A low-frequency square wave signal has now been found to be significantly more effective than all tested alternatives...

It took some time but the National Fire Protection Association (NFPA) has changed its standards regarding smoke alarms as a result of the 2006 study done by researchers in Australia’s Victoria University that HLAA reported to its members at the time. The study found that those with hearing loss were much more likely to be awakened by smoke alarms with a much lower frequency tone than was to be found in devices on the market.

The Victoria University study found that the most effective signal for the hard of hearing was a 520-Hz square wave auditory signal, waking 92% at 75 dBA, compared with 56% waking to the 75 dBA high-pitched alarm. It was also considerably more apt to awaken both sleeping children and adults who were heavy sleepers and those under the influence of sleeping medications or alcohol.

The high pitched tone commonly found in smoke detectors is a 3100 hertz signal. The low frequency requirement in the new standards applies to sleeping spaces including lodging or rooming houses, hotels and motels, dormitories, apartment buildings, and residential board and care facilities and the bedrooms of the hard of hearing and calls for smoke detectors and carbon monoxide detectors to emit a 520 hertz signal in what is called a square wave tone.

Square wave sound when diagrammed has a square pattern as opposed to the fluid pattern of the Sine Wave.

The Triangle Wave and Sawtooth Wave when pictured,

would look just like their names imply.

The Square Wave is higher, richer and louder than some other forms of sound waves and have odd harmonics that have a greater impact on the timbre of the wave and are thus more effective in calling attention to the sound than Sine Waves, Triangle Waves or Sawtooth Waves.

In a report on this new standard, HealthyHearing.com said, “Extensive studies have shown that almost all adults with normal hearing wake up within 32 seconds of the start of a standard 3100 Hz alarm at 60 decibels compared to only half of adults who are hard of hearing. This puts them at unacceptable risk of injury or death due to a house fire.”

Though greatly benefiting the hard of hearing, even those with normal hearing are more apt to be awakened with these alarms. The National Center for Biotechnology confirms this in reporting, “A low-frequency square wave signal has now been found to be significantly more effective than all tested alternatives in a number of populations (hard-of-hearing, children, older adults, young adults, alcohol impaired) and should be adopted across the whole population as the normal smoke alarm signal.” It should also be noted that they said, “Strobe lights, even at high intensities, are ineffective in reliably waking people with mild to moderate hearing loss.”

Most hard of hearing people have hearing loss in the upper frequencies. According to HealthyHearing.com, “Individuals with this type of hearing loss may have difficulty hearing sounds like the letters s, h and f and frequencies higher than 2,000 Hz.” With smoke alarms emitting a signal of 3100 Hz it is obvious that the hard of hearing would have a problem with them. To further exacerbate the problem, high pitched sounds lose their strength over shorter distances than lower pitched sound and, unless the alarm is in the bedroom, though the signal may be at 85 decibels leaving the alarm, by the time it reaches a person sleeping in the bedroom it might be at only 60 decibels (the sound level for normal speech) or even lower, a good reason to have an alarm in the bedroom.

The National Fire Protection Association says smoke alarms that are properly installed and maintained play a vital role in reducing fire deaths and injuries. If there is a fire in your home, smoke spreads fast and you need smoke alarms to give you time to get out. Having a work-

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Smoke Alarms

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...ing smoke alarm cuts the chances of dying in a reported fire in half. Almost two-thirds of home fire deaths resulted from fires in homes with no smoke alarms or no working smoke alarms.

The NFPA says you should:

- Install smoke alarms in every bedroom, outside each sleeping area and on every level of your home.
- Test your smoke alarms every month.
- Replace all smoke alarms in your home every 10 years.

New Mexico is among the small number of states that have not applied this new standard to their fire code. As a result, purchasing a product that meets the standard is problematic and expensive. The major manufacturers of smoke detectors don't seem to be terribly concerned that the hard of hearing can't hear their products and no smoke detectors meeting these new (but not mandatory) standards are to be found at Lowes, Home Depot, Ace Hardware, Walmart or any other local retailers.

There is one company that manufacturers such a 520 Hz alarm is named Loudenlow (http://www.loudenlow.com/). Their smoke alarm can be ordered online and retails for $179 with free shipping.

Another company, Lifetone Safety (http://lifetonesafety.com/) makes a combination alarm clock/smoke alarm that wakes you up and alerts you with 4 different signals: a loud, low-pitched [520 Hz] signal, a powerful vibrating bed shaker, instruction in a voice saying, “Fire! Get out!” and FIRE in large text against a flashing orange backlit screen. The price is $165 and, again, they offer free priority shipping to US addresses. This alarm does not sense smoke - it is set off when it senses a standard 3100 Hz smoke detector installed in each sleeping room, outside each sleeping room and on all habitable floor levels.

One benefit of an alarm like this is that it's portable, fast and easy to set up in homes or taken along to hotels, motels, hospitals, senior citizen residences, independent and assisted care facilities, in fact, every where that its user might sleep.

A somewhat similar product is the SafeAwake alarm (safeawake.com) pictured here. It provides the low frequency, high decibel square wave sound intended for the hard of hearing and the non-continuous, pulsed tactile stimulator [bed shaker] to awaken a sleeping person. It lacks the alarm clock and voice warning features of the Lifetone product and retails for $299.95. The SafeAwake alarm can be purchased at ATS Resources here in Albuquerque or ordered online from them (www.ATSResources.org or locally at 222-0608 and toll free at 1-877-287-0608) or from Harris Communications (www.HarrisComm.com or 1-800-825-6758). It can also be ordered from Grainger, a leading distributor of industrial supplies (www.grainger.com or 1-800-323-0620) with a showroom here in Albuquerque.

For commercial properties including hotels, dormitories, assistive living facilities, etc., the SafeAwake can be purchased through ADI Global Distribution, a Honeywell company [www.ADIGlobal.com or 1-877-228-6739], and for hearing healthcare professionals another resource is HalHen, a supplier to that industry [www.hlahen.com or 1-800-825-6758].

It would seem like making a smoke detector with a lower pitched alarm [referred to as a “sounder”] would be a simple task but, t'aint so McGee. Larry McKenna, a Fire Protection Specialist at the U. S. Fire Administration (USFA) in Washington, says it's a difficult and expensive undertaking. He is a member of a USFA research group studying the problem in order to help manufacturers develop the technology needed to produce reasonably priced HoH compatible smoke and carbon monoxide detectors.

McKenna says that for the lower pitched sounder needed for the HoH, manufacturers will have to switch from a technology that uses a vibrating piece of metal to make the alarm sound to a loudspeaker [note the speaker on the Loudenlow alarm pictured on this page]. This calls for greater battery power and other changes in the design and construction of the devices.

Once a new device has been developed, said McKenna, it must then be submitted to the Underwriter Laboratory (UL) for testing and approval before it would be offered to the public. The cost for the testing can exceed $100,000 and, added to development costs that precede it, there has been no major maker of smoke detectors like First Alert, Kidde, Code One or others has yet brought such devices to the market though they are reported to be working on developing such devices.

Permanently installed and wired smoke alarms that emit the 520 Hz signal are available for commercial installation and use but, as noted earlier, New Mexico has not adopted that standard and also only enforces smoke alarm requirements for apartments and they need not meet the new NFPA standards. In North Carolina, in comparison since 1999 newly constructed one and two family homes, apartments, condominiums and townhomes are required to have a minimum of one 110 volt NFPA compliant hard-wired, battery backup smoke detector installed in each sleeping room, outside each sleeping room and on all habitable floor levels.

A final thought, the NFPA says, “Smoke alarms that are properly installed and maintained play a vital role in reducing fire deaths and injuries. Smoke alarms save lives. If there is a fire in your home, smoke spreads fast and you need smoke alarms to give you time to get out. Having a working smoke alarm cuts the chances of dying in a reported fire in half.”