

1 LAWRENCE: May I interrupt. Jon, before you say anything we
2 would just like to say how very sorry we are for what has happened. And that
3 our thoughts and prayers are with the families not only the of the ones who were
4 touched very closely but those all around and we just want you to know that .
5 DESTEFANO: Thank you, Michelle. In fact thank you
6 Commissioners for your deep concern and your strong support of Jefferson
7 County Schools and Columbine High School during the greatest tragedy in
8 education in the history of this country and the world. I greatly appreciate your
9 support and assistance. On behalf of the Jefferson County Board of Education I
10 am here speaking with you tonight regarding your deliberations on the
11 placement of a transmission tower on Lookout Mountain. The Board of
12 Education has taken the position that the safety of our children is of utmost
13 concern and we took this position on March 12th. The lessons of the tragedy at
14 our Columbine High School at least one of them is that there are some things
15 we have no control over. There are other things that we have control over. You
16 have control over the tower issue. Inconclusive evidence of the effects of
17 microwave towers does not allay our concerns. We would urge you to
18 completely and definitively provide proof the placement of this tower at the
19 proposed site will not in any way harm the children living in the area or attending
20 Ralston Elementary School. If such as evidence is not available we urge you to
21 find an alternative site. Thank you for your considered attention to our serious
22 concerns and please keep at the forefront of your decision the safety of our
23 children. If we don't protect our children when we can, who will? Thank you.

1 HOLLOWAY: Jon, hold on just a second.

2 DESTEFANO: Oh, I'm sorry.

3 HOLLOWAY: Do you have any questions for Jon? Okay. Thank
4 you.

5 DESTEFANO: Thank you, too.

6 CARNEY: We're looking for Bryan Starling, Golden City
7 Council.

8 STARLING: Yes. I'm Bryan Starling. I reside at 900 12th Street in
9 Golden Colorado. I'm also a city councilor for the City of Golden. In addition to
10 that I'm also a medical researcher of about 25 years in medical implants and I've
11 had some experiences that run pretty similar to some of the things that we're
12 discussing this evening. So I'll discuss those outside of the city council domain.
13 I'd like to read for you the resolution that the City Council had passed. It is
14 Resolution Number 975. It's a resolution of the City of Golden, City Council,
15 requesting additional impartial and expert evaluation of the proposed HDTV
16 tower on Lookout Mountain. And it states, "Whereas the City of Golden is home
17 to the Colorado School of Mines which is the oldest institution of higher
18 education in the State of Colorado and whereas the Colorado School of Mines is
19 world renowned for the quality of it's teaching and research and whereas the
20 members of the Colorado School of Mines faculty have expressed to City
21 Council their grave concerns over the potential negative technical impact of the
22 proposed broadcast facilities on their research which brings over 20,000,000
23 dollars into the local economy and whereas the Golden area is the location of

Witness Testimony

Dr. Gary Olhoeft

1 HUTFLESS: Madame Chairman, before Dr. Olhoeft starts to
2 speak If I could clarify one thing with respect to some evidence.
3 CARNEY: Oh, I'm sorry.
4 HUTFLESS: I thought I'd mention about that tape. You did
5 mention this tape you know that you sent into me and asked to be put in the
6 record. Mr. Ragonetti, have you seen this tape? It's entitled Lake Cedar Group
7 Care Submission Amoco Building Chicago Tower?
8 RAGONETTI: We have not.
9 HUTFLESS: Okay, you want this included in the record, don't
10 you?
11 CARNEY: Yes, please.
12 HUTFLESS: It will be available for you to view by contacting the
13 clerk's office if you wish to look at it and then you could file any responses you
14 may have or deem appropriate in writing after viewing the tape. Thank you,
15 Madame Chairman.
16 HOLLOWAY: Thank you.
17 OLHOEFT: I am Gary Olhoeft. O-L-H-O-E-F-T, 1818 Smith
18 Road in Golden. I'm a professor of geophysics at the Colorado School of Mines.
19 I study electromagnetic fields. I study the natural fields that are generated when
20 the solar wind interacts with the earth's magnetic field and I study the fields that
21 are created by people and I create my own fields in order to study the earth. I
22 want to talk about radio frequency interference because it will interfere with what
23 I try to do everyday in teaching, and in doing research and in some of the things

1 that are done with geophysics in the Golden area. You'll pardon me if I'm
2 shaking. I have Parkinson's Disease. Last year I was doing a research project
3 and an educational exercise on Dinosaur Ridge over on Alameda where we
4 were using a 900 megahertz ground penetrating radar system in order to track a
5 hundred million year old dinosaur prints. You may know that it is illegal to climb
6 on the rocks there. Well, we had permission to be up on the rocks and we were
7 up on the rocks with our instruments. And every now and again somebody
8 would see us and stop with the car, look up at us and pick up the cell phone and
9 call the Sheriff to tell us we shouldn't be up there. Well the cell phone operates
10 at 900 megahertz. It wiped out my radar, so every time they stopped and called
11 us I had to stop doing what I was doing and redo it because they were
12 interfering with me. That's a common, more common than I would like to see
13 happen experience for me anymore because we have more and more radiation
14 being generated by people and by things people are doing. But think about
15 what happens when somebody does that when they go over Berthoud Pass
16 under construction and they're doing blasting. If they do that cell phone trigger
17 near a blasting cap they can trigger the blasting cap and kill somebody. That's a
18 collateral health risk that's associated with radio frequency interference, not the
19 direct radiation to the body but the direct radiation to something else, another
20 device that we're using that doesn't work the way we intended it to because
21 something got in the way, radio frequency interference. A garage door going up
22 and down can do the same kind of thing. School of Mines has it's research
23 survey field at the base of the mountain that they want to build this tower on.

1 We normally do surveying out there with instruments that use lasers and other
2 things and these days we do a lot with global positioning systems especially the
3 real time kinematic global positioning systems where you have two that talk
4 with the radio frequency in between. The kind of power levels they are talking
5 about we have requested information about. They have given us partial
6 information. They have not answered all of our questions. We cannot evaluate
7 fully what that will do to our teaching and research with the global positioning
8 systems. If it interferes with the communication between the two devices the
9 surveying will not work. And this same survey field the Department of Defense
10 has constructed an unexploded ordinance test site to use geophysical research
11 for tools to find land mines. There are about a hundred million land mines
12 scattered around the world that maim or kill 10,000 people a month according to
13 the U.N. We'd like to find them and they are very difficult to find. The kinds of
14 research required to do that uses geophysics. If they build this tower we already
15 have trouble enough from Lookout Mountain. We'd have to move that research
16 field to someplace outside of Golden. In the same location there is also a facility
17 built for research to help the Denver Water and Sewer Board try and figure out
18 how to find problems with sewer pipes or with leaking water pipes. You may
19 remember the I-25 incident where they had at the mousetrap a thirty million
20 dollar water flood two years ago. They'd like to be able to assess and evaluate
21 whether or not the condition of those pipes require the replacement now before
22 they break. We're trying to develop the tools to do that. We're already having
23 trouble again with the existing power levels. If they go up we'll have to move

1 that site. In the City of Golden I'm told by the Fire Department there is
2 increasing numbers of excavation damage where somebody goes in with an
3 excavator to dig a hole and hits a plastic gas pipe. If you look at the Country
4 there is about a house a month blown up by that kind of damage. They have
5 easy time with metal detectors finding metal pipes. They have a very difficult
6 time finding plastic pipes. The technology we use to find those pipes is again
7 called ground penetrating radar. It operates at about 500 megahertz to best find
8 a plastic pipe right in the frequency band that they are proposing to build the
9 super tower. In the Golden area we wouldn't be able to use those techniques.
10 Again what exactly what the pattern would be I can't predict because they can't
11 tell me what the multi-pathing is and they can't or haven't told me what their
12 antenna pattern is. That means we're going to have to find other technologies
13 which may not exist in order to find plastic pipes before they excavate so they
14 don't cause explosions by hitting plastic gas lines. I don't know that we can find
15 that technology. We also have a lot of people who come to Golden to work.
16 Bob Crowder is going to talk next about the industry that's here that involves
17 geophysics, partly attracted because of the Colorado School of Mines and the
18 Department of Geophysics and partly because there are a lot of people who like
19 to live here. They do things with these tools research, development,
20 manufacturing which is already interfered by Lookout Mountain. They may have
21 to move their businesses. Bob will talk about that. We also attract to the school
22 a number of conferences. I've heard different estimates but it's in the millions of
23 dollars brought into the economy, based on the conferences people who come

1 here want to learn from us, want to get together and learn from the industry
2 that's in the area. They want to see demonstrations of equipment. We're
3 already having trouble demonstrating that equipment. We're already at the
4 level, where just the normal background level has risen because of the RF in the
5 area not just Lookout Mountain but Mt. Morrison, the cell phone towers in
6 various locations make it very difficult for us to demonstrate equipment let alone
7 develop new equipment. This radio frequency interference is doing things to us
8 that we're not anticipating, or having a hard time anticipating. Right now I can't
9 predict exactly what will happen because I've not been supplied with the
10 information. A couple of weeks ago I had a John Browne come visit the
11 Colorado School of Mines Campus in order to talk to us from the Lake Cedar
12 Group. We asked him to supply certain information and he has not supplied it
13 and so again, I have to guess I don't know exactly what it's going to do to me. I
14 really would like to know what that impact is before they do it so we don't have
15 to go afterwards and try and figure out how we can get them to remove it. I
16 doubt we could do that. Thank you.

17 HOLLOWAY: Do you have any questions? Thank you.

18 CROWDER: My name is Bob Crowder. That's C-R-O-W-D-E-R. I
19 reside at 2114 Cheyenne in Golden. I am a co-owner of two small businesses in
20 the Golden area. The first business is Mount Sopris Instrument Company. It's
21 located at 17301 W. Colfax, Suite 165. That's literally catty corner from this
22 building across 6th Avenue. Mount Sopris, we manufacture high tech
23 geophysical equipment for the world ground water environmental and mineral

Witness Testimony

Dr. John Reif

1 was meters that detected the powers the amount of power of the energy that
2 was radiated to the monkeys eyes.

3 HOLLOWAY: Were they in a confined area?

4 PARDOS: They were in a confined area, yes. And they
5 were divided into 4 or 5 groups, 0.2, 1, 10, and 15 millowatts per centimeter
6 square.

7 HOLLOWAY: So, they were in a confined area and given
8 large doses of radiation.

9 PARDOS: Well, they were in a confined area given, I
10 wouldn't say large doses of radiation, but given doses of radiation, but more to
11 the point even if there was a background radiation, the controls, which there
12 were two sets of controls, those sets of monkeys that were given sham
13 exposure were sitting in the same areas, in the same environment, but not
14 radiated. And a similar group that was sitting in the same environment, same
15 area and given the drops and in those controls there was no change in the
16 vasculature of the cornea endothelium of the animals.

17 HOLLOWAY: Thank you do you have any questions?

18 SHEEHAN: Where was the study done? Where were the
19 monkeys?

20 PARDOS: I think it was in Boston. It should be in your
21 portfolios.

22 HOLLOWAY: Thank you. is it Dr. Rief?

23 REIF: It's Reif.

1 HOLLOWAY: Reif.

2 REIF: My name is John Reif, I live at 4638 Eagle Lake
3 South in Fort Collins. I am a Professor and Chairman in the Department of
4 Environmental Health at Colorado State University. I am a former member of
5 the Colorado Board of Health, former President of the Larimer County Board of
6 Health. I have served on several national panels for the National Institutes of
7 Health regarding the health effects of electromagnetic fields. I have had two
8 grants in the area of health effects of electromagnetic fields, one from the
9 Department of Energy and one from the National Institutes of Health. I am not
10 being remunerated in any way from my testimony here today and the opinions I
11 am going to offer are my own and do not necessarily represent those of my
12 employer. Let me first, very briefly describe the epidemiology evidence linking,
13 particularly linking cancer and 60 hertz electromagnetic fields or power
14 frequency magnetic fields. Because I want to draw the parallel to what we know
15 about this form of electromagnetic radiation and what we are beginning to learn
16 about radio frequency radiation. There are three large groups of studies that
17 focus attention on health effects associated with 60 hertz or power frequency
18 fields a relatively well established association with childhood leukemia and
19 residential studies. Also reasonably well established association between brain
20 cancer and occupational exposure to persons working in industries with the MF
21 exposure and a similar association with leukemia in adults working in
22 occupations with electromagnetic field exposure. And I am just going to give you
23 a couple of examples, the first is from my own work in collaboration with

1 investigators in New Zealand where I spent a year this is a study of
2 approximately 20,000 male cancer patients where we demonstrate elevated
3 leukemia risks for electrical workers not present for other cancer sites. In a
4 national study using the national cancer registry of the country of New Zealand.
5 Over all leukemia risk was increased about 62% of the stars that I am showing
6 indicate statistical significance wherever they appear. The highest risk for radio
7 repairers, electricians, lineman and power station operators. This is a study by
8 David Sabitz of the University of North Carolina, of 139,000 roughly male
9 workers employed at 5 large electric power companies in the U.S. between 1950
10 and 1986. This study demonstrated an increase brain cancer risk associated
11 with total exposure to magnetic fields in particular the highest exposure category
12 in the last two to ten years of employment was associated with over doubling in
13 brain cancer risk in this large cohort of electric utility workers in the United
14 States. A summary of all of the studies of brain cancers and 60 hertz fields
15 done by the electric power research institute in Stanford by (inaudible)
16 combined, did a combined analysis of 28 to 29 studies that were combinable for
17 which adequate data existed, 21 of those 29 showed some evidence of
18 increased risk by no means were all of them statistically significant but the point
19 estimates of all of those 21 studies of the 29 were above 1 indicating some
20 increase in risk. The pooled estimate quantitatively for all of these 29 studies
21 showed a 10 to 20% increase in risk for brain cancer and occupational exposure
22 to magnetic fields which was statistically significant. Now let's move to radio
23 frequency where the body of evidence is certainly less robust then what we have

1 for 60 hertz fields. I just give you first one example. A large cohort study of male
2 airforce personnel and all men in the airforce between 1970 and 1989, published
3 in the American Journal of Epidemiology in 1996 which employed a technique
4 called a job exposure matrix to identify work titles for each person in the airforce,
5 and then compare their work titles with their brain cancer outcomes and classify
6 according to probable exposure to 60 hertz fields or radio frequency fields.
7 Those persons who had exposure to radio frequency or microwave radiation had
8 about a 40% increase risk of brain cancer, that's what 1.39 means. Also,
9 military rank was associated with brain tumor risk something that seemed in
10 other places where higher socioeconomic status persons appeared to have
11 higher risk for brain cancer. In terms of biological effects associated with
12 exposure to radio frequency fields has been very nice discussion by Doctor Lai
13 just a moment ago, which summarizes some of what I have on this slide. These
14 are points made by Professor Repatcholi from the World Health Organization
15 study published in bioelectromagnetics a couple of years ago in which he lists
16 several biological outcomes associated with radio frequency fields. In particular,
17 I want to point out signal transduction effects, which are defects in how cells
18 communicate with each other so called cross talk between cells. And what this
19 implies is that when cells are no longer able to communicate with each other in
20 their growth cycle something can go wrong and so if you have a initiated cell
21 that's already got the kind of DNA damage that Dr. Lai demonstrated. The
22 additional effect on signal transduction perimeters is in many peoples view likely
23 to lead to cancer promotion. There are other phenomenon on the slide which I

1 won't go into detail about except I want to mention melatonin which has been
2 the area of our research. We have demonstrated consistently in two large
3 studies of electric utility workers in Colorado that persons working in electric
4 utilities with relatively modest increases in 60 hertz exposures have suppression
5 of melatonin about 30% of their normal output. What this means in terms of
6 cancer risks we are really not sure. But melatonin is a very powerful hormone,
7 it's a very powerful anti oxidant it scavenges the DNA radicals that are produced
8 all the time in our body. It is a very active molecule with respect to cell
9 proliferation which it tends to decrease, it plays a role in orchestrating the
10 immune system and we are a little bit away from being able to say exactly what
11 the significance of melatonin suppression is. But it certainly one of the primary
12 potential mechanisms by which electromagnetic radiation may play a role in
13 cancer induction and promotion. Let me just very briefly describe the three
14 studies of towers that have been published in the period literature. You heard
15 Ms. Carney describe one that is just coming out that has not appeared in a
16 period review literature yet. The first of these was a study in Hawaii. This is a
17 cluster of 12 kids with acute leukemia discovered between 1979 and 1990.
18 These children lived in the vicinity of a military institution along the Wahiawa
19 coast on the Island of Oahu. Their leukemia incidence for this particular cluster
20 was about doubled and leukemia mortality was also weakly associated that is
21 death from leukemia with proximity to the towers. Second of these appeared in
22 the medical journal of Australia in 1996. It's an ecological study of cancer
23 incidents and mortality in nine communities surrounding the North Sidney TV

1 tower complex. There are three communities or municipalities with near these
2 towers and six away from them so they compared childhood leukemia incidence
3 in the proximal municipalities, with that and also looked at the distal
4 municipalities they found incidence of childhood leukemia increased about 60%
5 and mortality increased over two fold, and that's the second. And the third is a
6 study from Great Britain by (name unclear) which is also a cluster evaluation of
7 cancer in four concentric rings around a large transmitter called the Sutton Coal
8 Field transmitter where they found an increased risk of acute leukemia only in
9 the proximal ring about 80% increase which declined significantly with distance
10 statistically significant. Brain cancer risk was also increased around this tower
11 although the increase was not statistically significant. They went on to try to
12 replicate their findings in a large national study with 20 transmitters and were
13 unable to do so. With respect to the Colorado Department of Health's Study for
14 which I served as an advisor both in the original senses tract analysis and the in
15 the further analysis let me make a couple of points. And this is in reference to
16 previous testimony before you. The first is that those end points that we chose
17 to look at were only those end points which had been established in the
18 literature as potentially associated with electromagnetic fields either 60 hertz or
19 RF. This was not a fishing expedition in which one will look at every kind of
20 cancer that one could. These were highly selected based on published period
21 literature and only those sites were selected for analysis. Brain tumor ratio in
22 the initial study even at the entire senses track level was elevated slightly but not
23 significantly so. And so the follow up study which the Health Department did

1 and then released in 1999 in February did show the statistically increased risk
2 for men in Block Group 3 with an over 4 times observed to expected ratio and
3 also for the women in Block Group 2. This Block Group 3 is known certainly by
4 perhaps not official but unofficial measurements of radio frequency fields
5 obtained by electrical engineers in the community and they are going to testify
6 later on. And it does in fact have the high exposures among all the senses tract
7 of 98. Not all persons in Block Group 3 however are exposed and it's important
8 to understand that because of the variable terrain that you have got up there.
9 Some persons in Block Group 3 are not exposed. And what this means if you
10 think it through, is that since exposure is only partial the risks that you are
11 measuring are actually higher since the expected and observed risks are based
12 on the assumption that all Block Group 3 is exposed. And if any portion of Block
13 3 is not exposed due to interfering terrain then there is misclassification of
14 exposure and that misclassification will drive the effect estimate or the ovary in
15 this case down towards the null or 1.0 it's a very important point that hasn't been
16 made previously. Further a tight clustering of cases in time is not expected at all
17 due to variations in both exposure and latencies in terms of when people have
18 moved into the community, how long they have been there, how close to the
19 towers they have lived, what kind cumulative dose they have. I would not
20 expect this all to occur suddenly in a short period of time. We have certainly
21 recommended further study both from the standpoint of exposure assessment
22 other outcomes such as the ones that have been described, sleep disorders and
23 immune function have been mentioned before. And in conclusion of the body of

1 evidence that I have certainly reviewed for this proceeding and others. I would
2 say the following, first the radio frequency data base is inadequate to assess
3 causality. It's not to say causality exists or doesn't exist the database itself so far
4 is inadequate, there is, I think there is no doubt that we haven't established that
5 a causal relationship exists between radio frequency fields and human cancer
6 risk. But there certainly is evidence there that requires further evaluation and
7 the jury is out at this point in time. However, the CDPHE study of cancer
8 incidence shows an association with male brain cancer we do have evidence for
9 biological mechanisms which would be plausibly associated with such a cancer
10 risk and the evidence in my opinion is adequate to dictate a cautionary approach
11 and avoidance of any additional exposure to radio frequency fields. Finally, a
12 quote was read from my former student, Dr. Michael McGeehan, Mike got his
13 P.H.D. with me in 1992 at C.S.U. he is currently at the Center for Disease
14 Control where you see his title below. This is an excerpt from a letter to
15 Richard Hoffman, dated April 26, 1999 the letter is in your package and with you
16 and I quote "we did not intend to imply in our review that radio frequency RF
17 transmissions are not associated with cancer. We do not currently know
18 whether such an association exists, no one does". I think Mike got it right this
19 time and kudos to him. Thank you very much for your attention. Yes, sir?

20 SHEEHAN: You had mentioned the findings in dealing with this
21 Coal Field transmitter, the finding is not replicated in the 20 transmitters study,
22 could you elaborate on...

1 REIF: Yes, I can this paper was published in the American
2 Journal of Epidemiology. They published a second paper in the same journal in
3 which they looked at cancer incidence for, in twenty different areas in Great
4 Britain where there were towers. And I can't tell you about which was the most
5 powerful or what the range of frequencies around the towers was but they
6 attempted to do a more comprehensive evaluation of that. And that study was
7 negative and when I present something I like to present a fair assessment of the
8 evidence and I presented that to you in good faith.

9 SHEEHAN: That's great, do you have, did they suggest why it
10 was negative?

11 REIF: No, they left it open, they left it open in fact those
12 both, the first study is certainly in your package and you will see at the end of
13 the first study in fact I think in the closing sentence of the abstract they indicate
14 that further research is done. That's the way science moves and it moves
15 ahead two steps and back one ahead two steps and back one and that's exactly
16 why Dr. McGeehan at the end in his letter to Dr. Hoffman says we still don't
17 know and I certainly concur with that. In epidemiology it is very rare to find every
18 study positive and people through out the smoking example where risks are
19 increased 10 to 20 times. Most environmental exposures that we deal with
20 things like indoor radon, things like second hand smoke, don't give you that kind
21 convincing body of epidemiologic evidence. It's always balancing studies which
22 show a positive association some show no association and some occasionally

1 show a negative association and that's the world in which we work and I can't
2 make any excuse for it.

3 HOLLOWAY: Did you happen to work with Dr. Bob Graves?

4 REIF: No.

5 HOLLOWAY: With his leukemia study?

6 REIF: No.

7 HOLLOWAY: Because he was also up there in that area and he
8 was mainly with the bone marrow but...

9 REIF: No.

10 HOLLOWAY: Thank you.

11 REIF: Thank you.

12 CARNEY: Madam Chairman we've received a request by a
13 desperate mother who would like to testify who is holding three children at bay.
14 It's a very short witness, I believe this one is Roberta Bolton, or a Balmes,
15 excuse me.

16 HOLLOWAY: What is your last name?

17 BALMES: My last name is Balmes, it's spelled B-A-L-M-E-S.

18 SHEEHAN: Being the father of three children too, I insist that she
19 go ahead.

20 BALMES: I missed the swearing in portion of the day.

21 CLERK: Do you solemnly swear the testimony you are about
22 to give is the truth, the whole truth and nothing but the truth so help you God?

Witness Testimony

Bob Barrett

1 the broadcasters to find another location away from populated areas. Thank
2 you.

3 HOLLOWAY: Mr. Barrett? You can start, go ahead.

4 BARRETT: I brought a book that Deb has convinced me not to
5 read to you.

6 HOLLOWAY: Thank you.

7 **BARRETT:** But, and I also have three children so I hope that you
8 will indulge me. Ladies and Gentleman, distinguished members of the Board of
9 Commissioners thank you for hearing my opinions about the Lake Cedar
10 Group's proposed tower. My name is Bob Barrett, I am a registered
11 professional engineer and a certified consulting engineer. I am also concerned
12 resident of the Lookout Mountain neighborhood near the towers. In fact I live
13 right under the Channel 31 tower. I live at 792 Aspen Road. I moved in two
14 years ago with my kids. Before we moved in we did an EMF study using and
15 industrial hygienist because we were concerned about the radio frequencies.
16 And when we did the test we found out that we were at about 1% of what the
17 government recommends which made us think that we were pretty safe. After
18 we moved in of course we learned more about radio frequencies and found out
19 that maybe that 1% is still several hundred times more than what most people
20 see and we are concerned about it. I won't bore you anymore. I know you are
21 not bored, but I won't talk about EMF. I am going to change the subject
22 completely in fact, I am going to talk about something that will give you all the
23 ammunition you need to turn this proposal down and simply put I am going to

1 discuss Section 15 of the Zoning Regulations. I am going to show you that this
2 tower violates the Zoning Regulations. And when we get done I am going to do
3 a demonstration in real time at a, one hundredths scale with this map that's
4 spread up the isle here and with the tower that my five year old and I built. I
5 hope it's a little less sturdy then what Lake Cedar is proposing but after, what I
6 have learned about tower failure, I am not sure about that. Okay, the summary
7 of what I am going to tell you, the tower violates the Jefferson County Zoning
8 Resolution with regard to tower setbacks from dwellings and from other
9 broadcast towers. It violates both those provisions. In order to meet the
10 requirements of the Zoning Resolution the tower must be located at least 1800
11 feet away from the dwellings and towers. Lake Cedar Group is proposing to
12 locate it about 235 feet away from the nearest dwelling that's not owned by Lake
13 Cedar Group, and 350 feet away from the nearest neighbor Mr. Ted Votaw that
14 Deb talked about that will not under any circumstances give L.C.G. an option on
15 their property no matter how much they offer them. And L.C.G. has tried to
16 convince the Board in their testimony in April that the Jefferson County setbacks
17 have been met. They have not. They used an expert in structure failure
18 analysis to present the best case scenario for tower collapse. The best case.
19 Mr. Hill is not a tower design expert according to Mr. Hill's resume his
20 experience with real structures is in reviewing and analyzing failures not in
21 designing towers. Mr. Hill was only aware of two tower collapses out of 160 that
22 I have uncovered in about 2 hours of internet research. Five hundred that are
23 estimated by another tower expert and other tower expert says that might be off

1 by a factor of 10. There may be 5,000 tower failures out there that Mr. Hill was
2 unaware of and also the Lake Cedar Group has glossed over their real experts
3 opinion of the worst case scenario. The real expert is the people that are going
4 to design and construct the tower. They are called Kline Towers. They are the
5 proposed engineer and fabricator of Lake Cedar Group's tower. They have
6 been designing and fabricating towers for over four decades. According to the
7 web site they are the preferred supplier of top communication corporations
8 around the globe. They prepared a report in February about their opinion of
9 what worst case scenario was. They said it was 110% of the tower height, not
10 25%. That's over 930 feet, but we feel the Kline has neglected the destructive
11 effect of the guy cables and anchors that would also fall down should the
12 proposed tower fall. They only looked at the mast or the central part of the
13 tower. Accounting for the guy cables extending the true worse case scenario's
14 debris that would be made up of the longest guy lines which are over 1,000 feet,
15 plus their attachment elevation on the tower which is 715 feet and if you add
16 those things together that's were we get the 1800 foot radius. There are at least
17 21 dwellings and 3 businesses within the 1800 foot setback there is also a
18 highway, a reservoir, a high power tension line. If the County Commissioners
19 elect to grant Lake Cedar Group's request they will be violating Jefferson County
20 Zoning requirements. If you grant the request you will be violating your own
21 zoning requirements. The request for rezoning should be denied for that
22 purpose. Now, I am going to show you the provision of the zoning requirement
23 that we are talking about. And as you can see if Section 15, Paragraph F2B, all

1 new structures must be set back from the property line sufficient to prevent all
2 ice fall materials and debris from tower failure or collapse from falling onto
3 occupied dwellings other than those occupied by the tower owner and then a
4 little farther down you can see that the setback is also has to prevent multiple
5 tower failures in the event of this tower's failure. According to Mr. Tim Carl who
6 is a planner with Jefferson County and I think the administrator of this case, the
7 sufficient setback must meet the worse case scenario. He doesn't describe it
8 but he accepted Klines' worse case scenario, he doesn't describe it but he
9 accepted Klines' worse case scenario of 110% and turned down or
10 recommended that this application be turned down simply on that basis. Mr.
11 Carl goes on to say that this proposal fails to meet the minimum standards
12 associated with tower failure or collapse identified with the Jefferson County
13 Zoning Resolution. This is from Page 23 of his report. Mr. Carl says earlier in
14 the report that if issues related to section fifteen of the Zoning Resolutions can
15 be satisfied, staff would recommend approval. But, the only way for the staff to
16 recommend approval would be for the Lake Cedar Group to purchase all private
17 property within at least 1800 foot radius of the tower and relocate all other
18 broadcast towers off the mountain that they would collapse against and obtain
19 governmental easements for endangered highways, water resources, and public
20 utilities. And let me assure you that broadcast towers do fall down. For as
21 expensive and as important as they are they fall down quite a lot. No single
22 entity keeps track of tower failures unfortunately. But, as I said within a few
23 hours of research we found over 160 tower failures, and Lake Cedar's true

1 expert Kline Towers estimated that there have been about 420 failures since
2 1959. On Lookout Mountain a self supported 330 foot tower for KOA failed
3 while under construction in December of 1953 and then it failed again 15 months
4 later. This is the tower that is near Mr. Votaw's house and in fact the existing
5 Channel 4 tower is built right on this site and the new tower is proposed to be
6 built 100 feet away. Based on opinion of other tower experts this number maybe
7 underestimated by a factor of 10. It may not be 450 may be 4,050 towers that
8 have collapsed since the early 1950's when broadcasting started. One tower
9 engineer firm in fact states that one in ten guy towers before the useful life is
10 over. One in ten towers fail. Tower Engineering is peer engineering firm of
11 Kline Towers and they published this paper that they printed on the internet and
12 as you can see in the highlighted example they say that there has been a failure
13 of several of the countries largest towers in the last few years and they go on to
14 say that guyed towers like the proposed tower in quotes "fail at an alarming rate
15 compared to other structures, it is estimated that one in ten guyed towers fail
16 before their useful life is over". So, how far away from the tower is safe? Well, it
17 is impossible to predict this because nobody knows for sure how a tower might
18 fail. In April, Lake Cedar Group tried to convince you that it would only fail on a
19 certain mode which is called Axial and the guy wires would stay intact and they
20 would guide the tower down to the ground. But that is not the worse case failure
21 of the tower by any means. I think in about two minutes we are going to
22 illustrate what that worse case scenario might be. I would also like to point out
23 that the two previous tower falls on Lookout Mountain were not in the axial mode

1 they were lateral failures. If the anchors or most of the guy lines on the same
2 side of the tower fail a full lateral mode collapse is possible, simultaneous icing
3 and wind loading, poor maintenance, an airplane strike, or a well designed but
4 simple act of sabotage can all create lateral and inertial mode failures, and by
5 inertial I mean the guy wires get into the act and they whip out past where the
6 tower is fallen. Unusual ice and wind destroy many broadcast towers every year
7 and recent events in Jefferson County remind us of the devastating effects of
8 sabotage. This is the tower that my son and I built. You can probably see my
9 son's imagination at play there. This is a 1/100 scale of the tower. The guy
10 wires are nylon cords and they are located at about the equivalent of a 720 foot
11 level or 715 foot level on the tower and the star mount is represented by three,
12 110 foot duplo towers up there. And my colleague Bob Woodward is holding a
13 map a portion of which we have taped to the floor over here. This map shows
14 the Lookout Mountain neighborhood, the dark circle in the far right is the tower
15 fall radius that Lake Cedar Group wants you to accept. The cross-hatched area
16 is the 1800 foot radius that we think is the worst case scenario. All those black
17 squares are either dwellings or support building for towers, the triangles are
18 towers themselves and the property lines are loosely indicated there except for
19 private property. Later on you will see a better map of that on the view graph.
20 Now, we are going to ask Bob and Neil and Dave, all neighbors of mine, to walk
21 you through the portion of the map over here. I don't mind if people stand up
22 and take a look at all and I hope the Board will indulge them. The large circle
23 that we were talking about in the far right is there on the floor. It's a 4'3"

1 diameter circle at 1/100 scale. It's only 225 foot radius in real life and this is the
2 tower in real life, it's about 850 feet tall over all. Now, what we are talking about
3 is debris radius. Debris radius, is simply what's left over after the tower
4 collapses. I have seen pictures in some of my research of pieces of tower 15
5 feet into the earth and I have seen just enormous destruction from this debris.
6 Now, if it can be limited to this small radius then we are protected as residents. I
7 live probably over there where that gentleman in the glasses is to scale. If that
8 tower is correct I am protected.

9 HOLLOWAY: Which one?

10 BARRETT: Pick one. It's past Jim. Raise your hand, Jim. Okay
11 and then it's the fellow two rows up.

12 HOLLOWAY: Oh, okay thank you.

13 BARRETT: That's my house.

14 SHEEHAN: Nice house.

15 AUDIENCE: Laughter

16 BARRETT: Yeah, it's very serviceable.

17 SHEEHAN: We haven't met your son yet, where is he?

18 BARRETT: Actually my whole family is out there I think urging, or
19 cheering me on silently.

20 HOLLOWAY: Yeah, I would have thought you would want to come
21 in and see....

22 SHEEHAN: If he is part of this we want to see him as part of the
23 demonstration.

1 BARRETT: Believe me he has seen me demonstrate it. I have
2 rebuilt the star mount about 3 times now. I would like to first demonstrate lateral
3 failure and Bob, incidentally the coffee cups are, locate pertinent structures in
4 the discussion. Unfortunately behind the table for most of you but I think the
5 Board can see a pink line on the floor. That's a high tension power line that
6 comes up from Golden over Lookout Mountain. It's, I think it's about 800 feet
7 away. So you can see that it might be less than that but you can see that the
8 tower will certainly fall over that. Remember Kline's radius is 110% it certainly
9 includes that tower line and it includes a whole bunch of that power line and
10 several towers. Then over here we have Mr. Votaw's house under that cup and
11 you can see that there's now doubt in the world that a lateral failure would
12 collapse on that, and then Bob's going to walk it over the tower farms there,
13 where he is, is U.S. West, AT&T, Union Pacific, all have broadcast facilities
14 there. I believe the Jefferson County Emergency Radio Transmission is over
15 that place. And then Bob is going to, Neil is going walk out the guy lines just to
16 show you again, these are to scale, these guy lines are about ten feet. Just lean
17 it over, lean the tower over, there is a lateral failure. Now as the guy wire whips
18 out there is what I am talking about when I say the inertia of the fall can make
19 the guy wire whip out. That is where the 1800 hundred foot radius comes from.
20 The guy cables incidentally are, I don't know what size they are going to be the
21 existing tower guy cables are only 5/8 inch in diameter. The heavier they are of
22 course the more destruction they are going to cause, the lighter they are the less
23 destruction but the more likely they are to break. These wires are typically

1 tension to within 15% of their breaking strength just in setting up the tower with
2 zero wind. Their stressed quite a bit more as the wind increases and if you get
3 enough wind and ice that is one of the ways that you can make these guys fail.
4 Now at the red line we are going to demonstrate the first way that, no I am sorry,
5 it's the loop. Let's say that something fairly good happens and the guy wire
6 stays anchored at 600 feet away from the tower. No, we just need yours Bob,
7 just pull it away 600 feet. This is 600 feet laterally from the tower but again the
8 guy wires 1,000 feet. Now lets say the tower falls, there is inertia in this wire it
9 could very well create a loop that extends this way even though it stays
10 anchored even though it stays attached to the tower it can extend out away from
11 the base of the tower up to 1100 feet. It's about 11 and 1/2 feet in our model.
12 The second way the tower can fail, this is the red one, let's just imagine that
13 there is incidentally I have got three cables there and I am sure Lake Cedar
14 Group is going to tell you this is ridiculous we have got five cables and they go
15 all the way up and down the mast but here is what happens if just one of the
16 longest cables fails, if Bob's going to put tension in the cord and Neil is just
17 going to let go. Did it work?

18 NEIL: Yeah.

19 BARRETT: Okay we were going uphill there. Anyway you go
20 away from the tower you go down hill at a pretty significant clip. So, I don't think
21 it's unreasonable to expect that if a guy tower, a guy wire separated at the tower
22 it could go all the way out that far. That's about 1700 feet.

23 LAWRENCE: Bob?

1 BARRETT: Yes?

2 LAWRENCE: So, if one guy wire, if we lose one guy wire the tower
3 will stand but the wire will cause disruption.

4 BARRETT: That's right and there's only two anchors on each
5 side there's 3, I don't know if you say side but there's three lines of support for
6 this proposed tower. There are five guy wires on each line of support but there
7 is only two anchors and it would be very easy, it's very easy to conceive a, of
8 some lunatic putting a charge at each of those anchors. There's no security up
9 there and timing it just right that would take out the entire side.

10 HOLLOWAY: Now in this radius that you are speaking of with the
11 guy wires whipping, are their residents in that?

12 BARRETT: Yes ma'am, 21 residents that are full time, about 3
13 that are summer cabins. One of them is me.

14 HOLLOWAY: That's why you are doing this!

15 BARRETT: That's why I am doing this! I want to show you the
16 most dramatic one.

17 UNKNOWN: I don't think we have got enough room here Bob.

18 BARRETT: Well, let's fake it. The only guy wire that needs to be
19 pulled tight is yours. We are gonna, if you will indulge us we are going to move
20 the tower out a little bit, just so we can do this demonstration. This is the one we
21 worked on the most. Dave if you could come around here and grab one of
22 these. Now what we are going to try to do here is illustrate what might happen if
23 some lunatic took out the anchors or if somebody crashed into the guy wires in

1 an airplane or if unanticipated...that wasn't the demonstration or if Kline under
2 estimated the wind or under estimated the ice. All of these factors could cause
3 this to happen. Since we are going to move it...move it three feet that way, Bob.
4 So you can get a good run at it, three feet, that's six inches.

5 AUDIENCE: Laughter

6 BARRETT: We are maybe 400 feet, 350 feet out from where we
7 should be where the tower is located.

8 UNKNOWN: I think we are going to hit somebody.

9 BARRETT: Okay, everybody here do you want me to do this.
10 Let me tell you what's going to happen.

11 HOLLOWAY: It's up to them.

12 BARRETT: I think we might be setting up some liability here. Let
13 me tell you what happens because of the tension in the wire you can imagine
14 what would happen. Because of the tension in the wire go ahead and just let
15 the thing fall. Okay, it falls you can imagine that the guy wires are going to fling
16 the cable and the anchor that away and theoretically they can bring them out as
17 far as the cable is long. That is 1800 feet, incidentally the landmark at that end
18 is the Cody Inn. I think everybody knows about the Cody Inn. So that's how far
19 away we are talking about. Okay that is not what was supposed to happen of
20 course the tower mount was supposed to go all the way to the end of the tower
21 and then explode. And short of killing somebody here in this building to illustrate
22 why you shouldn't allow this tower to kill people out on my mountain. I think that
23 is good enough and I appreciate you indulging us that. I would also like to point

1 out that there are steep hillsides all the way around the towers I said.
2 Presumably debris would interact with the ground and travel even farther away
3 from the tower base due to this potential energy and gravity would enhance
4 travel for any debris directed downhill after it contacts the ground. Again, almost
5 any direction away from the tower is downhill. You might expect the debris for
6 this reason to travel several hundred feet more than the 1800 feet that I am
7 recommending that you adopt. Under all three scenarios the debris radius is at
8 least a function of the longest guy lines and the tower elevation. Therefore it is
9 possible for significant debris to extend 1800 feet from the tower base in any
10 direction, any direction. Here are the dwellings and structures in the 1800 foot
11 radius recommended by CARE and now we are at the view graph. T.J.'s
12 holding up a string here, he's gonna, the string is going to go from the base of
13 the tower to the top of the tower and then down along the longest guy line. This
14 is from the PUD drawing actually the longest guy line is quite a bit longer
15 because they didn't take into account the worst case topography around the
16 tower. So, now he is holding the tower at the center of the tower to scale and as
17 he pulls out that string you can see where the 1800 foot radius comes from.
18 Now swing it all to the north there. There, right there is antenna farm that
19 belongs to Union Pacific and as you swing it around counter clockwise T.J.
20 that's Lookout Mountain's biggest tourist attraction, Buffalo Bill's grave. There is
21 the highway right there and that pink thing that angles across there is the power
22 line. You see there are several transmission towers and lots and lots of cable
23 there. There's the Robin's Nest and Golden Reservoir. There is the Cody Inn

1 and now we're approaching a lot of my neighbors and a lot of other transmission
2 towers. First of all I want to point out the public roads that are impacted nearly all
3 of Lake Cedar Road, I am sorry that's Cedar Lake Road. Nearly all of Aspen
4 Road, my road here and as you go around there to the right you run into the
5 proposed support building and the proposed tower. This is the road that was
6 condemned illegally by the same people that want to bring you this proposed
7 tower. Mr. Votaw's house is to the left there up, yeah right there and there are
8 several neighbors on Lake Cedar. I would like to just point out my house if I
9 could in the crook of Aspen Road down here that's my house.

10 SHEEHAN: Glasses (inaudible) we had glasses back then.

11 BARRETT: There's glasses, yeah and there is a four houses, six
12 houses on Panoramic Drive as well which is the access road from the Cody Inn
13 into our neighborhood. I want to finish up now, I think I have demonstrated that
14 the 1800 foot is a reasonable debris radius and therefore a reasonable tower
15 setback. I hope I have demonstrated that to you. A larger debris radius would
16 not be unheard of, I think it is reasonable to say it should be 2,000 feet or 3,000
17 feet. But, it is certainly not reasonable to say it's anywhere near 250 feet.

18 HOLLOWAY: Did you say Mr. Votaw's house is the closest in
19 proximity to the towers?

20 BARRETT: No, Lake Cedar Group owns or one of their members
21 since they are a limited liability corporation of course their isn't anybody that is
22 liable this tower should it fail. But one of their engineers lives in the house that is
23 second closest right there, John Hathway lives in the house that is closest and

1 he has given Lake Cedar Group an option in the event that the tower is
2 approved. Mr. Votaw's house is the third farthest away but there are other
3 support buildings and towers that are actually closer to the proposed tower. I
4 want to conclude by saying that tower collapse kills and injures people. The
5 weight of the debris in the event of any tower failure is going to be significant.
6 The tower itself, the mast, will weigh about 200 tons according to Kline towers.
7 With the guy cables, transmission cables and antenna the finished tower will
8 weigh 500 pounds, 500,000 pounds thank you. If the failure is due to ice
9 accumulation a very real possibility, more than 650,000 pounds of shrapnel
10 traveling at up to 1,000 miles per hours may strike any location within the debris
11 radius what ever it happens to be. We have a list of difficult questions for Lake
12 Cedar Group since they will get a chance to rebut my testimony and the citizens
13 won't get the same opportunity probably if we follow the Board's rules. We
14 would like in addition to the questions that you all want to ask for you to ask
15 Lake Cedar Group several questions and ask them to provide acceptable
16 answers to help clear up our concerns about this tower failure issue. Getting
17 back to their expert that they presented the end of April he is a registered
18 professional engineer. Ask him if he has ever designed an antenna
19 transmission tower of at least 854 feet in height. And if he has, has the tower
20 ever been built. I think what you will find, is he has never designed a single
21 tower. Then you might ask are there any such towers designed by anyone,
22 anywhere in the world that have been designed to collapse within a radius of
23 25% or less of their height in all failure modes and you should ask (inaudible) an

1 act of sabotage that's responsible for the failure and then explain how that could
2 work and then you might ask if they are expert and that experts firm which
3 (inaudible) will take professional engineering liability for their claim that they can
4 design a tower that won't fall outside of that radius. And you might ask him to
5 list any tests or research that would substantiate their claim. And in the event
6 that you decide to accept the setback less than the worse case scenario, I would
7 ask the Commissioners to please respond to how you will have Lake Cedar
8 Group and it's successors guarantee that this tower won't be sabotaged or in
9 any other way experience a guy cable or anchor failure during it's entire life. And
10 if they are going to make that guarantee what monetary resources will they use
11 to back that up? They are a Limited Liability Corporation. Are they willing to
12 expose all their partners in this corporation. Are they willing to form a
13 partnership and expose the partners to the liability of a tower failure and if they
14 aren't who is going to insure that compensation will be made when and if the
15 tower is the one in ten that falls down. Really all we are asking you to do is
16 protect us from the worst case scenario. All we are asking you to do respectfully
17 is comply with the zoning regulation. As a representative of CARE I respectfully
18 ask that the Board of County Commissioners deny the Lake Cedar Group tower
19 as our County Planning Department has recommended. Thank you very much
20 for your attention.

21 HOLLOWAY: Do you have any questions?

22 RAGONETTI: Madam Chair, would you please make it part of the
23 record along with the model. We may wish to use it as well.

**Proposed Tower Violates
Jefferson County
Zoning Resolution**

By Bob Barrett, P.E.

Neil Dunbar, P.E.

Bob Woodward

- The Lake Cedar Group cannot meet the tower setback requirements of the Jefferson County Zoning Resolution !

Fallacies of LCG's Presentation

- Lake Cedar Group wants you to believe that Jefferson County's setbacks have been met.
 - They have not!
 - Their expert in structural failure analysis, Howard Hill, presented the BEST CASE SCENARIO for tower collapse at 25% (214').
 - He's never designed a tower.
 - Only knew of 2 tower collapses in his entire career (out of at least 500 since 1950).

From Jefferson County's Website for "January 1999 Jefferson County Zoning Resolution
– Adopted by the Board of County Commissioners on July 24, 1978 (as amended).

Web address: <http://co.jefferson.co.us/dp/planning/zoning/sec15.html>

SECTION 1: ADMINISTRATIVE PROVISIONS

A. PURPOSE

In pursuance of the authority conferred by Chapter 92, Session Laws of Colorado, 1939, this Zoning Resolution is enacted for the purpose of promoting the health, safety, morals, convenience, order, prosperity and welfare of the present and future inhabitants of Jefferson County ...

...SECTION 15: P-D PLANNED DEVELOPMENT DISTRICT

F.2.b. ...

- (2) All new structures must be set back from the property line sufficient to **prevent all ice-fall materials and debris from tower failure or collapse from falling onto occupied dwellings other than those occupied by the tower owner**, and protect the public from NIER in excess of that allowed herein. Where more than one tower is located on a site, the set back between such towers shall be sufficient to prevent multiple failures in the event one tower fails. (orig. 5-11-93)

**“Sufficient set-back must meet the
worst case scenario.”**

**- Tim Carl, Planner
Jefferson County**

Excerpt from report by Tim Carl, Planner

FINDINGS/RECOMMENDATIONS:

Staff finds that:

1. The proposal is not in substantial conformance with the Central Mountains Community Plan or Telecommunications Land Use Plan because it does not entirely conform to the policy recommendations associated with visual resources, public facilities/service, mountain site design criteria, and tower siting. Further, this proposal fails to meet the minimum standard associated with tower failure or collapse identified within the Jefferson County Zoning Resolution. 
2. The proposed land use is compatible with existing and allowable land uses in the surrounding area in all directions because construction of a consolidated tower will reduce the overall visual impact of broadcast facilities on Lookout Mountain by eliminating several towers. The proposal incorporates design criteria that blend the proposed transmitter building into the hillside and is consistent with the nature of this area for broadcast and telecommunication operations.
3. No known commercial mineral deposits exist upon the subject property. Staff recommends that Case No. 98016154RZP-1 be DENIED because the minimum standards related to debris from tower failure or collapse cannot meet the "minimum standard" established in the Zoning Resolution. 

PC RECOMMENDATION (Resolution Dated January 13, 1999, Attached):

Approval
Approval with Conditions
Denial

 X

On January 13, 1999, the Planning Commission passed a motion recommending approval of this case with a 5-1 vote. One of the major concerns expressed by the Planning Commission, and as noted in these comments, is the size of the proposed equipment building.

COMMENTS PREPARED BY:


Timothy W. Carl, Planner

3.4.99

Residents' Recommendation

- Turn down proposed tower, unless LCG can:
 - Purchase all private property within an 1800' radius of the tower
 - Obtain governmental easements for endangered highways, water resources, and public utilities.
 - Relocate all other broadcast towers within the Cedar Lake Road “tower farm” to prevent “domino effect”.

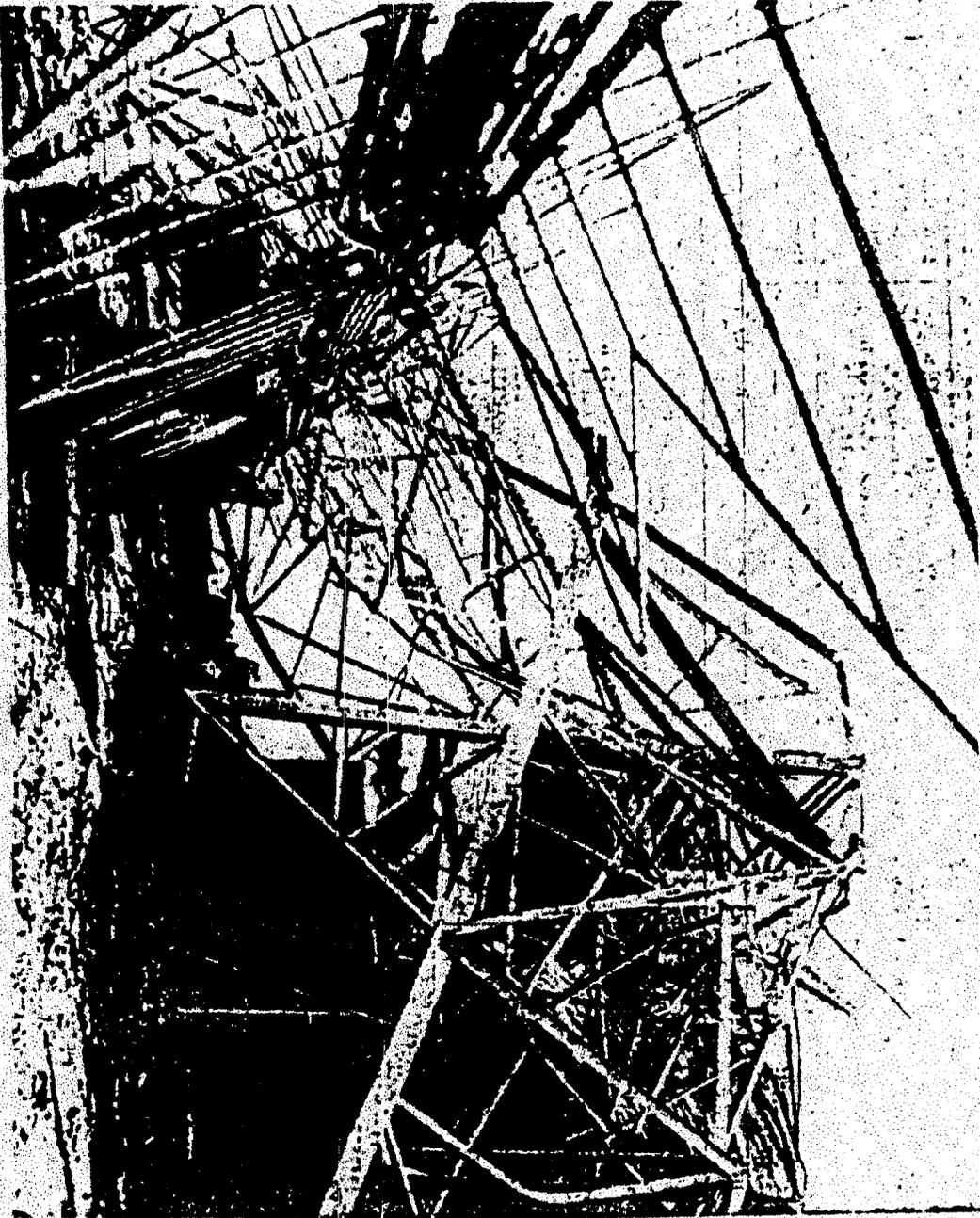
Towers Do Fall Down

- No composite listing of all tower failures.
- LCC's expert knew of only 2, giving some audience members the idea that towers didn't normally fail.
- Kline estimates 420 failures since 1959.
- U.S. Army Cold Regions Research and Engineering Lab '96 study lists 140 failures due to atmospheric icing alone.
- Two towers collapsed on Lookout Mtn in '53 and '55.

Tower Collapse on Lookout Mtn

Monday, Dec. 7, 1953, Denver, Colo. — ROCKY MOUNTAIN NEWS — 68

Falling TV Tower Tears Hole in Building



KOA-TV's 300-foot tower on Lookout Mountain was knocked to the ground Sunday by high winds. Workmen were preparing to raise the transmitter antenna (lower left) when the tower came

tumbling down. The falling tower bore a gaping hole in the transmitter building, as right. STONE ON PAGE 11.

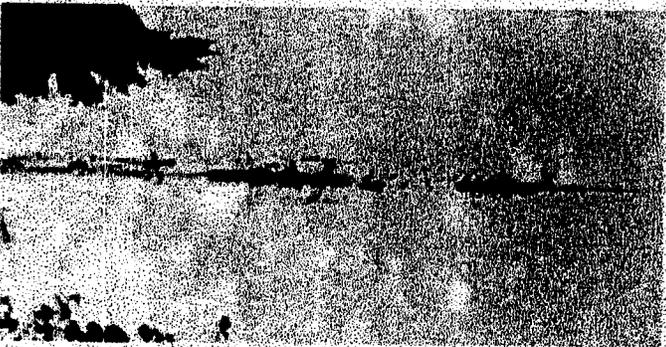
Rocky Mountain News Photo.

Towers Do Fall Down

- TOWER ENGINEERING STUDY INDICATES ONE OUT OF TEN GUYED TOWERS FAIL BEFORE ITS USEFUL LIFE IS OVER.

Excerpt from paper by Madison J. Batt, PE - Tower Engineering

Guyed Towers



Some guyed towers in use today have been in service for up to 50 years. The difference between these older guyed towers and self-supporting towers of the same age is that the older guyed towers are typically more capable of supporting additional antennas with minimal upgrade required. Replacement of the guy wires for these towers may be an issue if the original guys are still in place.

Newer guyed towers, especially towers built during the previous television expansion era in the 1960s, may not be as fortunate. Depending on their condition, these towers may not be capable of supporting new DTV antennas without major upgrades.

The failure rate of guyed towers should also be considered. These towers fail at an alarming rate compared to other structures. It is estimated that 1 in 10 guyed towers fail before their useful life is over. The recent failure of four of the tallest guyed towers in the last year confirms this observation.

In general, information on guyed tower failures is sketchy. No government agency or group in this country keeps track of these failures. However, in talking with chief engineers around the country, we have learned that many stations have experienced the collapse of a guyed tower. The causes of these



How Towers Fall Down

- **Axial Mode - BEST CASE SCENARIO**
 - Suppose the guy wires and anchors hold. The tower falls in on itself.
 - Only mode addressed by LCG's expert, Howard Hill.
 - Only works if all of the guy wires remain intact.
 - Kline Towers estimates the Axial Mode debris **radius at 50%** of the tower's height, **not the 25%** suggested by Mr. Hill.

How Towers Fall Down

- Lateral Failure Mode - **WORST CASE SCENARIO**
 - Case # 1: Loops of guy wires extend outward from their anchor points on the ground and from the collapsing tower.
 - This is like throwing a jump rope over one's head.
 - In proposed tower, guy wires could form a loop that extend over 1100' from the tower base.

How Towers Fall Down

- Lateral Failure - **WORST CASE SCENARIO**
 - Case # 2: Guy cable cut/breaks at the top of the tower and due to tension in line, whips out most of its length.
 - Guy wire could lash out up to 1600' from the base of the proposed tower.

How Towers Fall Down

- Lateral Failure - **WORST CASE SCENARIO**
 - Case # 3: Loosened guy wires and their anchors whip past the top of the tower as it falls.
 - Guy wire could extend 1700' from the base of the proposed tower.