

State of California
Department of Industrial Relations
Memorandum

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OCCUPATIONAL SAFETY AND HEALTH
STANDARDS BOARD



To: Marley Hart, Executive Officer
Occupational Safety and Health Standards Board
2520 Venture Oaks Way, Suite 350
Sacramento, CA 95833

Date: November 4, 2015

From: Juliann Sum, Chief
Division of Occupational Safety and Health
Department of Industrial Relations

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Re: Petition No. 549 for amendment of Title 8 Sections 3424(c) and 4299(d)

1.0 INTRODUCTION AND BACKGROUND

On August 27, 2015, the Division of Occupational Safety and Health (Cal/OSHA) received a petition to change Title 8 California Code of Regulations from Jeff Buchanan (petitioner). Although the petitioner holds the title of president of Jeff Buchanan Enterprises, Inc., the petition was filed personally by Mr. Buchanan and not as a representative of Jeff Buchanan Enterprises, Inc.

The requested petition is for the introduction of new regulatory language within Title 8 sections 3424(c)(6) and 4299(d). Sections 3424 and 4299 contain requirements for the design, construction, use and maintenance of mobile equipment used for tree maintenance and removal and woodworking respectively. The following is an evaluation of the petitioner's request, and the Cal/OSHA's recommendations relevant to the progression of the petition to rule making.

2.0 REQUESTED PETITION

The petitioner is requesting a new regulatory requirement for brush and tree chippers under Title 8 sections 3424(c)(6) and Section 4299(d). These sections contain the requirement for tree and brush chippers equipped with a mechanical infeed system to have a quick stop and reversing device on the infeed in reach of the operator. The new language requested by the petitioner would include the additional requirement for tree and brush chippers to have a passive presence sensing device that will interrupt power to the infeed wheel and stop motion before the wheel may be contacted by the operator. Although no specific language for the proposed regulatory change was provided by the

petitioner in the initial petition, specific language was discussed with the petitioner during the August 3rd site visit described in Section 9.0 of this evaluation.

3.0 HAZARDS TO EMPLOYEES OPERATING BRUSH AND WOOD CHIPPERS

Hazards to employees operating brush chippers are well documented within the Cal/OSHA's investigative history. Injuries and deaths commonly occur when an employee is pulled into the equipment's infeed wheels after clothes or a climbing rope is caught on the material being fed into the infeed. Due to the high power of the hydraulic infeed wheels and chipping blades, serious or fatal injuries will likely occur in the event that an employee is pulled into the machine. Potential injuries include:

1. Amputations
2. Fractures
3. Crushing injuries
4. Contusions
5. Lacerations

4.0 EXISTING TITLE 8 REGULATIONS

*Title 8 CCR General Industry Safety Orders
Article 12. Tree Work, Maintenance or Removal
§3424 Mobile Equipment.*

* * * * *

(c) Brush Chippers.

* * * * *

(6) Each disk-type tree or brush chipper equipped with a mechanical infeed system shall have a quick stop and reversing device on the infeed. The activating lever for the quick stop and reversing device shall be located across the top, along each side of, and as close to the feed end of the infeed hopper as practicable and within easy reach of the operator.

*Title 8 CCR General Industry Safety Orders
Article 59. Woodworking Machines and Equipment
§4299 Brush and Slash Chippers.*

* * * * *

(d) Each disk-type chipper equipped with a mechanical infeed system shall have a quick stop and reversing device on the infeed. The activating lever for the quick stop and reversing device shall be located within easy reach of the operator.

5.0 APPLICABLE FEDERAL OSHA REGULATIONS

Federal OSHA addresses the guarding requirements for brush and tree chippers within Federal Code of Regulations for machine point of operation guarding under General Industry Safety Orders Subpart CC Section 1911.212. Federal OSHA does not have regulations specific to brush and tree chippers.

19210.212(a)(3)(ii) The point of operation of machines whose operation exposes an employee to injury, shall be guarded. The guarding device shall be in conformity with any appropriate standards therefor, or, in the absence of applicable specific standards, shall be so designed and constructed as to prevent the operator from having any part of his body in the danger zone during the operating cycle.

6.0 APPLICABLE CONSENSUS STANDARDS

The American National Standards Institute (ANSI) addresses the design construction and use of brush and tree chippers within ANSI Z133.1. Guarding of chippers with mechanical infeed systems is specifically covered under Section 5.3.5 of the 2006 edition of the standard.

ANSI Z133.1 - 2006

Section 5.3.5 Chippers equipped with a mechanical infeed system shall have a quick stop and reversing device on the infeed. The activating mechanism for the quick stop and reversing device shall be located across the top, along each side of, close to the feed end of the infeed hopper within easy reach of the worker.

The ANSI Z133.1 standard is not incorporated by reference within Title 8 Safety Orders.

7.0 PETITIONER'S OPERATIONS AND DESCRIPTION OF CHIPPERS AND CHIPSAFE SYSTEM

7.1 Petitioner's Operations

The petitioner is the president of Jeff Buchanan Enterprises, Inc. that contains, as a division, Jeff Buchanan Tree Service. This company provides tree trimming and removal services to industry as well as the general public. Additionally, the applicant, with his brother Mark Buchanan, currently hold three patents for ChipSafe™, a passive safety system that can be employed on brush and tree chippers. This system is described in Section 7.3 below. The petitioner has entered into an exclusive licensing agreement with Morbark, Inc. for the fabrication sale and installation of the ChipSafe™ system.

7.2 Brush and wood chippers

Brush and wood chippers are mobile pieces of equipment that reduce portions of brush and trees up to 20 inches in diameter to very small pieces (chips). Chippers are usually transported on an integral trailer and are comprised of three basic parts; an infeed, chipping blade and exit chute. An internal combustion engine provides power for the equipment's operation. The infeed system includes an infeed hopper and in-running



Figure 1. Stop and Reversing Bar

hydraulically powered infeed wheels. These wheels pull the wood to be processed into the equipment and feed it to drum or disk-type chipping blades which perform the work on the wood. The processed wood chips then exit through the exit chute.

Currently, Title 8 Safety Orders address the hazard of the in-running infeed wheels within paragraph 3424(c)(6) and Section 4299(d). These sections include requirements for a stop and reversing device for the mechanical infeed system. This device usually

takes the form of a metal bar that extends over the top of the infeed hopper. Figure 1 shows such a device installed on a Morbark, Inc. wood chipper. These bars have either three or four positions for controlling the forward and reverse motions as well as a stop and, on some models, a neutral function of the infeed wheels. In the event that an operator is caught and pulled into the infeed hopper, the bar is manually pushed to stop and reverse the infeed wheels.

7.3 ChipSafe™ System

The ChipSafe™ system is a passive presence sensing safety device (PSD) for wood and brush chippers that interrupts power to the mechanical infeed wheel of the equipment when the presence of the operator is detected. Figure 2 shows the ChipSafe™ system installed on a Morbark Beaver M15RX wood chipper. The two metal plates shown in the figure are sensors, referred to as



Figure 2. ChipSafe™ PSD Device

antennas, capable of detecting magnetic fields. Permanent magnets of varying sizes are incorporated into wearable accessories (Figure 3) including gloves, bracelets, anklets and shoe inserts that are worn by the chipper operator which are detected by the sensors.



Figure 3. Wearable Magnetic Accessories

When the sensors detect the presence of the magnetic field, a signal is sent to a processing unit which, in turn, disconnects power to the hydraulic pump of the mechanical infeed stopping the infeed wheels. The system also includes presence sensing device initiation (PSDI) in which an initiation sensor is required to be reset upon startup and whenever the system has been tripped. A magnetic accessory must be placed in close proximity to one of two PSDI sensors located on the lower

outside corners of the infeed hopper in order to reset the system and

reinitialize movement of the infeed wheels.

The ChipSafe™ system is adaptable for installation on most wood chippers equipped with a hydraulic infeed system either during fabrication or as an equipment retrofit. The total cost of the equipment is approximately \$3500 with an additional installation cost of approximately \$500. As indicated in subsection 7.1 of this evaluation, Morbark, Inc. holds the exclusive rights for fabrication, sale and installation of the ChipSafe™ system.

8.0 PETITIONER'S BASIS FOR NEW REGULATION

The petitioner asserts that the current Title 8 regulations regarding the safety of wood chippers are inadequate to protect employees from many preventable injuries. In support of his assertion, the petitioner references data collected from the Centers of Disease Control and Prevention (CDCP), the California Fatality Assessment and Control Evaluation (FACE) program statistics report and additional internet research. Based on this research, there were 31 fatal and 2042 nonfatal injuries to workers operating wood chippers reported to the CDCP from 1992 to 2002. Of the reported nonfatal injuries, 155 resulted in amputations. From 1992 to 2009, the California FACE statistics report indicates 73 fatal injuries resulting from wood chipper accidents and an additional 15 fatalities were identified from other internet sources by the petitioner related to wood chipping activities.

According to the petitioner, the occurrence of such accidents can be attributed primarily to the lack of adequate safety requirements for wood chipper mechanical infeed systems. Specifically, the petitioner argues that the current manual stop and reversing bar commonly employed to comply with Title 8 regulations does not effectively prevent injuries to employees. Drawing on his personal experience, the petitioner asserts that the bar often cannot be actuated effectively by an operator being pulled into the machine or by another worker before an injury occurs. The requirement for a passive device such as the ChipSafe™ system, he contends, would provide a superior level of safety as it does not require any action on the part of the worker for it to function.

Additionally, the petitioner believes that a passive presence sensing system such as ChipSafe™ would also prevent the hazard of workers accessing the infeed table of brush and wood chippers. Although expressly prohibited pursuant to Title 8 paragraph 3424(c)(8), the petitioner asserts that, based on his experience, workers commonly stand on infeed tables to manipulate or push material into the infeed wheels. This practice, he adds, is commonly performed so that the operator may use their feet to push material into the machine that has become stuck. Due to the available anklet and shoe insert accessories of the ChipSafe™ system, the petitioner contends that an added level of safety is introduced. If the anklet or shoe insert is worn, the infeed wheel will stop if the employee were to climb onto the infeed table and the ChipSafe™ system works properly. As with the control bar mentioned above, the petitioner argues that a passive presence sensing system removes the necessity for a worker to take any action for the system to function and remove the hazard.

9.0 ON-SITE EVALUATION OF THE CHIPSAFE™ SYSTEM

On August 3, 2015, an on-site evaluation of the ChipSafe™ system was conducted at a Morbark, Inc. facility located in San Gabriel, CA. Contact was made with the petitioner as well as representatives of Morbark, Inc. The functionality of the system was discussed with the petitioner as well as the specifics of what he wished to accomplish with the petition request. Measurements, photographs and videos were taken of the system components as well as the available wearable accessories and manufacturer's documentation was requested from Morbark, Inc.

A performance evaluation of the ChipSafe™ system was also conducted. The system was installed per the manufacturer's instructions on a Morbark Beaver M15RX wood chipper. The distance from the inner and outer edges of the two antennas installed on the right and left vertical hopper panels measured 10 and 24 inches from the infeed wheels respectively. This distance may vary, however, depending on the type of equipment subject to the installation.

The petitioner demonstrated the performance of the system with the chipper engine running and the infeed wheels moving at its highest operational speed. Wearing a magnetic glove accessory, the petitioner demonstrated the PSDI and PSD functions of

the equipment. Multiple performance tests were conducted at different approach speed and in different locations within the infeed hopper.

The effectiveness of the antennas to detect the glove accessory was observed to be primarily dependent on three factors:

1. Approach speed of the accessory.
2. Distance of the accessory from the antennas.
3. Distance of the accessory from the hopper panels.

Observations during the testing indicated that the ability of the antennas to detect the accessory is directly proportional to the approach speed and distance from the hopper panels and inversely proportional to the distance from the antennas. Therefore, the faster, closer to the hopper side panels and farther from the top and bottom panels the accessory was, the faster the system was observed to react. At very slow test speeds, especially near the top and bottom hopper panels, the antennas completely failed to detect the accessory allowing the infeed wheels to operate. A minimum threshold approach speed could not be effectively determined, however, due to the multiple variables involved in the PSD.

It was also not possible to determine a minimum safety distance as defined within Title 8 Section 4208 for the minimum placement of the sensing antennas of the ChipSafe™ system as a stopping time of the infeed wheels could not be effectively measured. The current available equipment (stop-time device) normally used for calculating the stopping time of a power operated press ram could not be applied to the operation of the chipper infeed wheels. However, the stopping time of the infeed wheels during testing was observed to be a fraction of a second once the system was tripped and no significant inertial movement of the wheels was observed.

10.0 ANALYSIS

10.1 Benefits of new proposed regulation

Cal/OSHA agrees that the requirement of a passive PSD such as the ChipSafe™ system has the potential to augment the safety of brush and tree chipping operations. Adoption of such regulation would not weaken any current Title 8 safety standards and the installation of this type of system would not interfere with the operation of any safety devices currently required. When properly used and maintained, a passive PSD system could provide an added layer of protection for employees working with brush and wood chippers.

Cal/OSHA also agrees that a passive PSD could prevent employees from engaging in dangerous activities such as accessing chipper infeed tables. Title 8 section 3424(c)(8) prohibits the placement of an employee's hands, arms, feet, legs, or any other part of the body on the feed table when the brush chipper is in operation or the rotor is turning.

This standard is, however, completely reliant on an employee's behavior to be effective. Since employees would most commonly access infeed tables to push material into the infeed wheels, a PSD system such as ChipSafe™, when used with the proper accessories described in subsection 6.3, could engineer out this hazardous activity by removing the benefit of an employee accessing the infeed table.

10.2 Limitations of the Chipsafe™ System

Although the ChipSafe™ system can provide additional safety for brush and wood chipping equipment, is not without limitations. As indicated in Section 8.0 of this evaluation, the ChipSafe™ system failed to function at slower approach speeds of the wearable magnetic accessories. The system was also less effective when the accessories were near the hopper panels and further from the antennas. Such limitations are to be expected, however, due to the physics of magnetic fields. The force experienced by anything that may be acted on by a magnetic field is directly proportional to the velocity at which the magnet or affected material is traveling. Therefore, the faster the magnetic accessory moves toward the sensors, the more force will be applied on them. The reduction in effectiveness of the sensors near the hopper walls of the chipper is related to the material of the hopper itself. Ferrous materials, such as the steel of the chipper infeed hoppers, weaken the magnetic fields by drawing them away from the permanent magnet as the steel itself becomes magnetized.

Another limitation of this system is that the behavioral element is not entirely eliminated. Although the system itself does not require any specific action by the user for it to function when the proper magnetic accessory are worn, it is still left up to the user to don the accessories. The magnetic accessories necessary for the system to function, may also become damaged or lost during loading and unloading, transport and use. This would be of particular concern if a lost or damaged accessory was not discovered in the field as it would be unlikely that the workers would return to their facility to obtain the proper system accessories before starting the work. In such a situation, a false sense of security could be created by PSD systems such as ChipSafe™.

10.3 Challenges of new proposed regulation

The most prominent disadvantage of this petition is the limited market availability of the PSD system that will be required by the regulation. Although other patents have been issued for similar safety systems, ChipSafe™ is currently the only PSD system that would comply with the proposed regulation for brush and wood chippers. In concert with petitioner holding the patents for the ChipSafe™ system and an exclusive licensing agreement with a single manufacturer, endorsing the very specific regulatory language proposed by the petitioner could be perceived as an arbitrary Cal/OSHA endorsement of and requirement to use the ChipSafe™ system.

11.0 Conclusion

Cal/OSHA has reviewed the pertinent information regarding the petition for the requirement of a passive PSD system for brush and wood chippers to be included within Title 8 Sections 3424(c) and 4299(d). This included information provided by the petitioner as to what would be accomplished by the petition, how a passive PSD system could be employed on wood chipping equipment and the benefit new regulation would provide for employee safety. Manufacturer's specifications, installation and operating procedures of the ChipSafe™ PSD system were also reviewed and operational testing was conducted on chippers equipped with the ChipSafe™ system. Additionally, extensive research was conducted regarding the availability of similar PSD safety systems from other manufacturers for brush and wood chippers.

The requirement for a passive PSD system for brush and wood chippers has the potential to enhance employee safety during chipping operations. However, due to the specific regulatory language requested by the petitioner and the lack of availability of other similar PSD systems for chipping equipment, such a regulation would likely compel all employers who use wood chippers to purchase the petitioner's product. Cal/OSHA recommends that the Occupational Safety and Health Standards Board consider the benefits and disadvantages of amending sections 3424 and 4299. The safety and economic issues are best addressed through the advisory committee process. The advisory committee should consist of representatives from manufacturers of wood chippers, manufacturers of wood chipper safety devices, employer's who use wood chippers, employees who use wood chippers, relevant employee representatives and labor unions, occupational safety professionals, and relevant government agencies.