

**LIGHTNING DATA CENTER
MINUTES
AUGUST 14, 2009
ST. ANTHONY CENTRAL HOSPITAL, DENVER, CO
www.stanthonyldc.org**

Monthly Quote: “

1. Meeting began at 11:50 AM and adjourned at 1:05 PM.
2. Members present: Yarnell, Wells, Gift, Cui-Gift, Clark, Collier, Mendez, Nibbe. Clark moderated the meeting.
3. It is now official: The LDC now has officers, as motioned and seconded by Drs. Cherington and Wachtel during the July meeting. The officers are:

President – Ken Langford
Vice-President – Greg Stewart
Secretary – Steve Clark
Treasurer – Mike Foley

Although not officially an officer, Bob Wallace has agreed to serve as the LDC's liaison to St. Anthony's Hospital. Thank you, Bob.

4. An officer's meeting was held on Wednesday, August 5, 2009, with Bob Wallace. Items 5-9 are details from that meeting.
5. The officers decided that the LDC needs to enlist the enthusiasm of Michael Cherington and Phil Yarnell for physician recruitment to the LDC. The officers share the belief that physician participation is important to the LDC since Dr. Cherington is retired and Dr. Yarnell is nearing retirement. It was decided that we would also approach Dr. Charlie Mains, as he is the Head of Trauma Services for the Centura family of hospitals and has attended a dozen LDC meetings.
6. We discussed funding for LDC projects such as the poster evaluation. Bob Wallace said those wishing to contribute funds to the LDC can mail their checks to: St. Anthony's Health Foundation, 4231 W. 16th Avenue, Denver CO 80204. Please be sure to indicate on the memo line of your check "Restricted For Use By the Lightning Data Center" so that the funds will be correctly routed to the LDC. Bob also announced that St. Anthony's has hired a half-time grant writer. Hopefully, the LDC can work with this person to secure additional funding. The Foundation is a non-profit 501(c)(3) entity, which means contributions are tax-deductible.

7. With regards to the new website, the four officers are each going to write a short introductory piece for the website in their areas of specialty. The officers will meet prior to the October LDC meeting to go over these pieces, with the idea of refining them before posting them to the website.
8. With regards to the lightning safety poster, Ken has been working to secure physical locations for the lightning safety poster project. He has attempted to contact the USFS at Mt. Evans, part of the Arapahoe National Forest. Some e-mails have been exchanged with them. He's also tried to contact the administrator of Bergen Peak, which is part of the Denver Mountain Parks system, but has not heard back from this person. Ken has also been in contact with Deb Thomas, a professor with the Department of Geography at the University of Colorado – Denver. She will oversee the creation and administration of the survey. Finally, Ken has had contact with Sara Newman, Program Director for the National Park Service's Public Risk Management group. Greg has offered his assistance to Ken for making contacts for the project. After the officers' meeting, Ken contacted both Sara and Deb, and they are still enthusiastic about the project. Deb has a specific graduate student in mind, and she will try to set a meeting soon. Regarding funding for the poster project, \$2100 in pledges have been received as follows:

St. Anthony's Health Foundation:	\$1000.00
Mr. Random Enterprises, Inc.:	\$1000.00
Dr. Michael Cherington:	\$100.00

Greg Stewart thinks he may have located a source of funding for the remaining \$900 needed to initiate the study.

9. The Denver Post profiled the LDC in an article dated July 24, 2009. This article generated some publicity for the LDC. On Wednesday, July 29, 2009, Steve Clark was interviewed on KYGO 98.5 FM during the 7 AM drive time morning show (Kelly and Mudflap). In addition, LDC received an inquiry from a representative from CBS Evening News with Katie Couric, expressing interest in perhaps taping one of our meetings. The officers decided that it would be better to have them come out next spring as the storm season will be winding down over most parts of the country this year. Finally, an electric shock survivor read about the LDC and wants to tell his story. More about him below in Item 11. Our thanks go to the Denver Post for a terrific write-up. Here's the link to the article: http://www.denverpost.com/dontmiss/ci_12903830
10. Phil Yarnell advised there were some medical and case history inaccuracies in the July 2009 minutes due to proofreading issues.

11. Steve Clark announced that an electric shock survivor saw the Denver Post article and wants to tell his story at the September meeting. Clark asked if there was anybody that could volunteer to give this individual a ride to and from the meeting, as he does not drive. Robert Gift has tentatively volunteered; however, we still would like to have someone else there as a backup, since Robert could get a call for a blood run. This fellow lives near Leetsdale and S. Quebec. If any of you can offer to give him a ride to and from the meeting, please e-mail Steve Clark directly at: sclarkoto@eml.cc. Thank you.
12. Our speaker this month was Richard Collier, owner of RSC Lightning Protection Analysis and Testing. Mr. Collier assesses the lightning threat to structures using physical measurements of current flows, voltage potentials, and magnetic fields over time. He also runs computational models that simulate the same three parameters. He got started in the mid 1980's when Army bunkers in West Germany were being hit 1 to 3 times each summer. One bunker was hit twice in the same season and another lightning strike triggered an alarm and other problems. For the Army, this was deemed to be a significant problem as the bunkers were used to store nuclear weapons.

Lightning is thought to threaten critical asset elements (people, explosives, circuits) in three ways:

- Direct Threat: Resistive heating of critical asset elements due to direct attachment of lightning current.
- Indirect Threat: Resistive heating of critical asset elements due to indirect secondary currents induced by time-varying electric and magnetic fields in the lightning environment.
- Resonance Coupling: Resonance coupling to critical asset elements in the lightning spectral range – up to 20 or 30 MHz, can lead to long-term heating.

To better assess the threats to critical assets, physical measurements were collected via three test methods: rocket-triggered lightning, high voltage Marx generators, and by injection of low-level RF currents into structures. In addition, computer modeling of the field components (voltage, current, and magnetic field) was performed using the finite difference form of Maxwell's equations. The computations were done iteratively, using time steps of 1.8 nanoseconds for external coupling problems and anything from .45 to .9 nanoseconds for internal coupling problems. These two methodologies enabled Rich to identify the three kinds of threat noted above, inside a structure.

Below are some of the findings.

In a vent stack, the maximum current penetration was seen for a range of frequencies between 1 and 5 MHz.

The most damaging frequency range for lightning is roughly from 200 kHz through 5 MHz. At frequencies higher than 5 MHz, the damage potential drops off considerably.

Finally, comparison of modeled results versus physical measurements for current and for magnetic fields shows two main things. One, the models tended to under-predict the magnitude of the parameter being measured. Second, in terms of relative amplitude, the modeled results tended to follow the measured results pretty closely over time; although the modeled results tended to lag behind the measured results for a few seconds.

And finally, a little trivia: It takes 3 trillion floating-point computations, using a 200 X 200 X 200 grid, to simulate 1 microsecond of lightning.

Rich, thank you for your very informative presentation.

13. These minutes do not represent official positions of LDC or its members. They simply reflect the comments made at the meeting.
14. Next meeting: Friday, September 11, 2009 at 11:45 AM in the Main Auditorium of St. Anthony Central Hospital. Speaker will be an electric shock survivor.

Respectfully Submitted,

Steven E. Clark, Consulting Meteorologist