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# The Mystery of “Sonic Health Attacks” on Havana-Based Diplomats

**F**or the past few weeks, media outlets have been reporting on the US State Department’s disclosure that Havana-based US diplomats were experiencing health issues [1-5]. Their residences were described to have been targeted with bursts of sound waves. Diplomatic staff and family members have repeatedly reported hearing loud buzzing or scraping sounds. Symptoms included severe hearing loss, headaches, ringing in the ears, nausea, and problems with balance or vertigo, which are suggestive of a connection to the inner-ear apparatus within the human head.

While suspicious of a Cuban governmental role in directing the “attack,” US officials have yet to pin down the source, nor have they found any weapon that potential culprits might have used. Experts consulted by media outlets and the US government appear to have been baffled by it.

The Cuban government has denied any involvement. US State Department officials have speculated that the diplomats may have been attacked with an advanced sonic weapon operating outside the range of human auditory response.

The reporting of health issues associated with hearing loud buzzing, or what was described as bursts of sound, is mystifying, and has caused considerable distress among embassy staff and their families. Indeed, the incidence has caused some diplomats to return to the US with their families.

It is known among audiologists, otologists, and hearing scientists that robust audible (and perhaps, inaudible) sound could damage hearing and vestibular sensory systems,

and alter human emotions and moods. However, it is not clear whether a weapon that covertly uses sonic energy to injure people actually exists today. Nevertheless, this event is calling attention to the reality that sonic and ultrasonic waves could potentially be weaponized for health attacks.

The US State Department has called on Cuban authorities to ferret out who is making these health attacks. Apparently, the Cubans have offered to let the FBI go to Havana and investigate the incident, implying that they are cooperative in the investigation, and that they did not deliberately target US Embassy personnel with any sonic weapon. Indeed, to date, the consensus among media reports seems to be a collective dismay, that “scientists still have a big mystery to solve.”

Wait a minute. There actually may be a scientific explanation.

It is plausible that the loud buzzing, burst of sound, or acoustic pressure waves may have been covertly delivered using high-power microwave radiation, instead of blasting the subjects with conventional sonic sources. It has been scientifically well-documented that absorption of a single microwave pulse impinging on the head, and conversion of a microwave pulse to an acoustic pressure wave by soft tissues inside the head, may be perceived as an acoustic click or knocking sound, depending on the intensity of the incident microwave power. A train of microwave pulses to the head may be sensed as an audible tune, chirp, or buzz [6-8].

Would the sound show up on an acoustic recording instrument? Yes and no. It would depend on design and fabrication of the sensing device. Some readers may regard the mentioning of auditory perception of or hearing microwave pulses as preposterous and astonishing. Therefore, let me explain.

Studies have shown that the auditory phenomenon occurs at a specific-energy-absorption-rate threshold of microwave radiation of 1.6 W/g for a single 10- $\mu$ s-wide pulse of microwaves aimed at the subject or the subject's head, for example. Most significantly, the high-power microwave pulses may be remotely covertly delivered, so that only the intended target would perceive the sound in his or her own head. This obviously is at once astonishing and intriguing.

Microwave radiation, under other circumstances, cannot be perceived by humans, such as being seen as visible light or heard as airborne sound. Furthermore, the hearing apparatus commonly responds to acoustic or sound pressure waves in the audible frequency range (up to 20 kHz). The hearing of microwave pulses is thus a unique exception to the airborne or bone-conducted sound energy that is normally encountered in human auditory perception.

In fact, the hearing of microwave-pulse-induced sound involves a cascade of events. A minuscule but rapid ( $\sim\mu$ s) rise in tissue temperature ( $\sim 10^6$  °C), resulting from the absorption of pulsed microwave energy, creates a thermoelastic expansion of brain matter. This small theoretical temperature elevation is hardly detectable by any currently available temperature sensors, let alone felt as a thermal sensation or heat. Nevertheless, it can launch an acoustic wave of pressure that travels inside the head to the inner ear. There, it activates the hair cells in the cochlea, and it then is relayed to the central auditory system for perception, via the same process involved for normal hearing.

Depending on the intensity of the impinging microwave pulses, the level of induced sound pressure could be considerably above the threshold of auditory perception at the cochlea: to levels approaching or exceeding discomfort and even tissue injury, including reported headaches, ringing in the ears, nausea, and problems with balance or vertigo.

Assuming that the reported event is reliable, there is actually a scientific explanation for the source of sonic energy. It could well be from a targeted beam of high-power microwave pulse radiation.

End note: The reader may also be interested in my article in another publication [9], where I discussed the mysterious sonic health attacks on Havana-based diplomats by the potential use of short high-power microwave pulses directed toward the subjects.

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