

David Thomas, Board Chair
Occupational Safety & Health Standards Board
2520 Venture Oaks Way, Suite 350
Sacramento, CA 95833

Re: Petition for Updated Regulations Related to Operation of Agricultural Equipment

Dear Chairman Thomas:

Monarch Tractor respectfully submits this petition for the promulgation of a Department of Industrial Relations regulation that will update Title 8, Section 3441(b) to allow for the use of driver optional tractors without a human operator stationed at the vehicular controls within a strict set of safety guidelines.

Monarch Tractor is the world's first fully electric, driver-optional, smart tractor. It enhances farmers' existing operations and improves farm worker efficiency to help alleviate labor shortages and maximize yields. By enabling precise and emissions free 24/7 farm operations, Monarch Tractor is advancing wide scale implementation of regenerative, sustainable and organic agriculture. Monarch is committed to elevating farming practices to support safe, clean, efficient, and economically viable solutions for today's farmers and the generations of farmers to come.

I. Safety Benefits of Driver-Optional Machinery

Autonomous and driver-optional machinery provides a multitude of benefits for the agriculture industry, including improved air quality, sustainability and food quality. One of the most tangible and significant benefits, however, is improved farm worker safety.

According to the Bureau of Labor Statistics, agriculture is the deadliest profession in the United States and in the State of California with roughly 40% more deaths per 100,000 workers than any other industry [[Fatal Occupational Injuries in California 2013-2019 \(CFOI\) Report](#), Pg. 18]. Tractor accidents are a leading cause of serious injury, accounting for about one-third of farm fatalities annually. The majority of tractor fatalities are from side or rear rollovers that can occur due to a range of factors including improper weight distribution, user error, and bad terrain conditions. Rollovers can happen to any operator; roughly 80% of fatalities involve experienced operators [[NASD Tractor Overturn Information](#)]. Autonomous operation removes the possibility for human error and harm to tractor drivers, and also allows farm workers to avoid fields when chemicals are sprayed, significantly reducing - if not eliminating - employee exposure to dangerous chemicals.

Operation of autonomous tractors in agriculture can be easily understood and standardized. Operations occur at low speed, in linear direction, and in controlled and fixed locations. Still, Monarch Tractor proposes the inclusion of a number of additional safety enhancements and assurances, including anti-rollover control, collision prevention, and fail safes at every level of operation. If the tractor ever encounters an unfamiliar situation, it simply stops and calls for assistance.

II. Current Regulation is Outdated, Creates Ambiguity

The regulation governing the operation of agricultural equipment, specifically Title 8, Section 3441(b) (included below for reference), does not take into account ongoing technology advances in tractors and other farm machinery. This specific section of Title 8 regulation dates back to the 1970's and has not been altered in the fifty or so years since it entered into law. Furrow-guided driverless tractors were the primary type of automatic equipment that were in use when this regulation was first instituted. Without an operator stationed on the furrow-guided tractor, humans within the equipment's path were at risk of injury or death because the equipment had no way to detect them or stop itself. For more information on the danger of furrow-guided driverless tractors, see here: [[Raven, Kimberly D.: Driverless Tractors: A Matter of Life or Death - San Joaquin Agricultural Law Review vol. 11:67 2001](#)].

With today's highly advanced autonomy technologies, driverless tractors are an entirely different machine from their twentieth and early twenty first-century counterparts. Now, the driverless features of tractors and agricultural equipment are powered by sensors, computers, and advanced artificial intelligence. All Monarch tractors are equipped with Real Time Kinematic (RTK) GPS systems and 8 cameras that provide key data for navigation and safety. Additionally, Monarch's tractors feature AI safety guard rails that deploy whenever a human is within 7 feet. When the guard rails are triggered all movement and operations cease until the human is out of the safety zone. This feature completely eliminates the risk of farmworkers being injured if they fall into the tractor's path or slip when mounting or dismounting.

Unlike their mechanical counterparts from the previous century, today's driverless tractors present many advantages to growers and farmworkers alike. They're more efficient, incredibly precise, and perhaps most important of all: safe.

Regulation as it appears in DIR code today:

Title 8, Section 3441(b) (<https://www.dir.ca.gov/title8/3441.html>)

(b) All self-propelled equipment shall, when under its own power and in motion, have an operator stationed at the vehicular controls. This shall not prohibit the operator occupying or being stationed at a location on the vehicle other than the normal driving position or cab if

controls for starting, accelerating, decelerating and stopping are provided adjacent and convenient to the alternate position. If the machine requires steering other than ground or furrow steering or operates at ground speeds in excess of two miles per hour, steering controls shall also be provided at the alternate location. Seedling planters and other similar equipment traveling at a speed of two miles an hour or less where a control that will immediately stop the machine is located at the operator's workstation will satisfy this requirement.

(1) Furrow guided self-propelled mobile equipment may be operated by an operator not on the equipment provided that all of the following are complied with:

(A) The operator has a good view of the course of travel of the equipment and any employees in the immediate vicinity.

(B) The steering controls, when provided, and the brake and throttle controls are extended within easy reach of the operator's station.

(C) The operator is not over 10 feet away from such controls and does not have to climb over or onto the equipment or other obstacles to operate the controls.

(D) The equipment is not traveling at over two miles per hour ground speed.

As currently written, the regulation calls for an operator to be stationed at the vehicular controls for all self-propelled equipment. With automated technology rapidly advancing and increasingly used across a number of applications and sectors, a wide array of sensors, telematics and sophisticated software functions as the “operator” of self-propelled equipment. This equipment has the ability to safely operate without a human operator physically stationed on or in the equipment. It is unclear whether autonomous software operating automated machinery meets the operator standard, which has created confusion and ambiguity throughout the farming industry and among machinery manufacturers who are already deploying advanced technologies.

The ambiguity and out of date language in the regulation, which has not kept up with advancements in technology, has resulted in the industry interpreting the regulations differently. To the best of our knowledge, only Monarch Tractor has successfully been issued an experimental temporary variance allowing them to operate in a driver-optional mode, but there are a number of others in the industry that are testing or deploying in the state. The combination of the regulation being ambiguous, the labor shortage, and growing demand for alternate solutions has increased the utilization of autonomous and semi-autonomous technologies by growers in order to carry out farming functions, including pesticide spraying and other potentially hazardous operations. With demand for the technology high and the market moving fast, today’s regulations need to catch up quickly.

A regulation change will also place California farmers on an even playing field compared to their counterparts in other states. Farmers in other states are easily deploying these technologies at a fast pace, in part, because they have no regulatory or statutory barriers. Other states and the federal government are silent on this issue, and we strongly believe that California can successfully and swiftly update their regulations in a manner that balances worker safety and support for innovative technologies.

III. Temporary Experimental Variance Creates Pathway for Updated Regulation

The Division of Occupational Safety and Health (Division) has the ability to grant temporary variances from a Title 8 order to allow for the demonstration or validation of new techniques, and it recently granted an experimental variance associated with Section 3441(b) allowing Wente and Crocker & Starr vineyards to operate driver-optional farm machinery in their vineyards.

The Division and Monarch Tractor worked collaboratively to develop the variance for nearly two years to ensure the necessary safeguards were in place that would allow autonomous electric tractors to safely operate. The temporary experimental variance includes extensive data collection and oversight by the Division, along with a deliberate, multi-step process that must occur before machinery may be operated without a human present.

The main steps of the temporary experimental variance include:

- Stage 1 -- zero to 500 hours or one year of operation of the tractor technology with an operator on the tractor at all times, allowing for advancement to Stage 2 only if there are no close calls, incidents, injuries, or accidents and CalOSHA is satisfied with the data;
- Stage 2 -- an additional 500 hours of operation of the tractor technology and operation during all four seasons (summer, fall, winter, spring) without an operator on the tractor so long as there is a video feed from the tractor to an onsite remote operator, that operator is alerted whenever the tractor detects an obstacle, the operator and the technology meet additional enumerated requirements, there are no close calls, incidents, injuries, or accidents and CalOSHA is satisfied with the data;
- Stage 3 -- autonomous operation allowed with video feed available at all times to an onsite remote operator and applicant reports information on any injuries, incidents, close calls, and data on certain conditions is regularly reported.

The variance also contains robust requirements on the type of functionality and technology the tractors must have, including for example: Real Time Kinematic Global Position Systems, 8 cameras, a Deep Learning Neural Networks computer, emergency stop buttons, audible and visible warning systems, breaking standards, speed limits, lights, detection avoidance systems and training requirements. These standards are extremely comprehensive and exhaustive,

creating a pathway that is currently testing the viability and safety of the technology in a robust manner.

While the variance process is still underway, the technology is performing extremely well and meeting the standards developed by the Division in the variance. To date, the technology has operated 760 hours with zero incidents of any kind, while displacing approximately 16.6 tons of CO2 emissions.

The two years of work that went into developing the variance standards and the performance of the technology during the variance process provides a foundation for approval of the regulation proposed herein. In other words, we recommend that approval of the regulation occur if the technology meets the lengthy and comprehensive variance process.

IV. Incorporating Enhanced Safety Guidelines

As part of a regulatory update, including changes to Section 3441(b), Monarch Tractor recommends the Division consider other safety measures to maximize farm worker protections and public safety. In particular, the temporary experimental variance contains a number of safety precautions that could be mirrored if the Board deems it necessary. Some examples include:

- Posted signs, visible from 50 feet during daytime or nighttime, at the entry and exit of every field where autonomous technologies are deployed, reading “Driver Optional Vehicle in Use”
- Limits on tractor speed during autonomous use, below 5 mph during operations and below 10 mph on private roads connecting fields
- Manufacturer-provided digital training, accessible to all employees
- ISO recommendations:
 - The driver-optional vehicle shall be provided with a perception system capable of detecting and locating persons or other obstacles relative to the machine;
 - The driver-optional machinery shall be provided with a perception system capable of locating and positioning the driver-optional machinery as required for the operations involved while preventing unintended excursions beyond the boundary of the working area;
 - Before each movement of the driver-optional machinery, it shall be ensured, by the safeguarding system, that there is no obstacle in the hazard zone;
 - While performing highly automated operations, the driver-optional machinery shall, when an obstacle is detected in or enters the hazard zone, give an audible or visual alarm and enter its defined safe state;
 - The driver-optional machinery shall be provided with the means to enable a local or remote operator to stop or start highly automated operation; and

- The driver-optional machinery shall allow adequate supervision by a local or remote operator.

V. Proposed Regulation

Based on the foregoing discussion, the proposed regulation could provide an exception to Title 8, section 3441(b) as follows:

Notwithstanding section 3441(b), self-propelled equipment is not required to have an operator onboard the vehicle when the following conditions are met:

- *The manufacturer certifies that the technology has gone through appropriate safety protocols in the following: Product development; Monitoring and testing of the technology; and the technology meets the operational requirements of the three stages listed below:*
 - Stage 1 -- zero to 500 hours or one year of operation of the tractor technology with an operator on the tractor at all times, allowing for advancement to Stage 2 only if there are no close calls, incidents, injuries, or accidents;
 - Stage 2 -- an additional 500 hours of operation of the tractor technology and operation during all four seasons (summer, fall, winter, spring) without an operator on the tractor so long as an onsite remote operator was alerted whenever the tractor detects an obstacle, allowing for advancement only if there are no close calls, incidents, injuries, or accidents.
- *There are posted signs, visible from 50 feet during daytime or nighttime, at the entry and exit of every site where autonomous technologies are deployed, reading “Driver Optional Vehicle in Use”;*
- *The driver-optional vehicle shall be provided with a perception system capable of detecting and locating persons or other obstacles relative to the machine;*
- *The driver-optional machinery shall be provided with a system capable of locating and positioning the driver-optional machinery as required for the operations involved while preventing unintended excursions beyond the boundary of the working area;*
- *Emergency stop buttons shall be affixed at the outermost perimeter on both sides and the rear of the tractor, depressing the emergency stop buttons shall immediately initiate braking to stop the tractor; and*
- *The tractors shall come to a full stop before any human encroaches a 7-foot radius from the tractor, and the 7-foot clearance applies regardless of the agricultural operation or the implements attached to the tractor.*

VI. Continuing to Collaborate to Advance Safety and Sustainability



12/15/21

Monarch Tractor is fully committed to providing the safest and most technologically advanced products possible, and appreciates the Division's ongoing collaboration toward these objectives. By modifying this regulation, the Division and California will enable technologies to be deployed that will improve farm worker safety, support the agricultural economy, reduce emissions and promote sustainable farming practices.

We look forward to our ongoing collaboration to support the development of updated regulations. Please let us know if you have any questions or concerns regarding this request, or would like to work with our in-house experts to address any questions about the technology, its operation, or benefits.

Thank you in advance for your consideration and please feel free to contact me if I can be of any assistance.

Sincerely,

A handwritten signature in black ink, appearing to read "P. Penmetsa", with a stylized flourish extending to the right.

Praveen Penmetsa
CEO Monarch Tractor