

Wearable Technology and Video Analysis to Measure and Mitigate Hand-Arm Vibration Exposure in Industrial Maintenance Tasks

What's the Risk?

At Ocean Spray Cranberries, more than 500,000-700,000 wooden bins are used annually to transport, freeze, store and process harvested cranberries. These bins undergo repeated cycles of filling, dumping, freezing and handling, which leads to frequent structural damage requiring repair. Approximately 100 employees across receiving stations and plants perform bin repairs using high-vibration power tools, including vibratory saws, grinders and other handheld equipment.

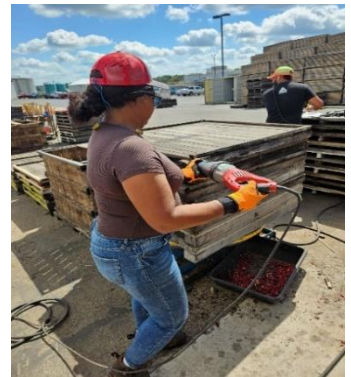
Workers have historically reported symptoms consistent with hand-arm vibration syndrome (HAVS) (e.g., persistent tingling/numbness, reduced grip strength, and “vibration white finger” or finger blanching), particularly from vibratory saw use. Yet exposure mitigation relied largely on employee complaints, reactive rest regimens and inconsistent adherence to standard operating procedures.

The combination of high-amplitude vibration tools, repeated long-duration cuts, variable techniques among operators and limited real-time feedback created the conditions under which HAVS risk remained elevated. Ocean Spray sought a data-driven method to measure, visualize and control exposure to prevent chronic injuries related to HAVS and improve work practices.

Project Aims

Ocean Spray partnered with Feraru Dynamics LTD to pilot the HAV-Sentry wearable glove system with the following aims:

- Quantify vibration exposure among workers performing high-risk vibratory tool tasks during bin repair
- Identify root causes of elevated exposure by correlating vibration peaks with worker technique through matched video analysis
- Coach employees using objective data, improving adherence to safe tool handling procedures and reducing improper cutting behaviors
- Reduce overall vibration exposure, and minimize the likelihood of HAVS over time. These aims were designed to transition Ocean Spray from a reactive model to a proactive, evidence-based exposure management program



Description of Project Activities and Implementation

From November 2024 to August 2025, the HAV-Sentry system was deployed at the Babcock, Wisconsin, Ocean Spray receiving station, a facility where wooden bin repairs are performed. Employees wore HAV-Sentry gloves while operating vibratory saws and other high-vibration tools as part of their normal workflows.

Sensor Wear

Workers wore HAV-Sentry units integrated into textile gauntlets designed to continuously monitor hand-transmitted vibration. The embedded Aegis sensing modules captured real-time vibration amplitude, frequency and exposure duration as experienced directly by the hand. The system calculates exposure continuously and provides visual or audible alerts when vibration approaches recognized safety thresholds (as defined in ISO 5349-1:2001):

- **EAV (Exposure Action Value):** 2.5 m/s² over eight hours – level requiring employers to take action to reduce exposure
- **ELV (Exposure Limit Value):** 5.0 m/s² over eight hours – maximum allowable daily exposure requiring immediate intervention if exceeded



Video Matched Analysis

After each session, exposure data were downloaded and reviewed through the HAV-Sentry online dashboard, which automatically flags periods when workers neared or exceeded the EAV or ELV. These flagged intervals were then matched to synchronized camera footage, allowing the team to pinpoint the exact motion, grip or saw-handling behavior associated with the elevated readings. This process revealed clear correlations between improper tool handling and spikes in vibration exposure.

Coaching and Work Practice Improvement

Supervisors used the combined dashboard data and video evidence to deliver targeted, precision coaching. This helped workers visualize how their technique deviated from standard operating procedures and how specific behaviors contributed to overexposure. Coaching emphasized grip force, cutting posture, saw engagement technique and blade selection. Additionally, the work practices of the lowest-exposure employees were used as models for the highest-exposure employees.

Project Challenges

There was some resistance to wearing the HAV-Sentry glove to measure vibratory exposure, though it was a minor issue. The additional layer of the HAV-Sentry glove underneath the work glove caused discomfort for some workers. Additionally, early units had a wired link between the palm sensor and dorsal recorder, which workers found restrictive. Feraru Dynamics has since revised the design to resolve this issue.

Project Accomplishments and Lessons Learned

The project accomplished a great deal and generated insights that Ocean Spray can continue using to reduce HAVS risk. Key accomplishments and lessons learned include the following:

- **Objective identification of improper tool use:** Video matched with sensor data made it immediately clear when vibration peaks aligned with incorrect cutting technique, enabling supervisors to target the exact movement patterns contributing to HAVS risk.

- **Significant reductions in vibration exposure:** Over the pilot period, elevated vibration readings decreased by 50% as coaching improved operator technique and workers became more aware of risk factors.
- **Increased employee awareness and skill:** Before the pilot, employees knew little about HAVS; afterward, all participants were better trained on HAVS risk and proper vibratory saw technique. The technology allowed workers to clearly see the specific actions producing elevated vibration exposure, strengthening the impact of coaching.
- **Identification of additional best practices:** The pilot highlighted the value of using vibration-dampened blades, securing bins to reduce resonance, initiating cuts slowly to limit kickback, and maintaining proper holding technique by letting the tool do the work rather than applying excessive grip force or pressure. The sensor data also helped inform job rotation frequency.
- **Dissemination across the organization:** Findings were shared with all Ocean Spray facilities performing bin repair and across its broader environmental health and safety network.

Overall, this project successfully demonstrated how real-time, wearable vibration monitoring combined with video matched analysis can transform hand-arm vibration management from a reactive to a proactive, data driven process. The pilot achieved meaningful reductions in high risk vibration exposure through targeted coaching and improved work practices and also increased employee awareness, engagement and skill related to HAVS prevention.



Feraru Dynamics LTD is an occupational health and safety technology company dedicated to helping organizations prevent Hand-Arm Vibration Syndrome (HAVS). Its HAV-Sentry wearable glove system measures hand-arm vibration exposure in real-time and pairs objective exposure data with user-friendly software to support effective, personalized risk mitigation strategies. By alerting workers and employers before exposure limits are reached, HAV-Sentry helps organizations proactively manage vibration risks, improve workplace safety, and reduce the likelihood of vibration-related injuries.

Contact Us:
msdsolutionslab@nsc.org

Learn More:
nsc.org/msd

