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Your nuisance alarms are the most honest audit you will ever get

One haul truck, seven days, 580 alarms, zero misses. Most were dismissed as nuisance. They were the site telling its managers something the safety statistics could not.

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The safety profession has a settled view of nuisance alarms. They cause fatigue, drivers learn to ignore them, and the answer is to tune them out. That view is half right. It also wastes the most useful information a warning system produces.

One truck, seven days, 580 alarms

In 2006 Todd Ruff of the US National Institute for Occupational Safety and Health published a field evaluation of a radar proximity warning system on an off-highway dump truck. The site was a surface copper mine in Arizona. For seven days of normal operation, a recorder on the truck logged every reversing movement and every alarm, and researchers classified each one from the video.

The results, from Table 1 and section 4.1 of the paper:

- **618** reversing movements.
- **580** alarms. One sounded on **94%** of reversals.
- **0** missed alarms.
- **235** alarms, **41%**, required immediate action or extra caution.
- **243** were nuisance alarms: a real object that posed no danger.
- **102** were false.

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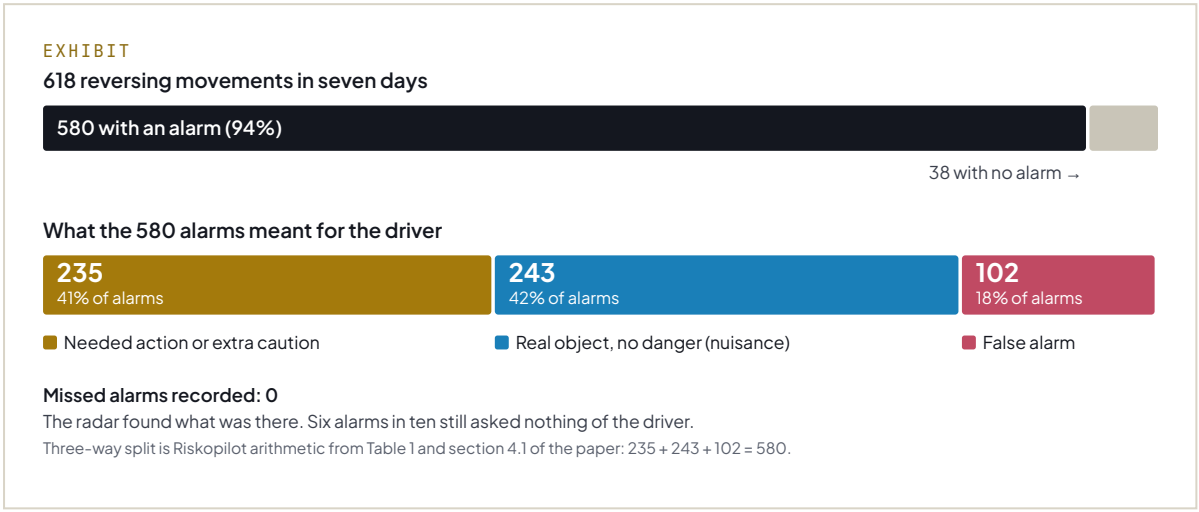
Those last three add up to 580. That sum is our arithmetic from the paper's own figures.

The usual reading stops at fatigue. Six alarms in ten asked nothing of the driver, so the driver will stop listening. That reading is fair. In May 2000 a flag person on a California freeway project was killed by a reversing truck whose back-up alarm, the state investigation recorded, was working properly. A sound that is always there protects nobody.



Now read the 243 differently

A nuisance alarm, as the study defines it, is a true detection. Something was in the radar's field behind a reversing haul truck. The paper reports that the system reliably detected small vehicles, berms, people and other equipment.

So sort the 243. Some will be berms and fixed structures. Those tell you the detection zone is set wider than the manoeuvre needs. The rest are vehicles, equipment and people who were close to the back of a reversing truck and happened not to be in danger that time.

That second group is an exposure count. This is our inference, and the study did not report the split. But the logic holds for any site: every "real object, no danger" alarm on a person or a light vehicle is a measurement of how often your traffic plan puts them behind heavy plant. No injury rate will show you that. No audit walk will catch it at 03:00.

Seen this way, the warning system has two jobs. The one it was bought for is to alert the driver, and the evidence that it does that well is thin. The one nobody bought it for is to tell managers where the layout is failing, and at that it may be the cheapest instrument on site.

Zero misses is a setting

One more number deserves suspicion: the zero.

Any detector trades missed events against false alarms. Widen the zone and raise the sensitivity, and you miss less and alarm more. A system reporting no misses alongside a 94% alarm rate looks like one set at the cautious end of that trade. A supplier who leads with "zero missed detections" is describing a choice, and you are entitled to ask what it cost in alarms per shift.

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There is a limit on the zero as well. Alarms were classified from a camera on the rear of the truck. A missed alarm could only be counted if the camera saw what the radar did not.

The strongest case against this article

It is this: the study is twenty years old, and the industry has moved on from warnings.

That is true, and it matters. The mining industry now distinguishes systems that make the operator aware, systems that advise, and systems that intervene by slowing or stopping the machine. South Africa has written the third kind into law. Regulations under its Mine Health and Safety Act require that, where there is a significant risk of collision, underground diesel-powered machines detect pedestrians and warn both parties, and that if no action is taken the machine slows and brakes automatically, failing to safe. The automatic-braking clauses came into force by notice on 21 December 2022. In the United States, a 2015 rule requires proximity detection on continuous mining machines in underground coal mines that warns and then stops the machine before it contacts a miner.

A system that stops the machine is a different control from one that sounds a horn. It takes the driver's reaction out of the chain. It deserves a higher place in the hierarchy of controls than a warning. An argument that lumps the two together is an argument with 2006.

Here is the reason for caution. The regulator projected that the US rule would prevent nine deaths and 49 injuries over ten years. NIOSH researchers reviewed 39 past fatalities and judged that conventional proximity detection could have prevented 82% of them, while noting that the data did not support statistically significant conclusions. Both are estimates made before or apart from the outcome. We looked for an independent evaluation of what happened afterwards and did not find one. If it exists, we want to read it.

Intervention also brings its own failure modes. NIOSH has documented a case in which a personal dust monitor interfered with proximity detection systems, exposing miners to the hazard the system was there to prevent.

So the strongest technology has the thinnest published proof of outcome. That is a reason to test it properly. It is no reason to dismiss it.

What to do with this

Ask for two denominators. Of all movements, how many triggered an alert? Of all alerts, how many required the operator to act? A supplier who can answer only the first has not tested what you are buying.

Run the alarm log as an exposure audit. Each month, export every time-stamped alert. Sort by location, hour and object type. Put the pedestrian and light-vehicle detections on a site plan. Where they cluster, the traffic plan is wrong. Fix the layout there.

Judge the fix by the log. The right result is fewer detections of people because people are no longer there. The wrong result is fewer detections because someone narrowed the zone. Never reward a falling alarm count until you know which it is.

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Choose between warning and intervention on time. If sensing, the driver's reaction and stopping distance do not fit inside the time available, a warning cannot work, however accurate. That is the case for intervention, or for removing the interaction altogether.

Be honest about small trials. Thirty staged encounters with no misses still allow a true miss rate of up to 9.5% at the usual confidence level, and only if the trials were independent.

What would change our view

A field study on current equipment showing that a classifying system cuts nuisance alarms without adding misses, measured against an independent reference. And an independent before-and-after evaluation of a mandated intervention system, with the denominators published. Either would move our advice from "test it" to "fit it".

Until then, the most valuable thing your warning system does may be the thing you have been trying to switch off.

> **Read the full report.** *Time to act: what technology can and cannot add to critical controls* is published by Riskopilot Research on Riskolabs.

Sources

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The reading of nuisance alarms as an exposure count is the author's inference. The zero-miss ceiling is a standard exact binomial calculation, 1 – 0.05^(1/n). The three industry levels of control are described from trade sources, not from the industry body's own documents.

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