

Minutes October 10, 1997 Lightning Data Center Centura Health St. Anthony Hospital

Quote of the Month:

"Although 78 percent of the atmosphere is nitrogen gas, plants cannot absorb it directly from the air as they can oxygen and carbon dioxide. Instead, they must wait until it somehow becomes fixed -- bonded with hydrogen or oxygen -- to form usable nutrients like ammonium and nitrate. In nature, there are two ways this happens: A small number of algae and soil bacteria have enzymes that enable them to convert nitrogen gas directly into useable form. And lightning transforms the gas into nitrates, which then rain onto soil."

William K. Stevens, 1996 NY Times

1. Meeting began at 11:30 am and adjourned at 1:45 pm.
2. Members present: Baccei, Blanke, Breed, Cherington, Clark, Fischer, Gustafson, Hammerberg, Kamin, Keen, Lammertse, Rhodes, Swanson, Toler, H Wachtel, Walker, Yarnell.
3. Part of our meeting was recorded on videotape by Eric Blumer, photojournalist, of KCNC-TV. Earlier this month, a reporter from the television station spoke with Dan Lammertse about producing a television documentary about LDC.
4. I brought the following materials for distribution. In each case I have selected a few quotes from the articles:

a. Einarson D, Bailey B, Inocencion G, Ormond K, Gideon K. Accidental electric shock in pregnancy: a prospective cohort study. *Am J Obstet Gynecol* 1997;176:678-681.

"The results of this first prospective controlled cohort study on accidental electric shock during pregnancy are in contradiction to the cumulative published case reports. Summation of these cases suggests a %76 mortality rate among fetuses of women exposed accidentally to electric shock....Our study suggests that in the typical home scenario in North America a hand-to-hand electric shock does not pose a major fetal risk...a rate of 2 cases out of 31 pregnancies is well within the expected rate of spontaneous abortions."

b. Seiden MV. Case Record of Massachusetts General Hospital Case 18-1997. Sigmoid stricture after radiation for prostate cancer. *N Engl J Med* 1997;336:1738-45.

"Since its earliest days, radiation has been known to have gastrointestinal toxic effects. In 1897, just two years after the discovery of x-rays, Walsh reported the development of crampy abdominal pain and diarrhea after exposure to x-rays, which could be avoided by shielding the abdomen with lead...More contemporary studies have shown that ionizing radiation causes cell death through the breakage of DNA strands. If the damage is slight these breaks may be repairable, but a critical load of breakage leads to apoptosis. Cell that are actively dividing are the most sensitive to ionizing radiation. At the start of the S (synthesis) or M (mitosis) phase of the cell cycle, cells with undamaged DNA initiate replication or mitosis, whereas those with damaged DNA stall and repair the damage or activate a cascade of genes for cell death."

c. Deutsch S, Wilkening GM. Electromagnetic field cancer scares. Health Physics 1997;73:301-309.

"It is well established that EMFs of ionizing radiation, such as x-rays, can initiate cancerous growth, depending on the dose. The present paper, however, is concerned with non-ionizing radiation with much lower frequencies, from zero up to 300 gigahertz (300×10^9 hertz, a wavelength of 1 mm)....EMF effects cannot bridge the cell membrane, which is an electrical insulating barrier that can withstand exposures that are several orders of magnitude greater...it is highly unlikely that there is a link between EMFs and cancer."

Nicolas Floret sent to me a letter and a medical questionnaire that is being used by APERI. I distributed both these documents to the members present. I shall present both these documents to our Administrative Committee at the AC meeting next month.

5. Phil Yarnell and Howard Wachtel discussed the possible effects of magnetic field changes on the cardiac conduction system and the central nervous system as the cause of cardiac arrhythmias. Chief Jerry Rhodes reported on the experience of EMS (Emergency Medical Services) regarding the treatment of out-of-hospital cardiac arrest patients. The duration of CPR to a good outcome is longer for lightning patients than for other cardiac arrest patients.

Phil presented the information on a patient who was struck by lightning 20 years ago. Since then she has had recurrent viral infections and an illness akin to chronic fatigue syndrome. Dan Lammertse told us that many of the patients with spinal cord disease that he cares for have some impairment immunity and an increase in infections.

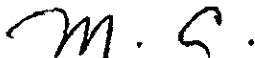
Phil provided us with a follow-up report on the woman who developed a facial nerve palsy from electric trauma while she was on the telephone. She was presented at our meeting earlier this year. She is improving.

6. Chief Jerry Rhodes reported on 14 episodes of lightning strikes to structures this summer. One episode involved a lightning strike to a house with "pressure wave" damage to the garage 150 feet away. He also raised the question of lightning safety to the people working in metal toll booths on E-470. Howard stated that the Faraday cage character of the toll booth would provide shielding effect against electric current but not against magnetic field changes. Carl Swanson said that an ideal Faraday cage is made of metal and is well grounded. Howard suggested that a metal flag pole, not adjacent to but not too far a distance from the toll booth might be a good lightning rod protector.
7. Dick Fischer raised the question of the Faraday cage effect on metal tractor and other equipment used in mining operations. Carl suggested the Faraday cage effect was jeopardized if there were no windows on the cab. Dan stated that the Faraday cage effect may be a relative phenomenon and that the interior of the cab might be preferable to standing outside unprotected. I invite our readers to write to us with their recommendations about this issue.
8. Dan Breed returned from a summer spent in Mexico. The NCAR rain making project is ongoing and will probably continue for 2 more years.
9. Gunnar Blanke brought a videotape of dramatic lightning storms that will soon be

seen on television.

10. Steve Clark's project on lightning cases from newspaper accounts is nearing completion. So far he has found 32 cases in Colorado for the years 1993-95. Steve brought a book entitled: The Nature of Ball Lightning by Stanley Singer. According to the author, the average size of ball lightning is 20 centimeters. Dan Breed comment that "ball lightning" reported by airplane passengers and crew represents ionized air, as a plasma ball. It can originate from electrical equipment or lightning.
11. Cheryl Toler distributed a summary of the questionnaire answers that our members returned to LDC via mail or fax. We are pleased with the suggestions and support provided in these forms. We can discuss this further at our next meeting, after everyone has had time to consider the various answers.
12. Julie Walker said that the 1993-95 hospital data collection project is nearing completion. The members of her committee will meet soon to analyze the data. Chief Rhodes will help with the next stage of this project with data from EMS.
13. Rich Keen reported the end of season data from the Coal Creek Canyon Thunderstorm and Lightning Observatory. There were 92 thunderstorm days. This is the most since 1992 the last time the El Nino was effecting our weather. The average number of thunderstorm days is 86. This is second only to central Florida (100 average number per year).
14. Howard provided us with a summary of his presentation on cancer link to EMF that he will give next month in San Diego at the Annual Review of EMF Bioeffects Research. He stated that the notion that cancer was linked to EMF started about 15 years ago in Colorado. Since then the evidence from many studies have shown little or no correlation between cancer and EMF from power lines, etc. However, powerline might be a marker for other carcinogenic factors, such as traffic and socioeconomic factors. He said that the incidence of childhood leukemia is greater in homes where nearby traffic flow is 20,000 vehicles per day. He speculates that pollutants (e.g. benzene) may play a role.
15. Carl Swanson provided us with videotape he had taken with examples of "bead" lightning which is seen as the flash in "breaking down. Carl distributed copies of "The International Safety and Rescue Guide against Lightning" by Andrews, Berger, Floret, Ishikawa, Kitagawa, and Ohashi. This article was presented at Lightning & Mountains Conference in Chamonix.
16. Next meeting: Friday, November 14, 1997 at 11:30 am in the Main Auditorium at Centura Health St. Anthony Hospital Central.

Respectfully submitted,



Michael Cherington, MD
Chair, LDC Scientific Committee

AR-85

WHY IS WIRE CODE ASSOCIATED WITH CHILDHOOD LEUKEMIA RISK IN SOME CITIES BUT NOT IN OTHERS? H. Wachtel¹, R. Pearson² ¹Electrical and Computer Engineering Department, University of Colorado, Boulder, Colorado 80309-0425, USA; ²Radian International LLC, Denver, Colorado 80202, USA.

OBJECTIVE: To formulate testable hypotheses that could explain why high wire codes are associated with increased risk of childhood cancer in certain metropolitan areas (such as Denver and Los Angeles), but not in others (such as the east coast or Midwest cities) studied by Linet et al. (1997).

BACKGROUND: Three independent studies, two in Denver and one in Los Angeles County, (LA) found that children living in the highest wire code category (VHCC or HCC) homes had a two to three fold risk of leukemia relative to those from low wire code homes (LCC or underground lines). However, Linet, et al. (1997), have recently reported that this association is not seen for the aggregate of cases they studied in nine eastern and Midwestern states. An earlier study by Fulton, et al. (1980) had also shown that the wire code association was not seen in the Providence, RI, area. One interpretation, suggested by Linet, et al., is that the Denver and LA studies were methodically flawed and gave spurious results, whereas their own study was free of such flaws. On the other hand, it is possible for wire code to be a valid risk factor for childhood leukemia in the newer western cities and not be a risk factor in the older cities of the east. Indeed, the relative age of the cities, and thus the different way they were historically "wired up", may be a key factor in explaining this dichotomy. In older eastern cities most of the streets that now exist were platted in the 19th century before the age of electrification and automobiles (and "upwardly mobile" residents). Thus, the relationships between power line distribution location and environmental impacts (such as air pollution and the socioeconomic status of residents could be fundamentally different from those of newer cities (such as LA and Denver) whose layouts were developed mainly in the 20th century. This leads us to hypothesize that whatever cancer risk factor is inherently captured by wire codes in the newer western cities is not surrogated by wire codes in older cities.

METHODS: Preliminary testing of this hypothesis starts with comparing street layouts of Denver and LA areas to those of older eastern and Midwestern cities studied by Linet, et al. Further exploration involves examination of power lines databases to ascertain where VHCC homes are located. "Automatic wire coding" and other GIS techniques can then be used to determine how high wire codes may relate differently to neighborhood characteristics in different cities.

RESULTS: Western cities, such as LA, Denver, Phoenix, etc., have distinctly different street patterns than older eastern cities. In particular, western cities more frequently utilize regularly spaced wide boulevards (approximately one-half to one mile apart) to collect and route traffic around residential neighborhoods. Such boulevards also tend to be where heavy feeder distribution lines are located. In western cities, this creates bands of VHCC homes on the fringes of low wire code neighborhoods. Such bands are less likely in older cities. This category of "boulevard proximal" VHCC homes is of particular interest to us because we have noted that in the Savitz, et al. (1988), study about 90% of such homes in Denver were cases, which accounts for a large portion of the overall "VHCC risk" in that study. Consideration of electrical distribution practices also reveals that in older eastern cities, VHCC homes are likely to be on narrow lightly trafficked streets served by thin wire lines very close to the homes. This is a very unusual pattern in newer western cities.

DISCUSSION: More rigorous testing of our "older vs. newer city" hypothesis is clearly needed. Such testing could include comparisons of the surrounding features of actual VHCC case (and control) homes in the Linet et al. study with those in Denver and Los Angeles. The importance of these wire code risk surrogacy questions transcends the EMF health effects issue. If it turns out that wire code risk factors can be identified in cities such as Los Angeles and Denver that are clearly not "surrogated" by wire codes in older eastern cities, then these delineating factors may provide a cogent clue as to the true cause of childhood leukemia.

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NEWS FROM NLSI, OCTOBER 1997

1. Reports from New Mexico Tech's summer 1997 rocket triggered lightning program indicate that eight hits were recorded to blunt, hemispheric-shaped lightning rods vs. zero hits to sharpened, conventional lightning rods. See NLSI's WWW page called "Lightning Rod Behavior: A Brief History" for more background. For an overview of New Mexico Tech's activities, see:

<http://www.ee.nmt.edu/~langmuir/>

2. For a very good overview of what's going on globally in lightning research activities, check out Earle Williams' twice-annual publication NEWSLETTER ON ATMOSPHERIC ELECTRICITY. The WWW site is:

<http://hawk.nmt.edu/bateman/ae-home.html>

3. A demonstrator Early Streamer Emitter (ESE) Air Terminal is being installed at a high asset value/high lightning risk national defense facility in north Florida. The region suffers some 10-12 lightning strikes per square kilometer per year. The site is about one square kilometer in size. Previous lightning activity during 1997 knocked out a lightning detector and (separately) a main telephone system. The ESE air terminal will have a lightning counter attached, to record strikes. The ESE device is to be located some 15 meters away from the primary structure which is equipped with a standard NFPA-780 system.

4. 911 Stations : NLSI has received many reports of severe personal injuries to employees and volunteers due to tower lightning strikes and improper bonding, grounding, and shielding of equipment. If you have any information about similar, local problems at 911 stations near you, please contact us.

5. NLSI recently received a consulting contract from a major gas pipeline company. 62 compressor stations and 1500 miles of pipeline are at risk from lightning's effects.

6. We recommend an excellent addition to your lightning library by L.A. GEDDES called *Handbook of Electrical Hazards and Accidents*, CRC Press, 1995. ISBN No. 0-8493-9431-7. He is at Purdue U., tel. 317-494-2995.

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Richard Kithil

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Please put these four citations in the next LDC minutes, thanks

rick.

Rec# 6164. Dollinger, Stephen J. and Cramer, Phebe. Children's defensive responses and emotional upset following a disaster: A projective assessment. Journal of Personality Assessment. 1990; 54(1-2):116-127.

Geoarea: US, IL.

Note: 26 references.

MZ00210.

lightning/ children/ psychological impact/ psychology.

Rec# 6580. Dollinger, Stephen J.; O'Donnell, James F., and Staley, Arlinda A.

Lightning-strike disaster: effects on children's fears and worries. Journal of Consulting and Clinical Psychology. 1984; 52(6):1028-1038.

Geoarea: US, IL.

Note: 26 references.

A lightning strike at a playing field knocked down all the child participants in a soccer game, as well as most of the spectators on the sidelines. Part of a larger project on the electrical, biomedical, and psychological aspects of a lightning disaster, this study has three objectives: to evaluate the respondent conditioning theory of the origin of children's fears; to assess the validity of the Louisville Fear Survey for Children (LFSC); and to study the mental health effects of disasters. Findings from the study indicate that the LFSC has impressive validity as a research tool in assessing aspects of children's fears, and that naturally occurring traumatic events offer an unusually fertile opportunity for the study of childhood fears.

MZ00143.

lightning/ children/ psychological impact/ mental health services/ psychology.

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Rec# 6631. Dollinger, Stephen J. The measurement of children's sleep disturbances and somatic complaints following a disaster. *Child Psychiatry and Human Development*. (Spring 1986); 16(3):148-153.

MZ00147.

lightning/ psychological impact/ children.

Rec# 15670. Greening, Leilani, Dollinger, Stephen J., and Pitz, Gordon. Adolescents' perceived risk and personal experience with natural disasters: An evaluation of cognitive heuristics. *Acta Psychologica*. 1996; 91:27-38.

Geoarea: US, IA.

Note: 23 references.

Over 450 high school students in Iowa were evaluated to determine whether negative life events caused by meteorological hazards had affected perception of these hazards. Adolescents with a mean age of 17 years came from 9 high schools affected by a weather disaster and 3 schools in communities where no known disaster had occurred. Criteria evaluated included personal experience, memory, availability, and imagery. Findings included 1) both personal experience and imagery rating for weather disasters were found to be significant predictors for perceived personal risk; 2) in reference to natural disasters, perhaps imagining limited control over the outcome of such events is more relevant for risk perception than simply simulating the event in one's mind; and 3) another variable--controllability--may influence the relation between personal experience and risk estimate.

TZ00307.

psychological impact/ psychology/ risk perception/ children/ meteorological hazards/ lightning.

Rec# 7303. Greening, Leilani and Dollinger, Stephen J. Adolescents' perceptions of lightning and tornado risks. *Journal of Applied Social Psychology*. 1992; 22(10):755-762.

Note: 14 references.

With the exception of flash floods, lightning causes more fatalities in the U.S. than any other natural disaster agent. In this study, more than 450 adolescents were surveyed to determine the subjective probability risk for lightning and tornado deaths. Results from the study included 1) the subjects perceived the fatality risks for tornado to be higher than for lightning; 2) there was a tendency for the subjects to have had more experience with lightning incidents and to be more aware of fatalities due to lightning than to tornadoes; and 3) personal experience with both lightning and tornado events contributed to more realistic risk perceptions of these hazards. Because teenagers are among the most likely victims of lightning strikes, hazard managers might consider personal experience with meteorological hazards a significant component of risk awareness programs directed at this age group.

MZ00292.