

LIGHTNING DATA CENTER MINUTES
June 11, 2010
ST. ANTHONY CENTRAL HOSPITAL, DENVER, CO
www.stanthonyldc.org

Monthly Quote: “Shocking; positively shocking!” ---James Bond, *Goldfinger*

1. Meeting began at 11:55AM and adjourned at 1:35PM.
2. Members present: Collier, Michael and Nancy Cherington, Stewart, Wells, Nibbe, Gift, Elder, Claus, Wachtel. Stewart moderated the meeting.
3. Stewart reminded members present of the dates for this year’s Lightning Safety Awareness Week, June 20-26. He stressed the importance of sharing a current and consistent safety message with the public. Suggestion that members promote coherent guidelines as developed by reliable sources like NOAA and the Lightning Safety Working Group.
4. William Roeder (meteorologist, 45th Weather Squadron) continues to share his findings on lightning safety with the LDC. Among the safety issues in our dialogue is one of public education. There is interest in improving a safety slogan for kids. The first part, “When Thunder Roars, Go Indoors!” has been deemed effective, but the second, “Half An Hour Since Thunder Roars, Now It’s Safe To Go Outdoors!” could use some work in his view. Roeder asks anyone interested in contributing to submit suggestions.
5. Stewart relayed Roeder’s warning on “sheltering” against a concrete wall which is “...no shelter at all”. The height of the wall is an issue, where either contact voltage or side-flash is a hazard. “In addition, concrete has been known to explode from lightning as it super heats trapped water pockets, flashing it into steam.”
6. Roeder also addressed the feasibility of a “lightning safety bag” one could crawl into and use like a portable Faraday cage. “Unfortunately...one of the lightning protection standards says metal needs to be 1/8 inch or thicker to offer good lightning protection. Such a bag would be too heavy/bulky for hikers/campers, etc. Additionally, “Faraday Cage strictly speaking applies to steady state electric charge. Lightning is anything but steady state!”
7. A local lightning incident was reported on. 9-year-old Lexie Archuleta of the Denver area was struck indirectly on May 29, 2010. With no clear visual evidence to point to, a thermal imaging camera detected smoke inside the walls of the building. LDC member Rich Kithil was consulted by the media on the incident. He commented: “Somehow there was a flashover from an intended conductor—maybe it was a wall outlet, maybe it was an aluminum window frame. This girl was close enough to that that lightning flashed over or was induced from an intended ground path to her. No fire, no burn marks—unusual but it happens.” (From: “*Girl, 9, Struck by Lightning Survives Without a Scratch*”, Collins, Hugh. AOL News, AOL Inc., 2010)

8. Stewart provided articles on the spacecraft Cassini which captured the first video images of lightning on Saturn. “The images have allowed scientists to create the first movie showing lightning flashing on another planet. It took years of waiting for Saturn to dim enough for cameras to detect bursts of light. The first images of the lightning were captured in August, 2009, during a storm that churned from January to October, 2009 and lasted longer than any other observed lightning storm in the solar system. Find the article at: http://www.nasa.gov/mission_pages/cassini/media/cassini20100414.html The video segment can be accessed on-line courtesy of JPL News/Video: “Saturn’s Flashdance of Lightning” at: <http://www.youtube.com/watch?v=clyB5mtn9kw> Footage was shot over 16 minutes and compressed down to the 10-second clip. “The cloud, which is about 1900 miles along its longest side, is illuminated by the reflection of Saturn’s rings. Each flash is about 190 miles (300 kilometers) across with an energy comparable to the most intense lightning here on earth.” (From: “*Cassini Captures First Video of Extraterrestrial Lightning*” Madrigal, Alexis. Wired Science, April 14, 2010)
9. Dr. Albert Nibbe, with research support from Karen Wells, presented “Shocking; Positively Shocking”. The presentation highlighted the effects of electric current on body tissue. A dramatic scene from *Goldfinger* helped get the audience in the mood. James Bond finishes off his opponent by shoving an electric fan into a tub the villain has fallen into. For a link: <http://www.youtube.com/watch?v=VD1ybsvhtng>
9. Important equations were reviewed like Ohms Law, $E=I \times R$. “... We are mainly concerned in assessing tissue damage and this is related to current flow...” A graph with heat (in Joules) shows a rapid climb as current is increased. Resistance of various body tissues to the flow of electrical current were categorized. A chart was displayed where burn dynamics, as a function of amperage, time and resistance levels were identified. One study (Dalziel, 1956) showed a graph of safe, let-go current versus frequency for men, woman and children, along with a relative discomfort curve.
10. Nibbe emphasized that with all the variables/parameters associated with electric current and its effect on tissue, there is no “typical electric shock”. Did the event involve direct contact or arc? What was the duration and skin resistance? What was the voltage? Was it AC or DC? What was the frequency, amperage and joules? With so many parameters, “...there are at least 362,880 possible combinations in analyzing electric shock.” (Hendler). The startle response was also reviewed (“accidental contact with a low voltage 60-Hz source can result in a startle reaction that can cause a subject to lose balance and fall.”). “However, published safety standards have not taken into account the possible effects of contact-current spikes. This is “...contact with a low voltage source as it is passing through its maximum...It results from charging the capacitor formed by the energized conductor and the body; the dermal layers of the skin are the dielectric.” Regarding EEG results, “Surprisingly, none were positive in electrical burns, but 75%, or 3 out of 4, were positive in lightning injury cases.” Many of the lightning injury cases did not involve nerve damage, but trauma. “Disc damage is common, either cervical or

other spine discs, because of contraction of the muscles.” Dr. Wachtel pointed out that for patients undergoing electro-shock treatment, mouth-guards are used to prevent jaw-related mouth/dental injury.

11. Dr. Michael Cherington in discussion of necrosis: One of the differences we see between lightning and generated electrical injury is “...there’s much more necrotic tissue requiring amputation...” Further, “...the necrotic tissue from generated electrical burns...much of that is thermal burning. I’ve never seen that with lightning. I’ve never had a lightning patient require amputation.”
12. Electroporation was discussed. Current flow through a cell may cause a permeable condition that could be utilized to introduce medications or other cellular components. Dr. Wachtel cited negative effects of electroporation: “At a certain level of electric shock, electroporation may cause cells to die slowly—to deteriorate.” Nibbe: “It is an attack on the cell.” Dr. Cherington: “Some of the neurologic conditions associated with generated electricity and lightning are delayed after the initial insult. The fact that electroporation has this delay may explain the delayed symptoms.”
13. Nibbe presents another graph showing the recovery of the sciatic nerve’s action potential amplitude after the application of electric shocks of different strengths. A study published in *Forensic Science International* on “Early Epidermal Changes in Heat and Electrically Injured Pig Skin” was cited. The findings from both a light and electron microscopy study were summarized here. Physical symptoms of electrocution (general diffuse, neuropsychological and pathway related) are listed with their percentage values for males and females (Morse and Morse). A chart (Hendler Mensana Clinic) showing a variety of medical tests (nerve block, neurometer, bone scan, root block, facet block etc.) and corresponding results for electrical burns versus lightning injury is presented. A list of confirmed diagnoses and percentage of positive outcomes, electric burn v. lightning, is contrasted. Nibbe projects another illustration showing how current lines differ when passing through a sphere of lower, equal and higher resistivity than the environment.
14. These minutes do not represent official positions of the LDC or its members. They simply reflect topics covered and comments made at the meeting.
15. Next meeting: Friday, July 9, 2010 at 11:45 AM in the Main Auditorium at St. Anthony Central Hospital. Information on agenda will be made available in Sue’s monthly announcement.

Respectfully Submitted,

Gregory Stewart