The results of hum studies in the United States

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ABSTRACT

Stories of mysterious hums, low frequency sounds that only select individuals can hear without being able to identify the source, have become prevalent throughout the world over the past 20 years. In the United States, the first formal study to determine the source of a hum was performed in the Toas, New Mexico area in the early 1990's. The results of that study were inconclusive. In 2003, another U.S. hum study was commissioned in Kokomo, Indiana, where hundreds of residents reported hearing a hum and blamed other, non-acoustical effects on the same phenomenon. In this paper, the lead investigator of the Kokomo Hum study discusses the study and its results, as well as consistencies with the results of the Toas Hum study and the reports of others around the world, in an effort to identify the still-elusive source of this mysterious phenomenon.

INTRODUCTION

Over the past 20 years, reports of untraceable sounds that can be heard by select individuals (which have adopted the label of hums by the press) have surfaced around the world. Since the reports began, several studies have been performed to attempt to identify the source of hums, most notably in Europe and the United States. The two largest funded hum studies in the United States were in Taos, New Mexico in 1993 and in Kokomo, Indiana in 2003. The author of this paper was the lead investigator for the Kokomo Hum study, and this paper discusses the nature of hums in general, the specifics of the Taos and Kokomo studies, and lessons learned from those studies that may point us in the direction of identifying these noise sources. As there are many people suffering from the effects of hums, the ultimate goal is to determine how to provide relief for affected individuals.

Characteristics of hums

A “hum,” as labeled by the press, is a sound that can be heard by some people but cannot be localized using standard acoustic instrumentation. In many cases, hums have been traceable to low frequency acoustic signals generated by industrial sources near communities, but in other cases, no acoustical signals can be detected where affected residents are located. Some people have reported feeling hums through vibrations sensed in different parts of their bodies. Because a small fraction of the populace can sense hums, people who have reported these sensations have often been ridiculed by peers and the press, making people less inclined to report such feelings. One of many common threads among people who sense hums is that they do not appear to be mentally infirm, as vocal critics who do not sense hums have tended to think. What they are sensing is real and is caused by something that they are sensitive to and most others are not. Our task is to determine the source of this phenomenon.

Most people who sense hums state that the sensations have begun suddenly and most who hear hums say that what they hear sounds like an idling diesel engine with a pulsating sound pattern. Covering the ears or using hearing protection devises usually does not reduce the sound level heard. Although many have learned to live with the sound, some have reported physiological effects which may or may not be

related. The most common reported effects include headache, nausea, diarrhea, fatigue, and memory loss. Psychological effects of annoyance, feelings of helplessness, sleep deprivation, and suicidal thoughts have been reported by affected individuals, all related to the nature of the source being undefined and uncontrolled. It is also interesting to note that many of those affected who have dogs as pets have reported that their dogs react to the hums at the same times as they do. Erratic behavior of birds and dying vegetation near their homes have also been described by affected individuals.

Unlike tinnitus, a physical condition for which internal sound is heard all the time at any location, hums appear to be site-specific. Most people who sense hums report that they do not sense the hums when they leave a general area (as large as a city or state), and they sense the hums both inside and outside of their homes. When driving out of an area the hum often is reported to go away and when driving back into the original area the hum returns. This implies an external stimulus. Most people who sense hums also report that the signals are most noticeable late at night but they still hear them most of the time in specific geographic areas. There do not appear to be trends related to gender and age among people who sense hums.

Since the cause of these hums is elusive, many theories have arisen as the cause for the hums, which vary from the plausible to the extreme, adding fuel to the media fire of interest in the phenomenon. A plethora of theories fill the internet with statements of proof for the cause of hums, yet none of these statements provides clearly supportable data.

Hum studies

The two most comprehensive hum studies performed in the United States were in Taos, New Mexico and Kokomo, Indiana. These are discussed below.

The Taos Hum Study

The most publicized of the American hum studies took place in Taos, New Mexico in the spring of 1993. The Taos Hum study resulted from U.S. congressional action reacting to local concern. The official study took place over a week-long period through a cooperative effort between Los Alamos National Laboratory, Sandia National Laboratories, Phillips Air Force Laboratory, and the University of New Mexico. The study was set up as an open public investigation coordinated by the University of New Mexico to allay concerns that a government agency may have been responsible for the hum and government-funded laboratories, working alone, may bias the results of the study.

According to unpublished study documentation in internal memoranda, 161 people reported sensing the hum out of a survey of 8,000 residents. Some of these residents took part in the study to identify when they sensed the hum concurrent with the monitoring. Equipment was used to monitor not only sound, but seismic activity and electromagnetic fields in the area. After a week of continuous monitoring (during which time affected residents were hearing the hum), the only unusual activity that could be reported by the measuring instruments was an elevated electromagnetic field level that was reportedly related to the local power lines. There had also been reports from affected people related to malfunctioning of electrical appliances in and around their homes.

Although many affected residents could replicate the sounds that they heard on signal generating equipment, no such acoustic signals were detected by any instruments during the study. No hum source was identified from the Taos Hum study.

The Kokomo Hum Study

The Kokomo Hum study resulted from a fund commissioned by the City of Kokomo, Indiana. The team performing the study was chosen through a national search and interview process.

The study began with a public meeting and private interviews of affected residents. One hundred twenty six residents were formally documented as being affected by the hum. Their homes were spread throughout the City. Several of those who were interviewed stated that they knew other affected residents who did not wish to be identified for personal reasons. During the last weeks of March and April 2003, the project team recorded sound and ground vibration levels at the homes of affected residents throughout the City. Due to the reported electrical issues in Taos and Kokomo, electromagnetic fields were also recorded using a portable gauss-meter.

According to American National Standards Institute (ANSI) Standard ANSI 3.29-1983, ("Guide to the Evaluation of Human Exposure to Vibration in Buildings"), the mean human perception limit for ground-borne vibrations in the 8 to 80 Hz frequency range is 8,000 microinches per second. The same standard states that the most sensitive human perceptibility limit is 4,000 microinches per second. These limits increase for frequencies lower than 8 Hz. With these limits in mind, ground-borne vibration levels were monitored at 12 locations throughout the City where hums had been reported. No ground vibration levels in excess of 200 microinches per second were measured at any location, including locations where residents claimed that they felt vibrational symptoms while the data were being recorded. Since the measured vibrations were more than 10 times below the level of minimum perception, it was concluded that ground-borne vibration was not an issue for this investigation.

From acoustic measurements, significant sound pressure level tones at 10 Hz (along with associated harmonics up to 60 Hz) and 36 Hz were detected at some of the residential locations while residents were present and feeling symptoms. These tones were each 20 to 40 decibels above the background levels. A 360-degree rotating dual-microphone boom was used at three locations to localize the 10 Hz tone to air compressors in an industrial facility near the center of the City. The 36 Hz tone was localized to a cooling tower on the roof of another industrial plant in a different section of town. In each case, the tones were clearly detectable at more than a 1 km radius from the sources.

In addition to these two facilities, several residents mentioned two other facilities that they were concerned about in the northern end of the City. Tunneling operations were being conducted at one of these facilities so underground access needed to be granted to investigate whether the noise from these operations or their associated ventilation fans could be generating the low-frequency tones measured in the communities. Since the fans did not generate any tones consistent with what was monitored in the communities and the facility did not operate at night (when most of the affected people sensed the hum), this facility was eliminated from consideration. No noise was audible or measurable from the other facility.

Management from the two industrial facilities that were identified as generating 10 and 36 Hz tones each volunteered to replace equipment and install silencing equipment to lower the emission levels of the tones. After these noise control measures

had been implemented in the spring of 2004, the project team visited the City and monitored the acoustic signals at the same locations as before. At that time, the 10 and 36 Hz tones were not detectable above the background levels at the same locations where they were previously more than 20 dB above the background. At this point, some affected residents expressed relief from their symptoms but most did not. In fact, one affected resident had become so disturbed that she moved more than 700 miles away to relieve her symptoms.

Since many affected residents mentioned unusual occurrences related to home electrical systems, including appliances suddenly burning out and cars having remote starters unexpectedly starting in garages, electromagnetic fields were monitored in areas where residents appeared to be most affected. In most cases, elevated electromagnetic field strengths of 3 to 50 milliGauss were experienced in and around the homes.

DISCUSSION

There has been a fair amount of discussion among affected individuals relating hums to low frequency sound, mainly because most people who hear hums report hearing just that. However, most hums that remain untraceable cannot be detected with acoustic instrumentation. If low frequency sound is the foundation of hums, it would be detectable by microphones that are sensitive to those frequency ranges. In fact, a special microphone was developed by the Taos Hum team to monitor low frequency acoustic signals and that microphone picked up nothing unusual in that study. Although no special microphones were used for the Kokomo Hum study, the microphones were rated to perform well down to below 5 Hz. Although low frequency tones were found in Kokomo, their reduction in intensity made little difference for most of the people affected by the hum. All indications were that the hum is not a traditional acoustical phenomenon and therefore not associated with low frequency acoustic energy.

The only apparent common thread is that of elevated electromagnetic fields and the potential for some people to have the sensation of hearing stimulated by these fields. Research by Frey (1962) more than 40 years ago introduced the potential for microwave hearing, a phenomenon by which people (including the clinically deaf) can hear sounds related to electromagnetic field exposures that are not accompanied by measureable acoustic pressure fluctuations. This has been attributed to thermoacoustic effects in the brain (bypassing the traditional hearing mechanism) caused by electromagnetic energy but little research on the phenomenon has been performed since Frey's early work. Symptoms other than hearing sounds referenced in Frey's work, such as a "pins-and-needles sensation," have been reported by individuals experiencing hums.

When asked what changed in their environment at the time they began sensing the hum, most referred to utility work associated with telephone, cable television, or power line maintenance, or a new cell phone tower in the neighborhood. Since being involved with the Kokomo Hum study, the author has been contacted by people from many areas of the United States, as well as Europe, with similar stories to those in the Kokomo area, both in terms of symptoms and environmental changes. Hums are clearly not localized to Taos and Kokomo.

Earlier in this discussion, there was mention of the observance of erratic bird and dog behavior related to this phenomenon. It has long been recognized by authors such as Ritz et al. (2000) that the natural geomagnetic fields surrounding the earth are related

to migratory patterns of birds and other animals, so these animals may be more sensitive to variations in electromagnetic fields than most people.

There has been a significant amount of debate related to the health effects of electromagnetic fields and this discussion is not meant to support either side of that argument. The results of the Taos and Kokomo studies shed light on the need for further investigation to determine the potential for electromagnetic fields to become audible by a means other than the auditory apparatus. By uncovering this transduction mechanism, indications are that we will solve the mystery of hums around the globe and find practical solutions for those who are affected by them.

REFERENCES

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