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October 12, 2007

Mr. Erik Olson
Senior Planner
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Snohomish County
3000 Rockefeller Avenue
Everett, WA 98201

Subject: CAAM Partnership LLC
Proposed 1520-AM Co-location
File No. 07 109195 LU

Dear Mr. Olsen:

I have been asked to comment on the materials submitted by Angela Day regarding potential health effects from the antennas proposed by CAAM Partnership LLC (CAAM). Along with her letter, Ms. Day submitted three epidemiologic studies (Ha et al., 2007; Michelozzi et al., 2002; Cooper et al., 2001) to support her interpretation that there is a justifiable concern about health risks from exposure to "high frequency radio transmitters." Radio transmitters, like the proposed antennas, emit radiofrequency energy (RF). She describes the study by Ha et al. as the most conclusive study to date.

This letter includes a brief summary of my qualifications for addressing issues of RF and health, a summary of my opinion, and the scientific reasons for my assessment.

Qualifications

I have 30 years of experience in epidemiology, which is the study of disease in human populations and their causes. As indicated in my attached curriculum vitae, most of my work has involved assessing health risks associated with environmental exposures, and evaluating epidemiologic studies and related scientific research. I have worked at the Environmental Protection Agency (EPA) to develop exposure limits, or standards, for contaminants in the water and the air. I am a member of the International Committee on Electromagnetic Safety (ICES), a committee of the Institute of Electric and Electronic Engineers (IEEE), where I work with engineers, biophysicists, physicians, and other technical experts to assess the potential impacts of RF energy on human health. I contributed to the development of the IEEE RF safety standard developed in 2005, and reviewed all of the epidemiologic studies (IEEE, 2005).

I have conducted research on RF exposure from mobile phones under the supervision of the FDA, and I have published articles on RF and health in the peer-reviewed scientific literature. These publications are listed in my attached curriculum vitae.

Summary

My opinion is based on my experience as an epidemiologist assessing human health risks from environmental exposures, including RF. I find that the materials submitted, including the recent study by Ha et al., do not provide scientific evidence that RF from radio antennas are a cause of cancer or other adverse health effects in people who live or work in the vicinity of radio antennas. The three studies submitted by Ms. Day are but a fraction of thousands of studies that are relevant to assessing potential health effects and developing exposure limits for RF. Selecting a few studies from the entire body of research is contrary to the standard methods scientists use to obtain objective information on the effect of any exposure on health.

Ms. Day has misinterpreted the results of these selected epidemiologic studies, and has failed to recognize that they must also be considered as part of the vast body of research that is the foundation of Federal Communication Commission (FCC) limits with which these antennas must comply. The FCC limits are consistent with the recommendations of many other scientific organizations that have reviewed the scientific research on RF, which included the two earlier studies included in Ms. Day's submissions. The Ha et al. study is inconclusive, as it did not show a clear increased risk with higher RF exposure from AM transmitters, despite an improved exposure assessment and larger population. Consequently, the Ha et al. study would not affect the RF exposure limits that are included in the relevant standards, and used to assess compliance with FCC guidelines.

Scientific Basis of the FCC RF Exposure Limits

Mr. Lockwood has evaluated the emissions from the proposed antennas based on FCC methods, and has concluded that FCC limits are not exceeded in areas accessible to the general public (S. Lockwood, August 2007).

The FCC regulates RF exposure to the public by requiring transmission facilities to comply with exposure limits (FCC, 1997). Their limits are based upon the recommendations of the National Council on Radiation Protection and Measurements (NCRP) in NCRP Report No. 86, "*Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields*," and the IEEE "*Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz*" (IEEE/ANSI C95.1-1992). The FCC, in reaching its decision on adopting the limits recommended by these organizations as regulatory limits, considered a large number of comments submitted in its rule-making proceeding, particularly those submitted by the U.S. Environmental Protection Agency (EPA), the Food and Drug

Administration (FDA), and other federal health and safety agencies (such as the National Institute for Occupational Health and Safety [NIOSH] and the Occupational Safety and Health Administration [OSHA]).

The recommendations that the FCC relied upon in adopting the limits were the result of a rigorous review and assessment of available scientific literature. For example, IEEE reviewed hundreds of papers for biological, engineering, and statistical validity. The limits recommended by the IEEE, which are substantially the same as the standards adopted ultimately by the FCC, are conservative because they were developed to be one-fiftieth (or 2%) of the RF levels where "potentially-deleterious health effects" occur. Thus, even at the exposure limit, the field levels are 50 times lower than what might be harmful.

The IEEE recently repeated the entire process of identifying, reviewing, and evaluating the scientific literature to update its standard (IEEE, 2005). As a member of the committee, along with other scientists, I participated in the recent review procedure, which evaluated over 1,000 scientific papers that are applicable to the question of the potential effects of RF and health. The IEEE committee did not find evidence to support changing the basic approach adopted by the FCC for limiting pubic exposure to RF (IEEE, 2005). Other national and international scientific organizations have evaluated this body of research as well, and they have not concluded that there is a connection between exposure to RF from sources such as radio transmitters and increased risk of any type of cancer (e.g., HCN, 2005; NRPB, 2004). These comprehensive reviews included two of the three studies submitted by Ms. Day (Michelozzi et al., 2002, and Cooper et al., 2001). The recent study by Ha et al. (2007) has not been evaluated by any of these organizations to date, however, the results of the study must be considered in the light of the considerable research already available.

Evaluating Epidemiologic Studies

The scientific process involves looking at *all* of the evidence on a particular issue in a systematic and thorough manner. This process is designed to ensure that more weight is given to studies of better quality. Quality is an important factor in assessing the reliability of the data reported in any research study in a weight-of-evidence review. The reason that all relevant studies are included in a weight-of-evidence review is to maximize objectivity, a major goal of science, by ensuring that studies with a given result are not selected out from all available evidence in order to advocate or suppress a preconceived idea of an adverse effect.

Epidemiologic studies examine and analyze people in their normal daily life. Such studies are designed to measure the association between exposures and a disease. An association is a measure of how things vary together. The association between a particular disease and exposure is measured quantitatively using an estimate of effect. In case control studies, such as Ha et al., which compare people who have already been diagnosed with a disease (cases) to a similar group of people who do not have the disease (controls), this quantitative measure is called the

odds ratio (OR). The general interpretation of an OR equal to 1.0 is that the exposure has no effect on the occurrence of disease. If the OR is greater than 1.0, the inference is that exposure increases the risk of the disease. On the other hand, if the OR is less than 1.0, the inference is that exposure reduces the risk of the disease. The higher the OR, the stronger the association between a particular disease and an exposure, provided that the OR can be distinguished from chance fluctuation. The interpretation of a reported OR, however, is affected by the quality of the exposure assessment and strengths and weaknesses in study design. It is essential to determine whether an association is the result of chance due to errors introduced by poor study design, such as small sample size, or other factors that may not have been accounted for, such as variations in genetic makeup, exposures, dietary intake, and health-related behaviors.

Epidemiologic studies, however, are only part of the evidence on an environmental exposure, such as RF and health, which are considered in a weight-of-evidence review. Data from epidemiologic studies and experimental studies in animals, isolated cells and tissues must be evaluated together due to the inherent limitations in each. Experimental studies of humans, animals, or cells and tissues complement epidemiology studies in assessing potential risks to human health. The reason these two approaches are needed is that, although people are the species of interest, they have large variations in genetic makeup, exposures, dietary intake, and health-related behaviors, as mentioned above. In laboratories, these variables can be controlled to provide more precise information regarding biological effects of an exposure. In epidemiology studies, it is difficult to control for these variables because we are merely observing individuals going about their ordinary lives. In addition, even though animal biology shares similarities with human biology, and have been highly reliable in predicting human cancer, animals are not the species of interest (IARC preamble, 2006). Taken together, epidemiologic and experimental studies provide a more complete picture of a possible disease etiology than any one study-type alone.

Evaluation of the evidence submitted

Ms. Day submitted three epidemiologic studies to justify her concern about health risks from exposure to “high frequency radio transmitters.” Although she does acknowledge that correlations, or associations, do not imply causation, she has not fully identified the limitations in these studies or even correctly interpreted their results.

Two of the three studies that Ms. Day has submitted (Michelozzi et al., 2002, and Cooper et al., 2001), and other studies of similar design to which she indirectly refers, have been evaluated and considered in weight-of-evidence evaluations that conclude RF from radio antennas were not causally related to any cancer (NRPB 2004; IEEE, 2005; HCN, 2005). As the Health Council of the Netherlands (HCN) noted, Cooper et al. did not identify any increased risk of leukemia within a 2 km radius of the transmitter, and found no decrease in risk with increasing distance from the transmitter in children or in adult men (HCN, 2005). Based on these data,

Cooper et al. concluded that their data did not support a causal inference. Michelozzi et al. studied a population in Italy in the vicinity of a Radio Vatican transmitter site. In adults, deaths from leukemia were not increased near the antennas (within 2 km), and no decrease in risk was found with increasing distance from the transmitters, which would be expected to occur if there were a causal link. An association with childhood leukemia was reported, but was based on the single case found within the 2 km radius from the transmitter site. A small number of cases in epidemiologic studies make it difficult to rule out random fluctuations or chance as an explanation of the association. The authors appropriately identified the lack of actual exposure data and the extremely small number of cases as weaknesses in the study that limited interpretation.

A common limitation in these studies is that they did not measure or calculate individual exposures to RF, but used distance of the home from the antennas as a proxy for every participant's exposure. The actual exposure depends not only on distance, but also on the nature of the antenna and its signal, the topography, direction of transmission, and amount of broadcast time. The HCN noted that distance is a highly problematic proxy for the study in Italy (Michelozzi et al. 2002) because some Radio Vatican transmitters are highly directional, and do not broadcast continuously.

In epidemiology, poor exposure assessments are prone to error and can produce inaccurate risk estimates. In general, studies with poor exposure assessments tend to underestimate the risk if there is one, and therefore, improving the validity of the individual's exposure assessment is important to follow up studies that have reported suggestive, but unconvincing, results. The recent study by Ha et al. reflects some improvement in exposure assessment compared to the previous studies by Cooper et al. and Michelozzi et al. In addition to distance, Ha et al. calculated RF exposure from each transmitter and used the highest exposure estimated for each case at their residence in the year before diagnosis. Ha et al. also had the advantage of many more cases than the other studies. They included 1,928 cases of childhood leukemia over the whole country (South Korea), in contrast to Michelozzi et al., for example, who found only 8 total cases in children over the 12 years of the study near Rome, Italy. Despite these improvements in exposure assessment and sample size, Ha et al. did not report higher ORs than other studies. There was no trend of a stronger association with decreasing distance from the antenna, as one might expect if the RF from the antennas caused leukemia. Even more important, the estimated exposure of children who had leukemia (cases) was not higher than that of those who did not have leukemia (controls); the association with RF was not increased in any of the RF exposure quartiles, and there was no exposure-response trend. Although Ha et al. reported positive associations with lymphatic leukemia, the most common form of childhood leukemia, for the second and third RF exposure quartiles, the ORs were weak (OR = 1.39 and 1.59, respectively). There was no clear increase in the highest RF exposure quartile, and no trend. This inconclusive study did not show a clear increased risk with higher RF exposure from AM transmitters, despite an improved exposure assessment and larger population

The studies submitted do not provide evidence of possible serious health effects, and the results of Ha et al. are equally unlikely to affect the existing assessments because the results are weak and inconclusive. In addition, an extensive database of over 30 relevant studies has not shown that RF exposure can cause cancer in laboratory animals, an important predictor of human cancer.

Ms. Day's letter misrepresents the comments of Cooper, Hemmings, and Saunders (2001)

To prevent misunderstanding, I wish to clarify that the comments Ms. Day attributes to Cooper et al., public health researchers from the United Kingdom, regarding the purported elevated incidence of leukemia around radio and television broadcast towers (paragraphs 2 and 4), were actually taken from a letter expressing an opinion of a single individual (Neil Cherry). Cherry's letter appeared directly below the letter from Cooper et al. in the *American Journal of Epidemiology* (2001), on page 204-205. Ms Day's attachment included both letters.

On the first page of her letter, Ms Day refers to studies of health effects from broadcast transmitters in various locations, "Great Britain; Rome, Italy; Honolulu, Hawaii; and South Korea" (also quoting from Cherry, 2001). The HCN reviewed each of these studies, and noted the role of chance, small numbers of cases, and poor study design and analysis, and concluded that "the overall picture that emerges from the studies described in this chapter is that there is insufficient evidence of a connection between living in the immediate vicinity of a radio or television transmitter and increased risk of leukeamia or any other form of cancer" (HCN, 2005 pp.96-97). The IEEE and the National Radiological Board of Great Britain also reviewed these studies and reached similar conclusions (IEEE, 2005; NRPB, 2004).

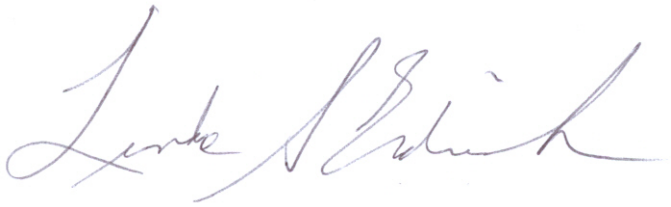
My opinion is based on my experience as an epidemiologist assessing human health risks from environmental exposures, including RF. I find that the materials submitted, including the recent study by Ha et al., do not provide scientific evidence that RF from radio antennas are a cause of cancer or other adverse health effects in people who live or work in the vicinity of radio antennas. The three studies submitted by Ms. Day are but a fraction of thousands of studies that are relevant to assessing potential health effects and developing exposure limits for RF. Selecting a few studies from the entire body of research is contrary to the standard methods scientists use to obtain objective information on the effect of any exposure on health.

Conclusion

The three epidemiologic studies that Ms. Day has submitted have been selected out of the massive amount of scientific research relevant to RF and health. The scientifically appropriate method to assess research studies is to consider them in the context of the vast body of research. The study by Ha et al., as any single epidemiology study, is unlikely to impact the scientific consensus reached by scientific and regulatory agencies because of its limited exposure assessment, and the lack of consistent evidence for an increased risk for childhood leukemia

with higher RF exposure from AM transmitters. Consequently, the Ha et al. study would not affect the recommended RF exposure limits. The FCC limits are consistent with the recommendations of other scientific organizations that have reviewed the scientific research on RF, several of which have reviewed the two earlier studies included in Ms. Day's submissions.

Sincerely,



Linda S. Erdreich, Ph.D.
Senior Managing Scientist

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Professional Profile

Dr. Linda S. Erdreich is a Senior Managing Scientist in Exponent's Health Sciences Center for Epidemiology, Biostatistics, and Computational Biology. She is an epidemiologist with 25 years of experience in environmental epidemiology and health risk assessment. She specializes in assessing epidemiological research and integrating this information with that from other disciplines for qualitative and quantitative risk assessments. She has prepared risk assessments for environmental and occupational chemicals, radiofrequency energy, electric and magnetic fields (EMF), and stray voltage. Dr. Erdreich has also prepared analyses of complex epidemiological evidence suitable for communication with interested parties of various backgrounds, including other scientists, executives, elected officials, and the general public. She has been particularly active in updating standards regarding non-ionizing radiation, both low frequencies (EMF) and radio frequencies. Dr. Erdreich has provided support to government agencies and private clients in health risk assessment and epidemiology.

Prior to joining Exponent, Dr. Erdreich was a Principal Scientist with Bailey Research Associates, where she specialized in epidemiologic research and analysis. Before that, Dr. Erdreich managed a research program in risk assessment at the U.S. Environmental Protection Agency and contributed to the development of risk assessment methods and guidelines. Dr. Erdreich has served on advisory committees to government, regulatory organizations, and industry regarding health risk assessments of chemicals and electromagnetic fields. Dr. Erdreich is also an adjunct associate professor at the Robert Wood Johnson Medical School in New Jersey.

Credentials and Professional Honors

Ph.D., Epidemiology, University of Oklahoma, 1979
M.S., Biostatistics and Epidemiology, University of Oklahoma, 1977
M.Ed., Science Education, Temple University, 1968
B.A., Biological Sciences, Temple University, 1964

Fellow, American College of Epidemiology

U.S. Environmental Protection Agency: Special Achievement Award for Development of EPA's Proposed Risk Assessment Guidelines (1984),Certificate of Achievement, Mentor: Research Apprenticeship Program (1983); Special Achievement Award for Development of Methodologic Approaches to Risk Assessment Essential to the Agency (1982)

U.S. Public Health Service Traineeship (1975–1979); Graduate Dean's Research Prize, University of Oklahoma (1978)

Prior Experience

Bailey Research Associates, Principal Scientist, 1991–1999
Environmental Research Information (ERI), Senior Research Associate, 1989–1991
Clement Associates, Senior Associate, 1987–1989
U.S. Environmental Protection Agency, Office of Research and Development, Methods Evaluation and Development Staff, Group Leader, 1984–1987
U.S. Environmental Protection Agency, Office of Research and Development, Environmental Criteria and Assessment Office, Senior Epidemiologist, 1980–1984

Publications

Erdreich LS, Van Kerkhove MD, Scrafford CG, Barraj L, McNeely M, Shum M, Sheppard AR, Kelsh M. Factors that influence the radiofrequency power output of GSM mobile phones. Radiation Res 2007; 168(2):253–261.

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Stara JF, Erdreich LS (eds). Selected approaches to risk assessment for multiple chemical exposures. Progress Report on Guideline Development, EPA-600/9-84-014a, 1984.

Non Peer-Reviewed Publications

Erdreich LS, Roberts W. Identifying flawed reasoning in biomedical science: A more cogent argument than “Junk Science.” Toxic Torts and Environmental Law Committee Newsletter. American Bar Association, Summer 2006.

Committee on Man and Radiation of the IEEE (COMAR) Technical Reports

The IEEE exposure limits for radiofrequency and microwave energy. IEEE Eng Med Biol 2005; 24 (2):114–117+121.

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Invited Presentations

Erdreich L. Epidemiologic methods in analysis of scientific issues in the courtroom. Acoustical Society of American 146th Meeting, Austin, TX, November 2003.

Erdreich, LS. Epidemiology of radio frequency energy exposure and health. Armed Forces Epidemiology Board, San Diego, CA, February 2002.

Erdreich, L. Epidemiology: What it can tell you and what it can't? Short Course on Electromagnetic Energy. RF Safety: Science, Compliance and Communications. Co-sponsored by the Electromagnetic Energy Association and the Center for Environmental Radiation Toxicology of the University of Texas Health Sciences Center at San Antonio, San Antonio, TX, January 2000.

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Erdreich LS. Epidemiology in developing exposure standards: science and policy roles. Electromagnetic Energy Association Annual Meeting and Symposium, May 1994.

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Erdreich LS. EMF health issues briefing. Residential and Small Commercial Services Seminar, Electric Council of New England, Manchester, NH, May 1991.

Erdreich LS. State policy options for managing extremely low frequency electromagnetic fields. Conference on Health Effects of High Voltage Power Lines, Center for Environmental Health, University of Connecticut, West Hartford, CT, June 1990.

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Thorslund T, Erdreich LS, Hegner R. Testing hypotheses of mechanism using epidemiologic data. Presented at the International Symposium on Chemical Mixtures: Risk Assessment and Management, Cincinnati, OH, June 1988.

Erdreich LS, Sonich C. Hypersusceptible subgroups of the population: determining numbers at risk. Presented at Satellite Meeting of the Environmental Mutagen Society, March 1983.

Teaching Appointments

- Adjunct Associate Professor, Department of Environmental and Community Medicine, Robert Wood Johnson Medical School, University of Medicine & Dentistry of New Jersey (1993–present)
- Lecturer, Short Course on Electromagnetic Energy: University of Texas Health Science Center, Center for Environmental Radiation Toxicology, San Antonio, Texas (1998, 2000)
- Adjunct Assistant Professor, Institute of Environmental Health, University of Cincinnati Medical Center (1982–1987)
- Teaching Assistant, Department of Biostatistics and Epidemiology, University of Oklahoma School of Public Health (1975–1979)
- Teacher of Biology and Chemistry, Ann Arbor, MI; Philadelphia, PA; Montgomery County, MD (1964–1972)

Advisory Positions

- Institute of Electrical and Electronics Engineers (IEEE) (1992–present)
  - Chair, Epidemiology Workgroup of Subcommittee 4 Safety Level with Respect to Human Exposure to Radiofrequency Fields (3 kHz–33 GHz), for the Standards Coordinating Committee 28 Non-Ionizing Radiation (1992–2000)
  - Member, Standards Coordinating Committee 28 Non-Ionizing Radiation, and Subcommittee 3 Safety Levels with Respect to Human Exposure (0-3 kHz), Institute of Electrical and Electronics Engineers (IEEE)
- Member of the Committee on Man and Radiation (COMAR) of the Engineering in Medicine and Biology Society (1995–2000; 2002–2007)
- Chair of the Expert Panel to advise the Massachusetts Department of Public Health, Bureau of Environmental Health Assessment regarding radio-frequency exposure from the Air Force Space Command's PAVE PAWS radar system on Cape Cod (1998–1999)
- Member of a panel convened by Health Canada to review a toxicity assessment of a priority substance under the Canadian Environmental Protection Act (1,3-butadiene) (1998)
- Served on peer review panels for risk assessments for chromium, cadmium, acrylamide, and for methylmercury, convened by Toxicology Excellence for Risk Assessment, a non-profit, 501(c)(3) corporation (1997–1998)
- Contributor to NATO Standardization Agreement: Evaluation and Control of Personnel Exposure to Radio-Frequency Fields - 3 kHz to 300 GHz (1995)

- At EPA, managed and co-authored the agency's first draft Interim Methods for Development of Inhalation Reference Doses (1987–1988)
- Member of U.S. EPA's work group to develop Oral Reference Doses for non-carcinogens, available on Integrated Risk Information System (IRIS) (1986–1987)
- Member of EPA's Risk Assessment Forum's Technical Panel: Developing a Scientific Policy for Thyroid Neoplasia (1986–1987)
- Panel member for an EPA workshop in weight of evidence/hazard identification for non-cancer health endpoints (1986–1987)
- Co-Chair of EPA's agency-wide committee to write Risk Assessment Guidelines for Chemical Mixtures (1985–1986)
- Program Committee to plan a national symposium *Epidemiology and Health Risk Assessment*, sponsored by private, governmental and academic institutions (1984–1985)
- Member, Environmental Advisory Council to the City of Cincinnati. Appointed to the Executive Committee, (1986, 1984–1987)
- Planned and managed an international symposium on "Advances in Risk Assessment of Systematic Toxicants and Chemical Mixtures," held October 1984; co-edited the proceedings (1983–1984)
- Chairperson for two international symposia: "Risk Assessment for Multiple Chemical Exposures," sponsored by EPA (1981–1983).