large portion of the blame could be laid on the deceased due to his lack of education and incorrect work
4. In my opinion the Ride Manufacturer contributed to this death by their lack of rudimentary inspection of the used ride that they sold.
5. In my opinion the state safety inspectors contributed to this death by their lack of rudimentary inspection of the ride.

Based upon these opinions, my client, the electrical contractor, was dismissed as a defendant in this action.