

OCCUPATIONAL SAFETY AND HEALTH  
STANDARD BOARD

PETITION FILE NO. 575

BOARD STAFF EVALUATION

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### **INTRODUCTION**

Petition File No. 575 (Petition) was submitted by Nathan Heit and Charles Megivern, Ski Patrol Managers, on behalf of Mammoth Mountain Ski Area, LLC. (Petitioners) on April 17, 2019. The Petition seeks to amend Title 8, General Industry Safety Orders, Section 5357(a), regarding snow avalanche blasting, to allow remote control deployment of avalanche charges (explosives), also known as Remote Avalanche Control Systems (RACS).

### **REQUESTED ACTION**

The Petitioners request consideration of the following changes to Section 5357 “Snow Avalanche Control Blasting” (additions are underlined, deletions in ~~striketrough~~):

(a) General Requirements.

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(4) Charges shall be placed, dropped, tethered, thrown or propelled to the desired location from a safe position by one of the following methods:

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(E) Deployed from such remote control devices accepted by the Division as providing equivalent safety ~~to the remote control devices allowed under subsection (e).~~

### **PETITIONERS’ ASSERTIONS**

The Petitioners assert the following:

- Explosive use for avalanche mitigation is constantly progressing due to improvements in the science of avalanche phenomena, initiation, and forecasting.
- Explosives deployed a meter above the surface have been shown to be more effective for avalanche mitigation than explosives on the snow surface.
- Remote Avalanche Control Systems (RACS) have been developed to achieve a blast at about one meter above the snow surface. An Aerial Blasting Ropeway and other explosive tram devices allow users to drop or tether charges to achieve such blasts.
- RACS are inherently safer because they reduce worker exposure to explosive blasts and adverse weather conditions.
- Due to the large capital investment requirements of RACS, users need a clear regulatory path forward to adopt.

## **STAFF EVALUATION**

### **Relevant Standards**

#### **Federal Standards**

- Federal OSHA 29 CFR 1910.109 “Explosives and blasting agents” – Provides requirements for the storage, transport, preparation, and use of explosives, as well as definitions and general provisions for various types of explosives. The standard does not address the use of explosives for avalanche control specifically, and would not prohibit a rulemaking effort based upon the Petitioners’ request.
- Bureau of Alcohol, Tobacco, Firearms, and Explosives, 27 CFR 555 “Commerce in Explosives” – Provides requirements for licenses, permits, and the conduct of business relating to commerce in explosives. The standard does not address the use of explosives for avalanche control specifically, and would not prohibit a rulemaking effort based upon the Petitioners’ request.
- Organized Crime Control Act of 1970. Title 18 USC, Section 1102, Chapter 40 “Importation, Manufacture, Distribution, and Storage of Explosive Materials” – Provides requirements for permitting, licensing, distribution, and inventory control of explosives. The standard does not address the use of explosives for avalanche control specifically, and would not prohibit a rulemaking effort based upon the Petitioners’ request.

#### **California Standards**

Title 8 Article 121 “Snow Avalanche Blasting” provides requirements for avalanche mitigation in California. Section 5357 “Snow Avalanche Control Blasting” discusses requirements for using explosive charges to mitigate avalanche hazards. Although the section does not explicitly prohibit RACS, existing regulations do not adequately address the potential hazards, nor govern the methodology, of using RACS to control avalanche hazards, as discussed below.

#### **Consensus Standards**

Staff is unable to locate a broad-scoped consensus standard governing the use of explosives in avalanche mitigation; however, several professional organizations exist that offer guidelines and best practices.

- American Avalanche Association (A3) – A3 is a nonprofit organization that works to provide avalanche safety, education, and research in the United States.
- Association of Professional Patrollers (APP) – The APP offers certifications through testing on topics such as Avalanche Rescue, Avalanche Science and Evaluation, and Explosives Used in Avalanche Control.
- Orica Explosives Guide – Orica is an explosives manufacturer that worked with the ski industry to produce a guide entitled “Recommended Safe Working Practices.” The

guide provides detailed information on explosives and equipment used in avalanche mitigation, including recommended best practices for the blasting team. The guide is in harmony with California requirements for avalanche mitigation.

### **Position of Division**

The Division evaluation, dated July 19, 2019, states that “The use of RACS is inherently safer than hand-deploying explosives as the worker is positioned away from the proximity of an explosive blast and the path of the resultant avalanche.” The Division recommends “that an advisory committee be convened to consider appropriate and specific regulations to ensure employee safety for the various types of RACS.”

### **Analysis**

RACS come in a variety of forms and are currently used in areas throughout the world where avalanche hazards are present. Currently Gazex, a technology which utilizes flammable gas to create an explosion, appears to be the most commonly used form of RACS in the western United States, including in California.

A Gazex system can be installed above an avalanche prone area on a mountainside and remotely activated several times throughout an avalanche season without the need to restock the gas (See Figure 1). Instead of explosives, Gazex ignites a mixture of oxygen and propane, stored in cylinders in the cement bunker at the base of the exhaust piping, to create a shockwave to displace avalanche-prone snow. Gazex is currently used by the State Departments of Transportation in Wyoming, Colorado, and California.

A second type of RACS is the Catex system, which relies on the cables of a ski lift conveyor to transport explosives to avalanche prone areas. The conveyor can be dedicated to the transport of explosives, covering several miles of terrain and delivering several charges to be detonated simultaneously. The system can also lower charges to be at a specified distance from the snow’s surface. Catex is primarily used in Europe.

A third type is an avalanche tower (See Figure 2), which is a cross between the Gazex and Catex systems. The tower is in a fixed position similar to the Gazex system, but it lowers an explosive charge to a specified distance above the surface of the snow for detonation similar to the Catex system. The tower can hold multiple charges and can be remotely activated. Avalanche tower technology is also primarily used in European countries.

Each of the RACS has the potential benefit of being remotely activated without the need to expose employees to the hazards of winter weather or explosive charges. Restocking can be done under favorable conditions. Disadvantages of the technologies can include the security of the stored charges, difficulty in placing the avalanche towers over avalanche prone areas, and the potential for cables to slip off of the pulley system due to ice buildup.



**Figure 1. A Gazex system in Colorado. Cylinders of oxygen and propane are stored in the cement bunker at the base of the exhaust piping. The gases are ignited and the resulting shockwave is directed over the top of the snow in avalanche-prone areas.**

Although Section 5357 does not specifically address RACS, some of the existing language could be confusing if applied to the RACS mentioned above. For instance, subsection 5357(a)(4) says that “Charges shall be placed, thrown or propelled to the desired location from a safe position by one of the following methods...” The words “placed, thrown, or propelled” more appropriately apply to hand charges and avalaunchers (a cannon used to fire charges to inaccessible areas of a mountain). Words such as “dropped” or “tethered” are more accurate for deploying charges using RACS.

Subsection 5357(a)(4)(B) says that charges can be “Deployed from a ski lift or tram...” but only if “there is no safe approach to the desired location from the ground.” The regulatory language for deploying charges from a ski lift or tram only addresses “thrown” charges (see 5357(c) “Handcharges deployed from ski lifts or trams”) and presumably envisions a blasting crew member riding on the lift and throwing charges from a seated position. The existing language is silent on charges deployed from a ski lift or tram by any means other than “throwing”.

Because of the potential increase in employee safety, as stated earlier, the use of RACS technology to mitigate avalanche hazards merits further consideration. Therefore, staff believes an advisory committee should be convened to discuss the necessary amendments to Section 5357 and other sections as needed to ensure that RACS can be used safely in California. The committee should discuss

potential hazards and concerns of the various types of RACS and develop methodologies to control them.



**Figure 2: The avalanche tower can be remotely activated to lower a charge to a specified height above the snow. The deployment box can be stocked with multiple charges, obviating the need for restocking during the avalanche season.**

OSHSB Petition File No. 575

Board Staff Review, August 1, 2019

**STAFF RECOMMENDATION**

Board staff recommends Petition File No. 575 be conditionally Granted, such that an advisory committee be convened to discuss safety measures and standards necessary to ensure the safe use of RACS in California. The Petitioner should be extended an invitation to participate in the advisory committee deliberations.