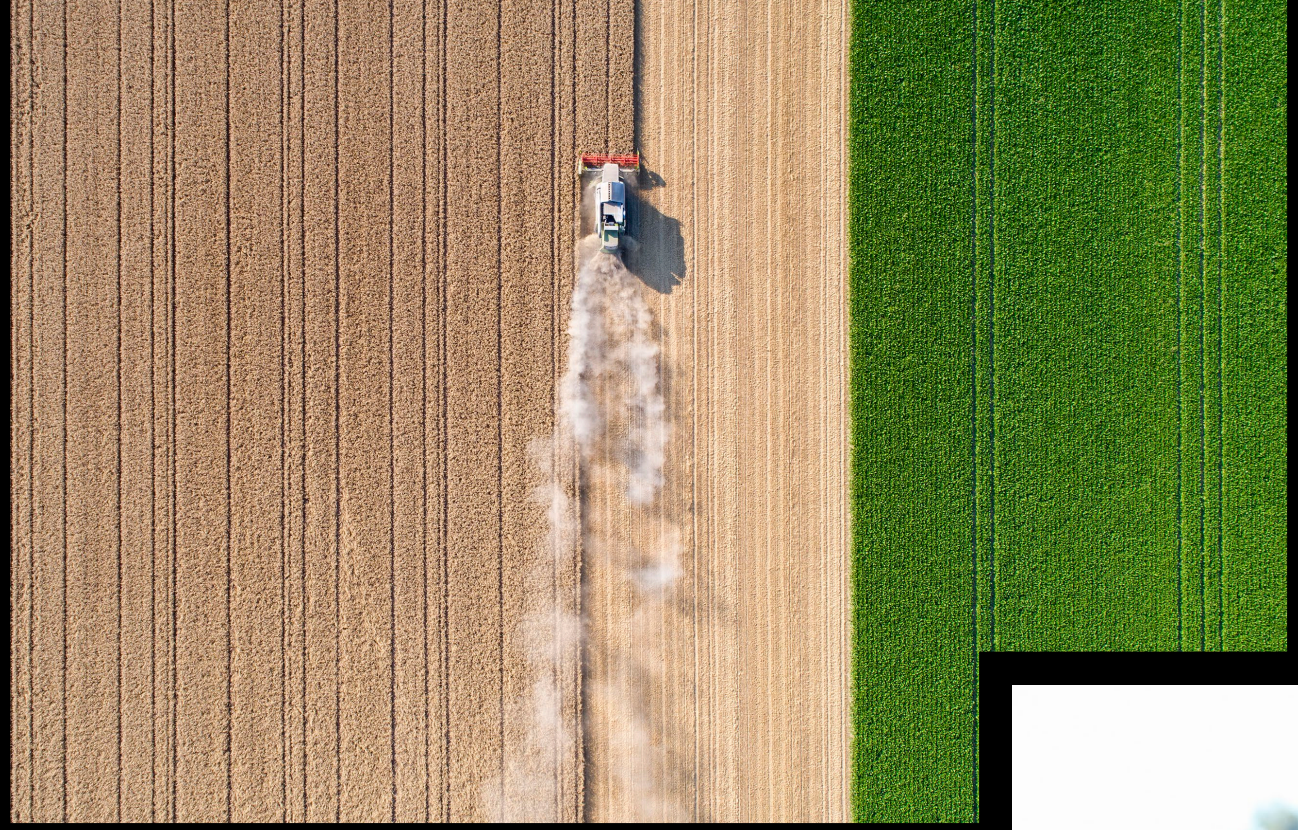
DPR's Approach to Emerging Technologies

Emily Bryson
Senior Environmental Scientist
Worker Health and Safety
emily.bryson@cdpr.ca.gov

DPR REGULATES ALL ASPECTS OF PESTICIDES:

- SALES & USE
- LICENSING
- REGISTRATION
- HUMAN HEALTH & SAFETY
- ENVIRONMENTAL IMPACTS
- PROMOTING IPM & SPM
- RESIDUE ON FOOD



- Predominantly department of scientists
- Historically, DPR has not regulated pesticide application equipment (with some exceptions)

- We regulate person(s) on and around equipment and pesticides coming out of it
- However, when AI makes decisions about how, where and what to apply, our jobs get a bit more complicated

Emerging Technologies Workgroup

- Established in 2021
- Platform agnostic
- Solo and swarm uncrewed aerial vehicles (UAVs)
- Self-driving and retrofitted tractors
- Fully autonomous ground rigs
- Targeted application technologies

Equipment examples are not to be construed as either an actual or implied endorsement

UC DAVIS
BIOLOGICAL AND AGRICULTURAL ENGINEERING

- Ken Giles
- Alireza Pourreza
- Stavros Vougioukas
- Farzaneh Khorsandi

UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources

- Gabe Youtsey
- Peter Ako Larbi

VERMONT
AGENCY OF AGRICULTURE, FOOD & MARKETS

- Zach Szczukowski

California Department of Pesticide Regulation

- Emily Bryson
- Alfonso Garcia
- John Inouye
- Ian Reeve
- Don Antonowich
- Colin Brown
- Maziar Kandelous
- Jessica Teague
- Alexis Cugini
- Leslie Talpasanu
- Brian Ingel
- Sapna Thottathil

Department of Industrial Relations
STATE OF CALIFORNIA

- Yancy Yap
- David Hornung
- Amalia Neidhardt

cdfa

- Nilan Watmore

UC DAVIS
DEPARTMENT OF PLANT SCIENCES

- Steven Fennimore

UCMERCED

- Leigh Bernacchi

Structure

- Information gathering and roundtable discussions
- Guest speakers and demonstrations of emerging technologies
- Review of current and emerging regulations at state and federal level
- Inclusion of other regulatory agencies to share resources and connections
- Participation in US EPA's AgTech workgroups and advisory board for UAVs
- Branch-specific topics for DPR representatives

Licensing of Remote Operators	Evaluation of Current Regulations	Proposal of Future Regulations	Worker and Bystander Safety
Evaluation of Label Language	Technology Coming Down Pipeline	Environmental Concerns	Risk Assessment Process

Topics of Discussion

- Capabilities and limitations of equipment
  - Drift prevention
  - Emergency shutoff
  - Connection to remote operator (Wi-Fi? Cellular? Bluetooth? Satellite?)
- Assigning liability
- Applicability of current regulations, label language and licensing
- Understanding DPR’s regulatory authority
- Providing information to equipment manufacturers
- Workgroup member recommendations

Capabilities and Limitations Findings

Initial concern that many fields wouldn't have reliable Wi-Fi or Bluetooth connection and about potential lag time with satellite connections

- How reliable is connection and what happens if it's dropped? If it relies on satellite connection, how does lag time affect drift potential?

Every piece of equipment we've looked into has reliable connectivity (e.g., multiple layers of connectivity) to remote operator*

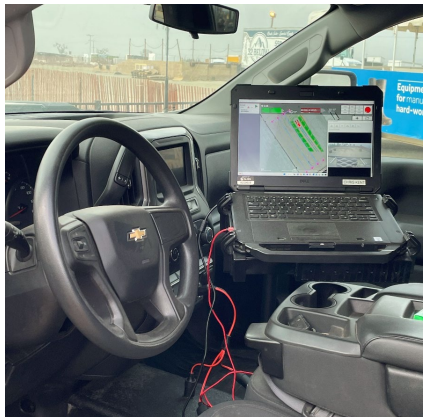
Most use Starlink satellites - utilize many low Earth orbit satellites (versus traditional satellite systems that rely on geostationary satellites) that respond in fraction of second when obstacle is encountered - equipment shuts off (moving and spraying) and remote operator is alerted and must prompt to continue

California's Sustainable Pest Management Roadmap and Emerging Technologies

By 2050, CA pest management approaches in both ag. and urban contexts will promote human health and safety, ecosystem resilience, ag. sustainability, community wellbeing and economic vitality

Implementation of these approaches will help steward CA's natural and cultural resources, enabling healthy lives for all and an abundant, healthy food supply for future generations

Primary goals by 2050	Eliminate use of priority pesticides when effective alternative product(s) or practice(s) are available (selected on basis of adverse human health effects and environmental impacts) by transitioning to sustainable pest management practices
	Ensure sustainable pest management has been adopted as de facto pest management system in CA



Targeted Application

- Equipment agnostic
- AI, computer vision, other components identify and specifically target pest(s) (e.g., weeds)
- “Right place, right time, right rate”
- Standalone or components can be retrofitted onto existing machinery
- Currently aimed toward postemergence weed control
- Drastically reduces the overall amount of pesticide(s) used during application
- Targeted applications have historically been done with backpack sprayers

Verdant Robotics

- Uses 68-96% less pesticides*
- Sprays with mm accuracy & precision based on 4D models of crops created in real-time
- Also includes laser weeding system for non-chemical weeding
- Robotics-as-a-service

*Based on information provided by the manufacturer

Equipment examples are not to be construed as either an actual or implied endorsement

Solinftec Solix

- Fully autonomous robotic targeted applicator
- Continuously scouts field to identify weeds in early growth stage
- Up to 95% reduction in herbicide application*
- Also developing tech to attract specific pest insects and utilize electroshocks in lieu of insecticides

*Based on information provided by the manufacturer

Equipment examples are not to be construed as either an actual or implied endorsement

What are Airblast Sprayers?

- Air delivery or airblast sprayers are used to apply pesticides, plant growth regulators and foliar nutrients to orchards and vineyard crops
- Apply materials as liquids carried in large volumes of air up above tree canopy

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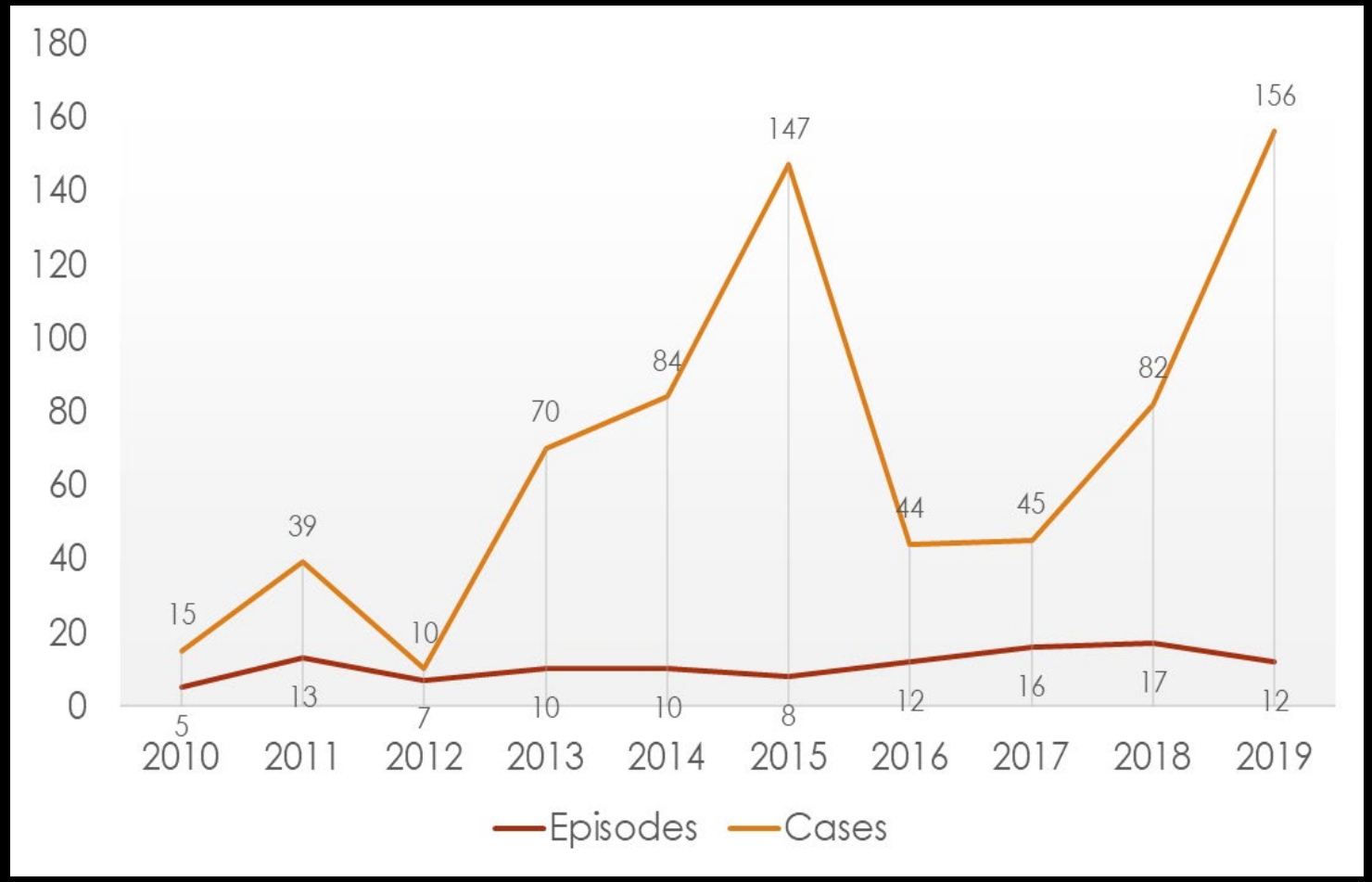
PISP Data: Illnesses Involving Airblast Sprayers, 2010-2019



N=110 episodes resulting in 692 exposure cases

Case Study: Tulare County (2014)

- Four crews (70 fieldworkers total) were harvesting in orchard when some workers smelled strong odor and developed symptoms
- Airblast application was taking place in adjacent orchard roughly 55 feet away
- Applicator was unaware fieldworkers were in neighboring orchard and stopped application when informed of their presence
- Of the 70 workers, 28 became ill and sought care

GUSS + Smart Apply

- LiDAR senses foliage and activates individual nozzles
- 50% average pesticide reduction by sensing presence of trees and vines and adjusting spray volume*
- Up to 87% less drift*
- Use combination of GPS, LiDAR, vehicle sensors, and software to move through orchards without onboard operator

*Technology and research from USDA ARS and various universities

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John Deere Autonomous 5ML Orchard Tractor for Air Blast Spraying

- Autonomy kit with added Lidar sensors for dense orchard canopies
- LIDAR sensors used to detect obstacles and drive down row while flagging humans, pipes, or other objects
- Can optionally use Smart Apply System for precision application, data collection, and analytics

Equipment examples are not to be construed as either an actual or implied endorsement

Pesticide Alternatives

- Carbon Robotics Laser Weeder
- Weed control system that uses lasers to target and eliminate weeds
- Equipment can attach to back of tractor or autonomous tractor kit can be purchased to retrofit existing tractor and make it driverless
- Uses AI and computer vision to identify, target and eliminate weeds with precision in lieu of herbicides and hand weeding
- No suitable biological herbicide candidates

Equipment examples are not to be construed as either an actual or implied endorsement

Pesticide Alternatives

- Automated weeders produced by number of companies including, but not limited to FarmWise, Stout, Naio
- Used in lieu of herbicides and hand-weeding
- Utilize mechanized blades or “finger weeders”
- Removes workers from occupational hazards related to pesticide exposure

Equipment examples are not to be construed as either an actual or implied endorsement

Pesticide Alternatives

- Steam systems and injectors
- Replace herbicides , fumigants and fungicides with steam to kill weeds, pests, soilborne pathogens, fungi and spores
- Used in number of settings, including ag
- Gaining popularity in schools and public parks/playgrounds, which have more restrictions on pesticide applications and more pressure to move away from common herbicides, like glyphosate (Roundup)

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Important Factors to Keep in Mind as we Assess New Technologies

- CA has strictest drift regulations in the country
- Individuals applying via emerging technologies need to obtain DPR licensure
- CA has most robust pesticide illness surveillance in the country
- No pesticide-related incidents to date in CA

California Licensed Applicators

as of January 2025

Certificate Type	Number Certified (Jan 2025)
Manned Apprentice	108
Manned Journeyman	208
Unmanned Apprentice	89
Unmanned Journeyman	17
Vector Control Technician (Unmanned)	49
Total	**480**

Both Manned and Unmanned license holders can currently apply via UAV

6614. Protection of Persons, Animals, and Property

Applicator prior to and while applying shall evaluate equipment, meteorological conditions, property to be treated, and surrounding properties to determine likelihood of harm or damage

No pesticide application shall be made or continued when there is reasonable possibility of:

Contamination of bodies or clothing of persons not involved in application

Damage to nontarget crops, animals, or other public or private property; or

Contamination of nontarget public or private property, including creation of health hazard on adjoining property

Application Exclusion Zones

Workers:

Responsibility of employer to keep workers out application exclusion zones

Handlers:

Applicator's responsibility to not apply pesticides in a manner that results in contact with persons not involved in application process

Current CA Regulations:

CCR §6614 already requires applicators to halt application when there is potential for exposure to persons

Application Exclusion Zones

Title 3 CCR §6762(c)

When pesticides are used for commercial or research production of ag. commodity, no employer shall direct or allow persons not making application to enter or remain in application exclusion zone (AEZ)

Application Exclusion Zones

If pesticide is applied for outdoor production:

Area that extends 100 ft. horizontally from equipment in all directions during application when pesticide is applied aerially; by air blast; as fumigant, smoke, mist, fog, or fine spray

Area that extends 25 ft. horizontally from equipment in all directions during application when pesticide is applied with other equipment and sprayed from height of >12 in. from soil using at least medium spray

Application Exclusion Zones

Following an Application

- Equipment typically exits field upon completion w/o driving back through
- Warning signs must be posted at points of entry when required by label or regulation
- DPR has additional regulations to keep people out of fields following applications when there is potential for exposure

Pesticide Illness Trends as a Measure of Efficacy of Regulations

- 8 cases involved exposure to non-application crew workers in field during ground application
- Comparatively, 87 cases involved handlers exposed while applying on ground equipment
- 582 cases for all agricultural-related exposures during ground applications
- Numbers above reflect five most recent years of available data (2017-2021)

Questions?

Emily Bryson

916-324-6344

emily.bryson@cdpr.ca.gov