

**OCCUPATIONAL SAFETY
AND HEALTH STANDARDS BOARD**

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**ADVISORY COMMITTEE MEETING MINUTES**

Amendments Recommended in Petition No. 500
Related to Broadband Sound Alarm Technology and the Requirements for
Warning Devices/Alarms for Backing Vehicles/Equipment

April 21, 2010
Sacramento, California

The meeting was called to order by the Chair, George Hauptman, Senior Engineer, Occupational Safety and Health Standards Board (Board) at 9:00 a.m. on Wednesday, April 21, 2010. Board staff present at the meeting included Marty Tamayo, Associate Safety Engineer, and Cathy Dietrich, Associate Governmental Program Analyst. Senior Engineers, Patrick Bell and Michael Donlon represented the Division of Occupational Safety and Health (Division) on behalf of the Research and Standards Unit. Steve Hart, Principal Engineer and John Leahy, Senior Engineer from the Division's Mining and Tunneling Unit were also present at the meeting.

The Chair explained that the Petitioner, Henry Morgan, Director and General Manager for Brigade Electronics Incorporated would attend the meeting via telephone (Mr. Morgan was unable to get a flight from Europe because of the numerous flight cancellations related to the Iceland volcano). Also, present at the meeting representing Brigade Electronics was Sales Development Manager, Corey Heniser from Portland, Indiana.

The Chair reviewed the Board's policy and procedures concerning the goals, objectives and use of advisory committees. The Chair explained that the committee role is to advise the Board. The Board will then consider the committee recommendations, usually accepting them, sometimes modifying them, and less frequently rejecting the recommendations if for example, the committee's recommendations would not be at least as effective as federal OSHA standards or would be considered as decreasing rather than increasing the level of safety afforded by the existing standards.

The Chair indicated that the advisory committee was convened at the direction of the Board in its Decision for Petition File No. 500. The Petitioner, Mr. Morgan, recommended amendments for various Title 8 standards such as Construction Safety Orders (CSO) Section 1592, and Tunneling Safety Orders, Section 8483(a)(3) and other safety orders that require backup alarms or warning devices to be audible from a distance of 200 feet. The Chair stated that the focus of Petition 500 is the use of Broadband Sound (BBS) technology for backup alarms. The Chair stated that there are a number of other types of alternative alarms and warning methods such as, radar sensing,

radio frequency detection and strobe lights. However, the committee focus and objectives will be the merits and necessity of proceeding with a rulemaking action based on the Petitioner's recommendations related to the use of BBS technology.

The Chair stated that a number of Title 8 standards were listed in the Petition with recommendations for amendments that would permit the use of BBS alarm technology. Those Title 8 standards were outlined in the committee member invitational material. However, the Chair stated that the primary standards for consideration are CSO Section 1592(a) and TSO Section 8483(a)(3)(A). These standards require that warning devices that operate automatically (backup alarms) be of such magnitude that they will normally be audible for a distance of 200 feet.

The Chair indicated that there are concerns that the BBS alarms may not be audible for the required distance as one moves away from the area directly behind the vehicle towards the sides of the vehicle and closer to the operator's station. In some cases, the alarms may not be audible for the required distance of 200 feet behind the vehicle. There are also Decisions After Reconsideration (DARs) from the Occupational Safety and Health Appeals Board that indicate with respect to CSO Section 1592(a) that the area of alarm audibility is not limited to the area directly behind the vehicle, but includes the area in all directions from the vehicle.

The Chair noted that BBS technology is not specifically prohibited by Title 8 standards. However, BBS alarms would have to meet the audible distance requirements where specified. A number of standards listed in the petition pertain to vehicles with obstructed view that are not subject to CSO Section 1592(a); those other standards require a warning device (horn) or do not specify the 200 foot distance of audibility and the use of BBS alarms would likely not be prohibited in these standards.

Mr. Morgan was given an opportunity to make opening statements regarding the Petition recommendations and the merits of BBS technology. Mr. Morgan stated that technical information in an article as far back as 1999 indicated that direction of BBS is locatable. With traditional tonal alarm sounds it is asserted that the direction that the sound is coming from is not easily recognizable. Consequently, the concept of producing BBS alarms that are audible and recognized directionally and focused in the alerting zone was born.

Mr. Morgan further stated that BBS alarms are used in the United Kingdom and are standard in the mining industry in both off-road and on-road equipment. They are also used on electric carts in airport operations as they reduce noise exposure levels for the cart operators. BBS alarms represent approximately 1/3 of Brigade's alarm sales in the U.K. Brigade has been selling BBS alarms in the US since 2005, and Mr. Morgan presented various sales figures. The alarms are being used in various settings including some aggregate operations and noise sensitive areas such as near hospitals, schools and trash and refuse collection.

The BBS alarm is only heard in and around the hazard area predominately to the rear of the vehicle and to a lesser degree at the sides of the vehicle. The audible pattern to the rear of the vehicle is somewhat balloon shaped. A concern of the Petitioner regarding provisions such as CSO Section 1592(a) is that BBS alarms cannot be heard in a circular pattern around the vehicle, and the 200 foot audible requirement, even to the rear of the vehicle, seems outside the effective alerting area. Mr.

Morgan stated that when alarms are unnecessarily heard outside the danger zone (false alarm), the response to typical tonal type (beeping) alarms is reduced proportionately to the level of audible false alarms. Conversely, the response of persons to alarm sounds when heard only in the danger or alerting zone is greater. This is because the person(s) at risk hear the alarm only in the alerting area where it needs to be heard and are not tuning out false or unnecessary alarms about the surrounding work area. Mr. Morgan stated that the emphasis of the Petition is not necessarily to specifically include provisions for BBS alarms, but rather to define that the required alarm sound must be heard only in the area where it is necessary to be heard in order to improve safety and that a 200 foot distance even behind the vehicle may be unnecessary.

The Chair explained that the meeting handouts included a list of accident scenarios from the federal OSHA accident website to give an idea as to how a number of serious & fatal backup alarm related accidents have occurred. There were a number of scenarios where the alarms were functional and apparently audible, but the accidents still occurred. As expected, there were a similar number of accidents where the alarm was malfunctioning or there was no backup alarm, and no alternative methods used such as a spotter. To a lesser degree, the surrounding ambient noise was a factor in hearing the alarm and/or employees involved lacked training.

In open discussion related to job site hazards, Peter Robertson, Cal Trans, stated that often they have high levels of ambient noise that exceed some of the examples in the petition documents. Mr. Morgan said that BBS will achieve greater loudness with less sound level pressure than tonal alarms and so has been effective when competing with background levels.

Dave Harrison, Operating Engineers Local 3, expressed concerns that their job sites always have significant ambient noise levels, and with the aging of the work force, many equipment operators and workers have lost some hearing in the higher frequency levels. Steven Wolfe, Acoustical and Vibration Consultant, stated that workers exposed to industrial noises typically lose hearing first at the higher frequencies. It was his opinion that most people even with some hearing loss, depending on the circumstances and environment, would have the ability to hear BBS type alarms. Tim Podue, International Longshore and Warehouse Union (ILWU) stated that in the marine terminals hearing protection is worn all day in some operations and questioned how effective BBS would be in that environment. Mr. Morgan responded that at the Port of Houston, BBS alarms are being used on rubber tired gantry cranes and other heavy material handling equipment. Their experience is that, particularly with hard shell hearing protection, audibility is not negatively affected.

Mr. Morgan indicated that one of the biggest tunneling projects in Europe (under the Swiss Alps) is using BBS technology. Ron Meyers, Laborers' International Union of North America, said that in the tunnels that are only 10 feet in diameter, tunnel boring machines in combination with other tunneling machinery and equipment produces a wide variety of sounds in a confined space, and he expressed concerns about hearing the BBS alarms in confined spaces.

Gerald Fulghum, Safety Engineer (former Cal/OSHA safety engineer), asked if there was a specific standard or criteria for evaluating BBS performance. Mr. Morgan stated that employers in the U.K. must provide a safe environment for workers or be subject to fines and penalties, but for other than mining operations, there was no specific environment mandating backup alarms. However, when they are used, they must be sufficiently audible to warn workers. Mr. Morgan added that BBS

meets SAE J 994 laboratory test methods that relate to the reliability of alarms under different environmental conditions.

Mike Donlon stated that in Title 8, California regulations have performance criteria requiring that alarms be audible for 200 feet. A Division concern is that if that criterion is missing, the standard may not be enforceable. Mr. Morgan responded that the hazard area where the alarm needs to be heard to the rear quadrant of the vehicle and to a lesser degree at the sides from the rear axles should be defined to eliminate unnecessary alarm sounds. Patrick Bell agreed that the concept makes sense but that there is a difference of opinion as to where the alerting zone needs to be. Certain vehicles and equipment can move quickly and at times can make wrong or unexpected turns, and the reaction and individual's response times have to be factored in.

Dave Harrison stated that he is curious to hear the BBS and that he may be in support of that technology, but he is not in support of making any amendments that would be less stringent than existing standards in order to support that technology.

The Chair confirmed with Mr. Morgan that later in the morning, the committee would hear a BBS alarm on a refuse collection truck that is equipped with a 97 decibel (dB) fixed alarm. The Chair reminded the committee members that when the alarm is heard they should keep in mind that it is not the loudest model BBS alarm. Brigade manufactures a heavy duty model that is designed for construction and other heavy equipment at 107 dB. The Chair reiterated that the BBS alarm concerns for audibility requirements appear to be specific to equipment and vehicles subject to the provisions in the CSO Section 1592(a) and TSO Section 8483(a)(3)(A).

At this point in the meeting, the truck driver from Atlas Disposal Company arrived, and members walked to the parking lot and adjacent street to hear the BBS alarm demonstrated. During the demonstration, the truck drove to the end of a city block and around the next street corner and then started backing up with the backup alarm operating. This was repeated 3 or 4 times to give everyone a sufficient opportunity to hear the BBS alarm.

After the demonstration, the Chair stated that, without earplugs on, he could hear the BBS alarm (a hissing type, or static sound that is very unique compared to typical tonal beeping alarms) as the truck started backing from the furthest distance at the end of the block. With earplugs on, at about 150 feet the sound was reduced somewhat, but he could still hear it. But the Chair indicated with an airplane overhead and subsequently a car alarm going off, he started to have trouble hearing the BBS alarm (with or without the earplugs) in the area behind the backing truck.

With the refuse truck stationary, motor running and the reverse alarm on, the Chair commented that walking past the rear wheels on the vehicle sides and up toward the operator and in front of the vehicle, there is little if any audible sound. With the motor running, the truck operator stated that he could not hear the alarm. The Chair noted that one of the Petitioner's concerns is that BBS alarm sound is very directional and focuses on the rear quadrant alerting area behind the vehicle and one alarm would not meet applicable standards or legal interpretations of those standards that require audibility in the vicinity around the vehicle.

Mike Donlon stated that he had trouble recognizing the BBS backing sound as an alarm as the sound is unfamiliar. He felt that it could be mistaken for other types of machinery like a compressor, drill rig or other equipment. He felt there would be quite a learning curve for workers to identify the BBS sound as a warning alarm and would have safety concerns during the transition time required. Dave Harrison stated that on construction sites, he agreed with Mike Donlon's comment but added that he liked the concept that when the vehicle turns away from the backing direction, the alarm is not heard and there may be a benefit to that. However, when the alarm was heard in the backing direction, he felt the sound was almost comforting (not alerting enough) and that complacency of a worker in a hazardous area would be a concern. The Chair stated that training would need to be a component of BBS alarm use on construction sites that typically have multiple employers and contractors on site.

Mr. Morgan indicated that there were similar concerns when BBS was introduced in the U.K. at mine sites. The conclusion was that when in the hazard area, provided the appropriate alarm is used, that the sound was obnoxious (significant) and locatable enough to warn workers. A further benefit is that it reduced the tuning out of alarms that is typical in their experience with tonal alarms when heard by workers that are not in the danger zone of a backing vehicle.

Gerald Fulghum was concerned that there would be some confusion with a mix of alarm types (BBS and tonal beeping) that may not be totally overcome with training as the standards require an effective alarm and do not specify one type versus another. Patrick Bell stated that it was his experience regarding permanent variance requests related to typical tonal alarms that individuals in the surrounding community cannot tune out the alarms and hear them during the evening hours.

Michael Herges, Graniterock Company, stated that his company has tried the BBS alarms (both the 107 and 92 dB models) on several types of vehicles/equipment using an alarm on both the back and front of the vehicle. They have used the alarms at an asphalt plant, sand and gravel operation and in a building materials yard where they have had residential noise complaints. Employees commented initially that the BBS alarm did not sound like a tonal alarm, but when they were asked if the alarms got their attention, the answer was "yes" because the sound was different from a tonal alarm. They are using the BBS alarms on some vehicles in conjunction with tonal alarms on other vehicles/equipment now for over a year and have not had any issues or close calls.

Ron Myers commented that at fixed plant facilities like those mentioned by Mr. Herges, you have the same employees for training and familiarity purposes, but at construction sites, employee turnover may be high and contractors at the job site change frequently. He felt that the existing standards and the 200 foot requirement for audible backup alarms are sufficient without amendments. He felt that BBS alarm sound in tunnels would not be discernable as a warning when competing with the noise of excavators, drilling machines, conveyors, trucks and other equipment and felt the alarm could sound like a tunnel boring machine.

Gerald Fulghum asked if existing standards that require alarms to be audible for 200 feet are adequate, or should they be amended to define the hazard area and what is required as to the alerting area to the rear of vehicles and equipment where the operator view is obstructed. He did not see any benefit to the concept that an alarm must be heard in the front of the vehicle.

Dave Harrison stated that it is not always just to the rear of the vehicle where there is a concern. Workers in the vicinity of the vehicle need to have a warning. Vehicle operators can make mistakes or wrong and unplanned turns. Certain vehicles and mobile equipment can have extensions, boom type features or other equipment to the forward part of the vehicle. A road/motor grader can have an offset blade. As these vehicles back up while turning, that extension equipment can sweep around. As he heard the BBS sound demo, the warning sound is greatly dissipated as the truck turns and changes direction.

Steven Wolfe stated that he felt with education and recognition of BBS alarm sounds as a warning signal, there would be a benefit of reducing alarms sounds that are too frequently heard when workers are not in the danger zone. By defining the hazard zone, it would permit the use of BBS alarms while not excluding the use of typical tonal alarms. The Chair indicated that he felt the concept of BBS sound has merit in that unnecessary (or what the petition refers to as “false alarms”) are reduced. We know that some accidents still occur with tonal alarms even though they apparently are audible and working properly. However, the Chair stated that he was concerned about the audibility of BBS alarms when there are competing noises of other equipment and vehicles on busy construction or surface mining sites.

Lee Travis, Vulcan Materials, stated that they have tried the BBS alarms at their Arizona asphalt plant, and they were essentially forced to do this by local ordinances requiring them to reduce the sound levels. They have been successful doing this, and they use the 107 dB level BBS alarms on heavy equipment. They have signs up at the facility stating that alternative backup alarms are in use and in some cases have individuals listen to the alarm for recognition purposes. They have not used these alarms yet on construction sites with a concern that other contractors on the job sites will not identify the BBS sound as a reversing alarm.

Steve Hart, Principal Engineer, Mining and Tunneling Unit stated he had concerns and was disappointed by the effectiveness of the BBS alarm in the demonstration this morning. However, the BBS is a relatively new technology and may have merit on a trial basis. The Division permits an experimental variance for a specified period of time for one employer in order to try out the merits of new methods and devices under controlled conditions monitored by the Division. He thought that BBS may have merit in this type of situation.

The committee reviewed several applicable federal OSHA construction standards that are located primarily in 29 CFR 1926.601(b)(4), 1926.602(a)(1) and 1926.602(a)(9). The Chair noted that where these standards permit or require the use of a backup alarm, the federal provisions require that the warning alarm be audible and/or distinguishable above the surrounding noise levels. The federal standards do not specify an audible distance for automatic backup alarms.

The committee reviewed Title 8 standards related to the Petition that were summarized in the invitation materials. The Chair noted that General Industry Safety Order (GISO) Section 3706(a) requires a warning device (horn) for automotive trucks of one-half ton or more capacity which can be clearly heard for a distance of 200 feet from the vehicle. Section 3706(b) provides that vehicles operating where their backward movement would constitute a hazard to employees on foot, and where the operator’s vision is obstructed to the rear of the vehicle must comply with CSO Section 1592(b).

Section 1592(b) provides alternative methods to safeguard employees including the use of an automatic backup alarm but omits the 200 foot audible distance that is specified for certain capacity haulage/construction vehicles in CSO Section 1592(a) and TSO Section 8483(a)(3). Gerald Fulghum also pointed out that the Mine Safety Orders, Section 7010(i) requires haulage and other vehicles to comply with GISO sections that reference back to the CSO.

The committee reviewed a DAR that indicates with respect to CSO Section 1592(a) that the area of alarm audibility is not limited to the area directly behind the vehicle, but includes the area in all directions of the vehicle.

The committee discussed whether amendments should be made to existing standards. Mike Donlon stated that California has language in Title 8 that is clear, succinct and enforceable, and the Division feels that the existing language and provisions should remain the same as amendments would reduce the current level of safety in the standards. He felt that new technologies and products should be designed to meet the existing standards. Dave Harrison stated that he concurred with Mr. Donlon's comments.

Steven Wolfe stated that he felt there could be improvement in the applicable regulations (200 foot audible requirement) to better define the hazard zone, noting that one does not really need to hear an alarm in all directions. To define a hazard zone would reduce listening to unnecessary alarms for workers outside the danger zone. The regulation itself does not state the alarm must be audible in all directions but rather it is a legal interpretation by an Administrative Law Judge via DARs.

Patrick Bell stated that several comments had been made that the operator can see forward and to the sides of a vehicle while turning and backing up. The Division has been looking at various construction/haulage type equipment to evaluate the visual fields and "masking" or obstructed views that occur related to another issue pertaining to the use of diesel exhaust filters. Mr. Bell stated that on some vehicles/equipment, there are large areas of obstructed view to the side or front because of the configuration of the equipment or because of an attachment or implement on the equipment. The operator cannot always see a person standing next to or at the side of the equipment, particularly as the vehicle is backing. Mr. Bell said it would be erroneous to assume that the hazardous area can be defined in a specific area to the rear quadrant of the vehicle. Mike Donlon added that regardless of whether an alarm is BBS sound or tonal beeping, as the alarm gets louder, one can tell if the vehicle is coming toward you.

Mr. Morgan responded that the BBS alarm is more readily identifiable from the direction it is backing up and gave an example of an injury that occurred with a typical tonal beeping alarm when a worker assumed the alarm was coming from a vehicle he could see and was actually hit by another vehicle backing towards him. Mr. Morgan also made it clear he was not proposing to prohibit tonal beeping alarms; but rather, his concern is that the provisions that require 200 feet of audibility from (or around) the vehicle would seem to exclude the BBS alarm.

Tim Podue stated that he is not against the concept of the BBS sound. However, notwithstanding we did not hear the loudest alarm model, he was not impressed with the type of alarm sound emitted during the BBS demonstration earlier. He felt further performance information was needed specific

to their industry. He would be reluctant to change the regulations at this time with the variety of sounds and equipment on the waterfront.

The Chair stated that he felt the federal OSHA without a measureable distance of audibility specified in their standards would have difficulty enforcing their standards when the audibility of an alarm was too low for the surrounding noise levels. He felt the 200 feet distance behind the vehicle was a safe distance for warning and proposed consideration of language similar to that in the draft proposal that would specify the backup alarm be heard for a distance of 200 feet in the direction of the vehicle travel. However, Mike Donlon stated that that kind of language could be problematic because it could be inferred to mean a straight line behind the vehicle, and as the committee discussed earlier, it is necessary especially when vehicles and equipment are turning while backing up to have audibility to the sides and in the general vicinity of the vehicle. He noted that in the demonstration, the alarm sound was minimal to inaudible as the vehicle passes a person and for that reason, he had a concern about a person walking into the path of a backing vehicle from the sides.

Ron Meyers said that the 200 foot requirement allows the appropriate time to move out of the way for fast moving vehicles in tunnel operations. Gerald Fulghum commented on the speeds at which certain vehicles like motor graders can move and the significant blind spots for operators. Steven Wolfe and Michael Herges said that it seemed we could better define the hazard zone for backing equipment subject to the 200 foot audible distance requirements. The Chair noted several attempts to define the hazard area had received objections including, but not limited to, opinions that audibility to an extent at the sides, in the vicinity of, and toward the front of certain vehicles and equipment has merit and is afforded in the existing provisions. Further, the federal standards for back up alarms require that the warning sound be audible above the surrounding noise levels.

The Chair asked if there were any labor representatives who felt there was merit to proceeding with amendments related to the audible provisions for backup alarms. With no one responding, the Chair noted that there was not support for a proposal among ILWU, the Operating Engineers or the Laborers International Union. Marc MacDonald, Pacific Maritime Association (PMA) concurred with the labor comments and stated that it would take testing and further conclusive evaluation before PMA would be in a position to consider supporting amendments to the standards in question.

Mike Herron, Engineering & Utility Contractors Association, stated that as he understood the discussion, California may be unique in its requirement that the reversing alarm be audible for a distance of 200 feet. If California's accident experience is statistically similar to other states, then he concurred with PMA's comments and doubted the need for amendments. Gerald Fulghum pointed out comparing various state and federal jurisdiction accident records is problematic because California has more stringent accident reporting requirements than states that follow federal OSHA requirements. The Chair noted that the random selection of approximately 90 backup alarm accidents for a ten year period reviewed by the committee included 66 fatal accidents of which 6 were California accidents representing about 9 percent of the fatal accidents. With California representing slightly over 12 percent of the nation's population, it does not appear California exceeds typical accident numbers of other states.

Mr. Fulghum felt that the majority of the committee attendees did not feel the BBS demonstrated was effective or recognizable as a reversing alarm, and he had concerns that in the transition of

permitting the use of these alarms, we may be introducing new hazards associated with the directional attributes and audibility of these alarms.

Dave Harrison stated that the committee membership included maritime industry, construction and mining and tunneling stakeholders that were not convinced the BBS as demonstrated at the meeting provides warning equivalent to existing standards given the wide variety of job site conditions and the variety of operating equipment and machinery in those industries. Tim Podue stated that ILWU feels that alarms should meet existing California standards rather than making amendments to accommodate new technology.

The Chair stated that, given the lack of support for making amendments from the majority of stakeholder groups at the meeting including the Division and labor, there was not a consensus to proceed with rulemaking amendments. He noted that several members mentioned that the BBS alarms associated with the provisions in Section 1592(a) might be a good subject for an experimental variance.

The Chair indicated that his recommendation to the Board would be to conclude any further action relating to Petition No. 500. There being no further comments or questions, the Chair thanked the Petitioner and committee members for their attendance and participation and adjourned the meeting.