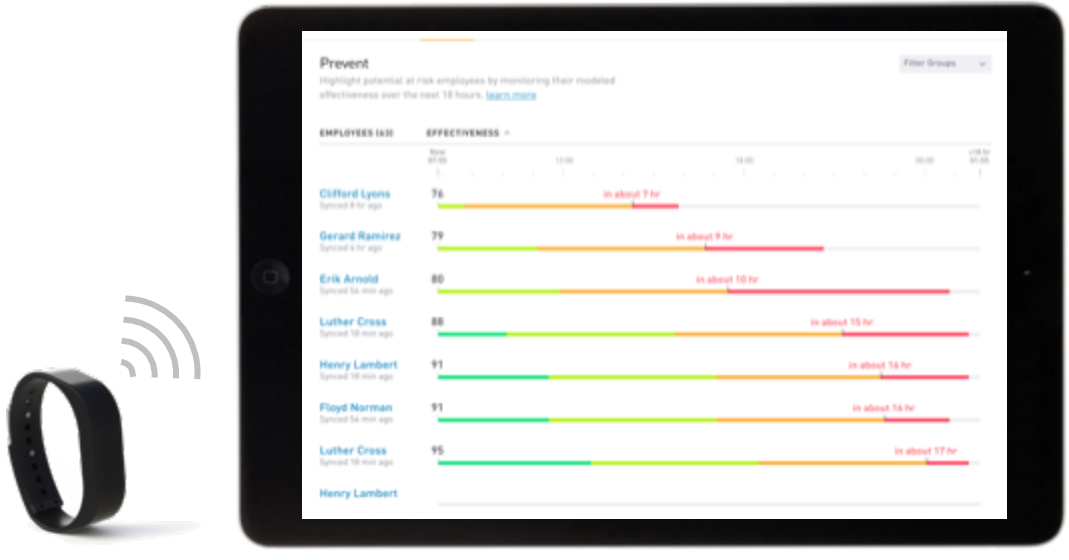
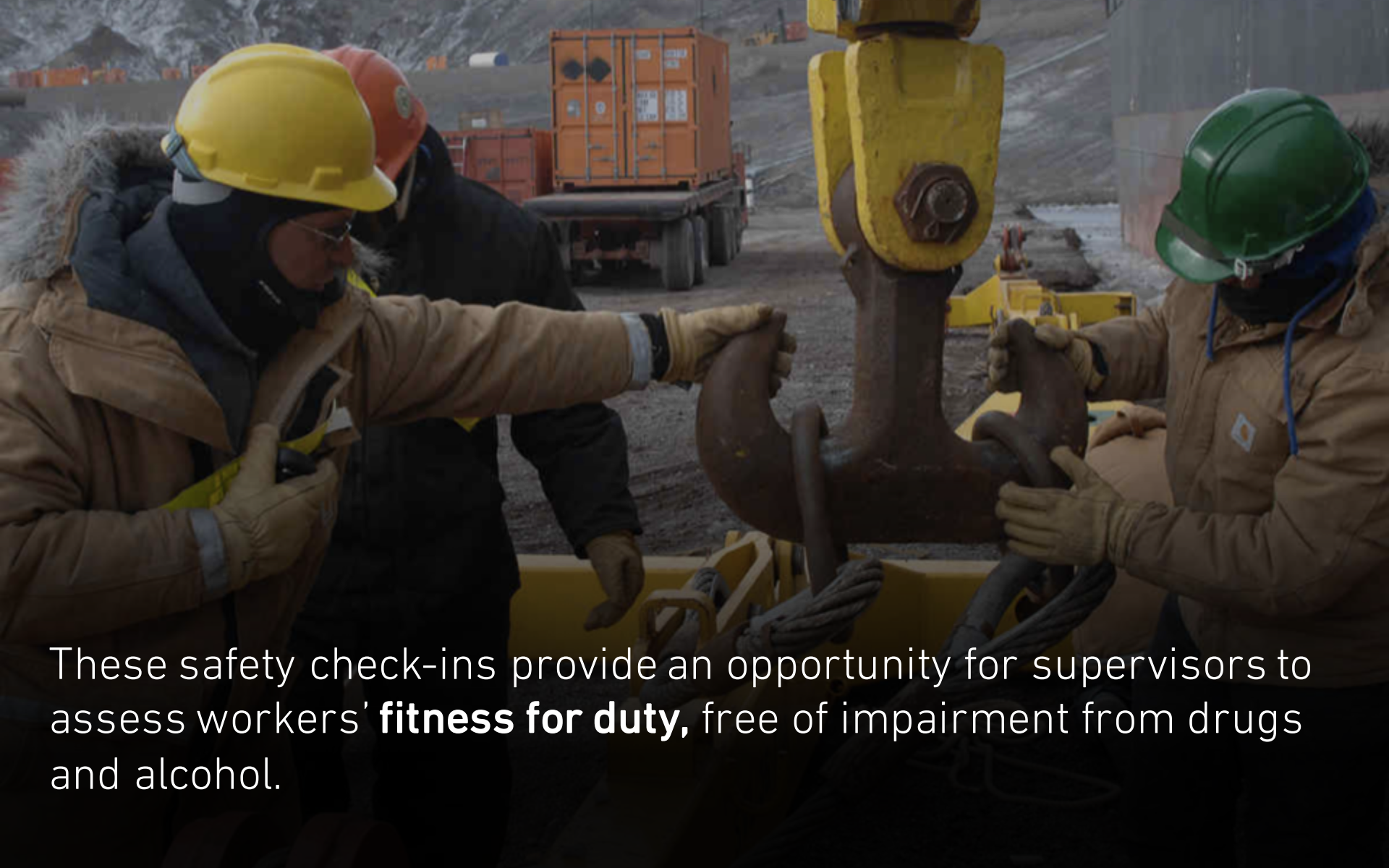
Predict Fatigue. Prevent Accidents.



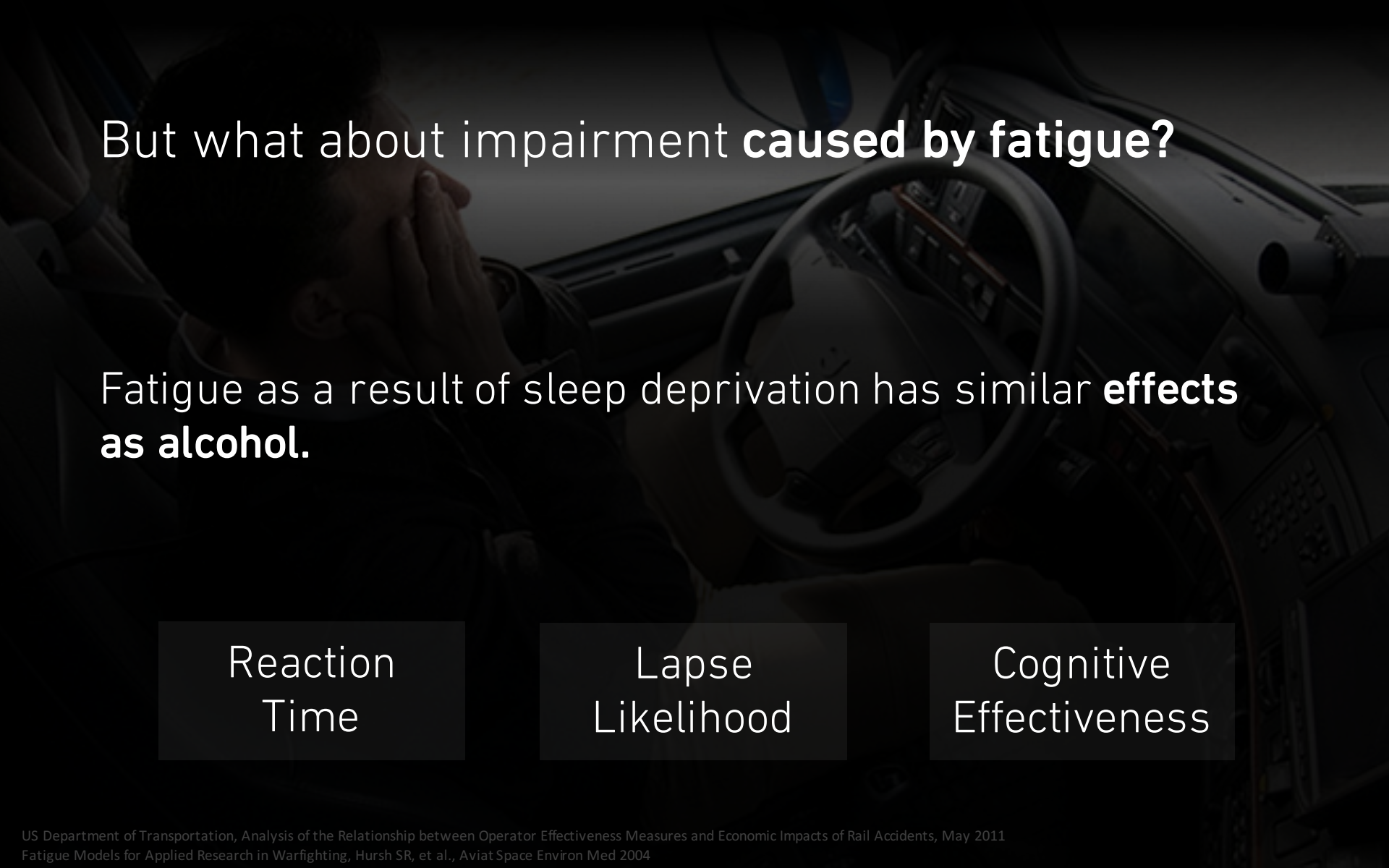
FATIGUE SCIENCE

Solution Overview


Every day, millions of workers begin their shift with a
safety check-in.



These safety check-ins provide an opportunity for supervisors to assess workers' **fitness for duty,** free of impairment from drugs and alcohol.



But what about impairment **caused by fatigue?**

Fatigue as a result of sleep deprivation has similar **effects as alcohol.**

Reaction Time	Lapse Likelihood	Cognitive Effectiveness

US Department of Transportation, Analysis of the Relationship between Operator Effectiveness Measures and Economic Impacts of Rail Accidents, May 2011
Fatigue Models for Applied Research in Warfighting, Hursh SR, et al., Aviat Space Environ Med 2004

Fatigue impairment is the **single greatest cause** of industrial accidents.

Up to 65%

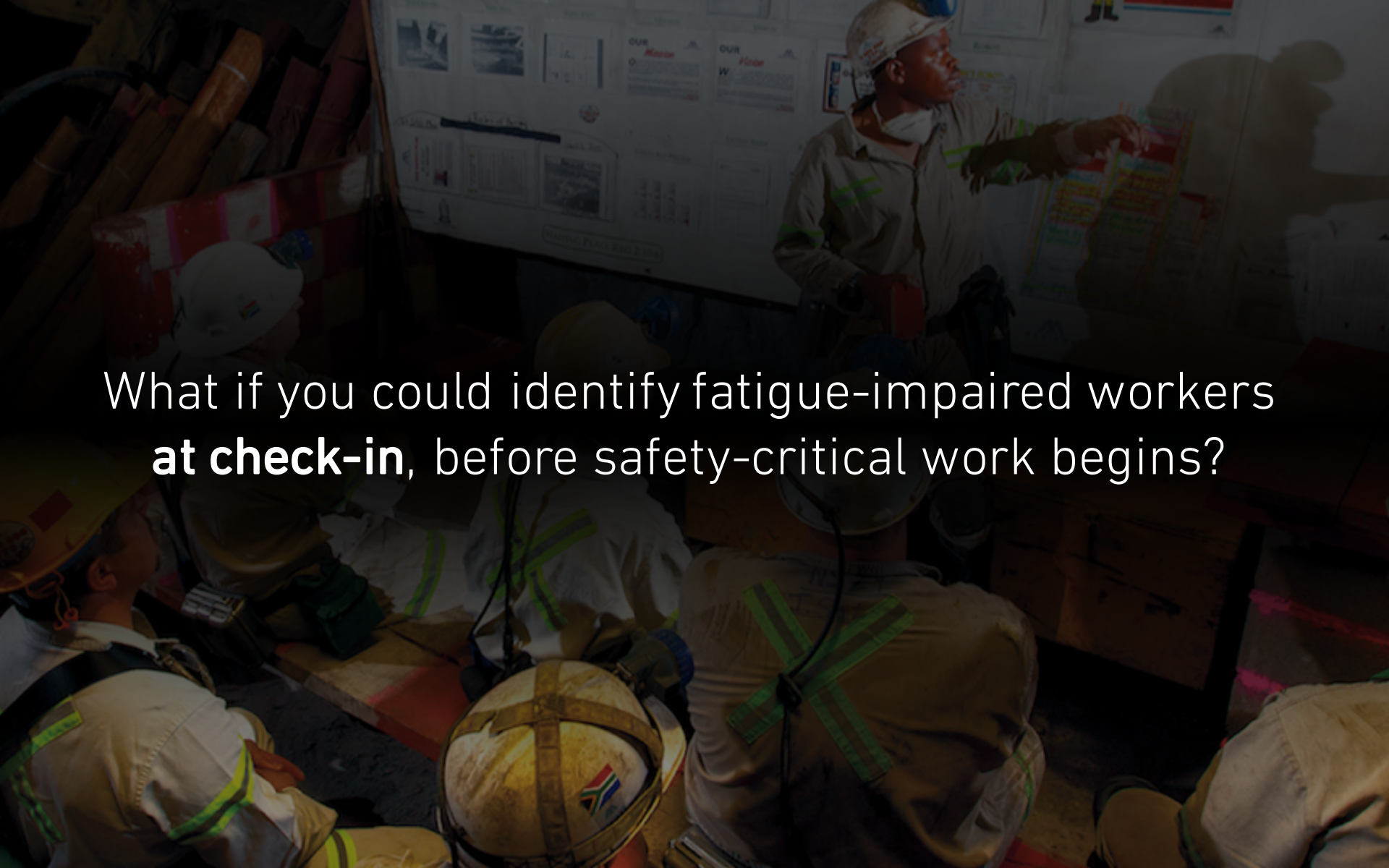
of surface mining haul truck accidents

Caterpillar Global Mining, 2011

up to 40%

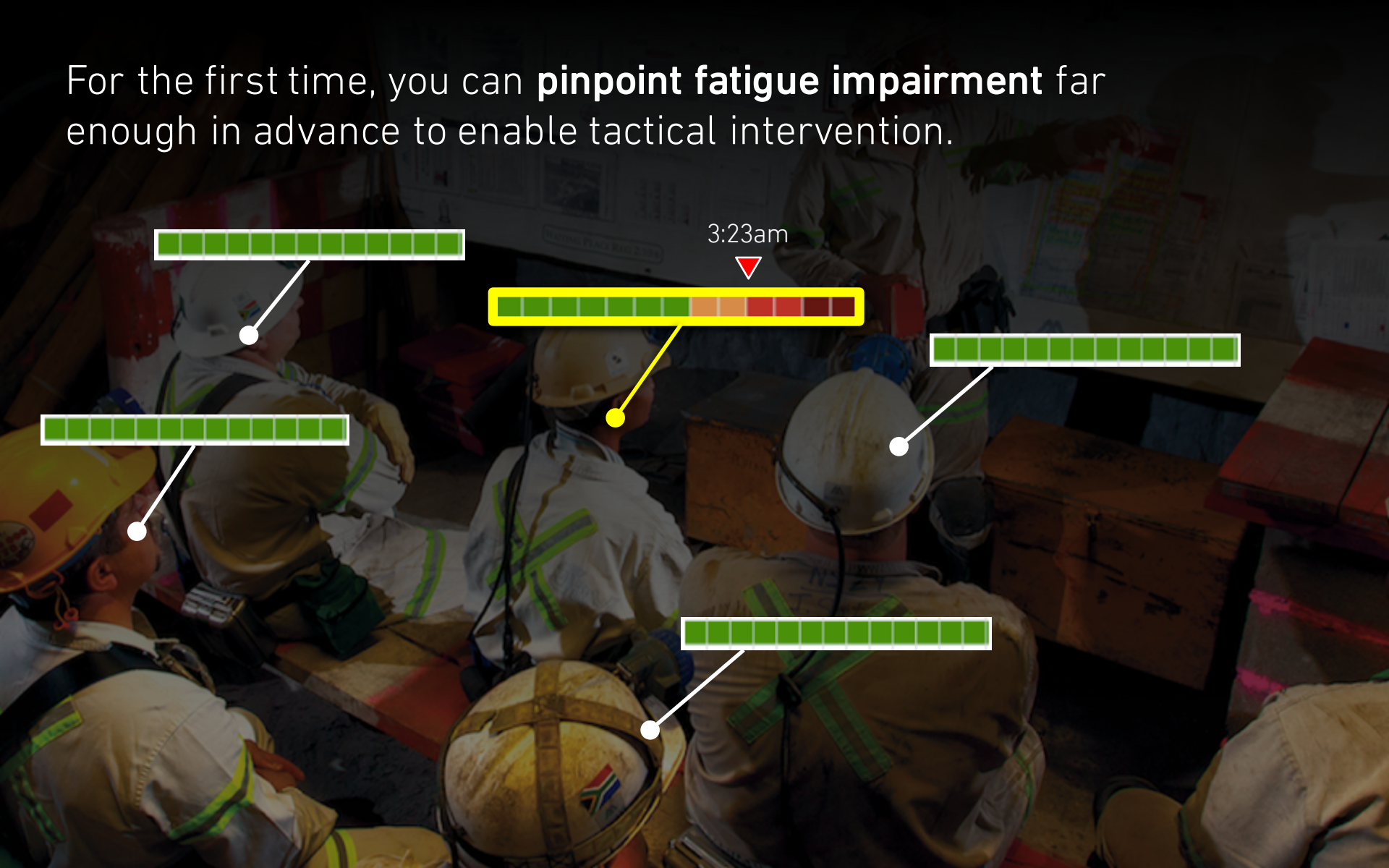
of commercial trucking accidents

NTSB



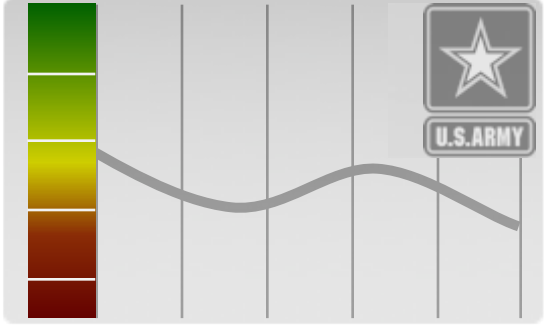
What if you could identify fatigue-impaired workers **at check-in**, before safety-critical work begins?

For the first time, you can **pinpoint fatigue impairment** far enough in advance to enable tactical intervention.



Our **Predictive Fatigue Monitoring Solution** is made possible by pairing validated bio-mathematical **science** with modern **wearable** devices.

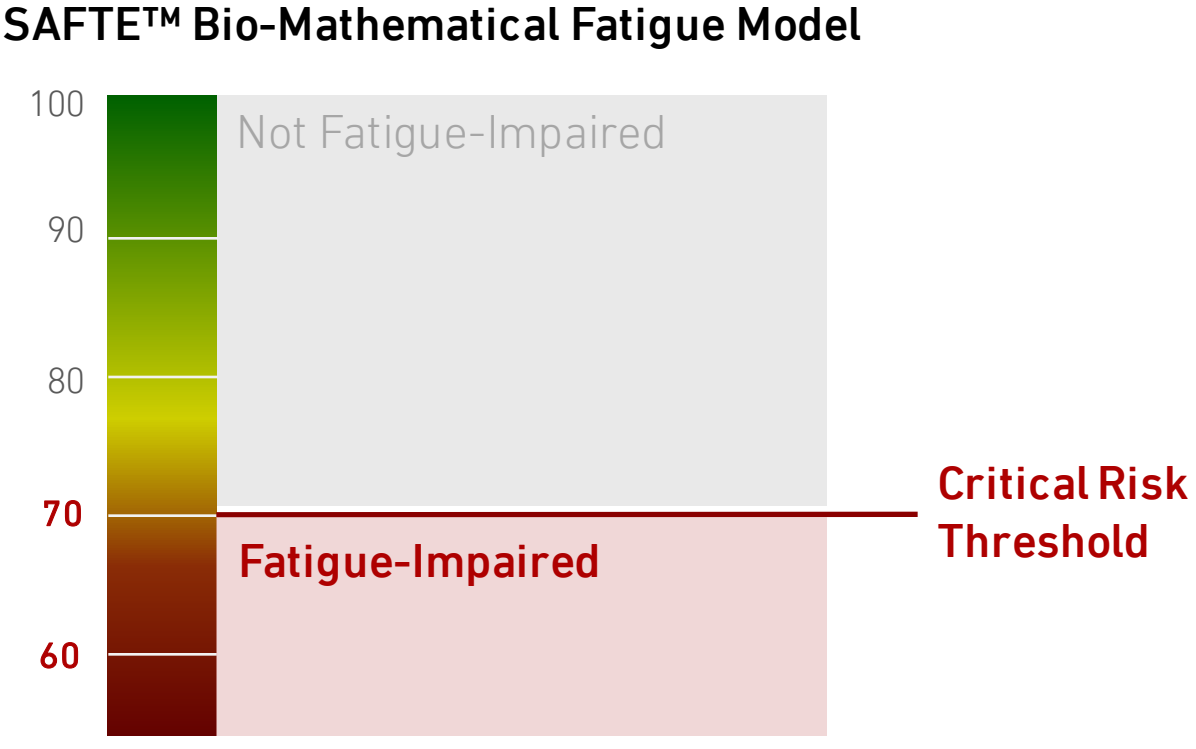
Bio-Mathematical Science



Cloud-Connected Wearables

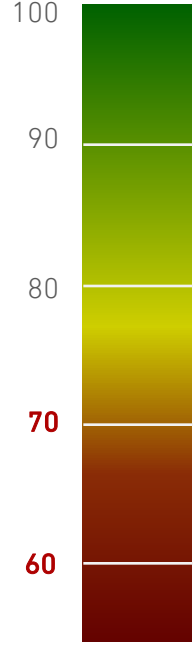
The science at the core of our solution is the **SAFTE™ Bio-Mathematical Fatigue Model.**

Developed by US Army Research Lab



For decades, the SAFTE™ model as been recognized as the **gold standard** for objectively studying and measuring human fatigue.

SAFTE Model



Developed by the US Army with **25+ years** and **$37M+ in research**, SAFTE quantifies the impact of each worker's sleep history into an objective measure of their resulting fatigue impairment.

US Army Research Lab

US Air Force

US Nat'l Transp. Safety Board

US Federal Railroad Admin.

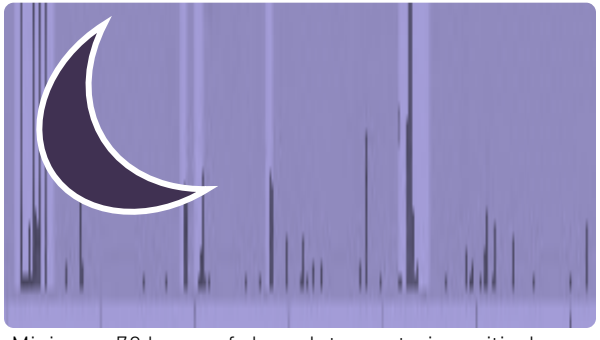
US Federal Aviation Admin.

US Dept. of Transportation

SAFTE is available exclusively from Fatigue Science.

With objective sleep data, SAFTE can accurately **predict the effects of fatigue** on a worker's upcoming hours of wakefulness.

Worker Sleep Data

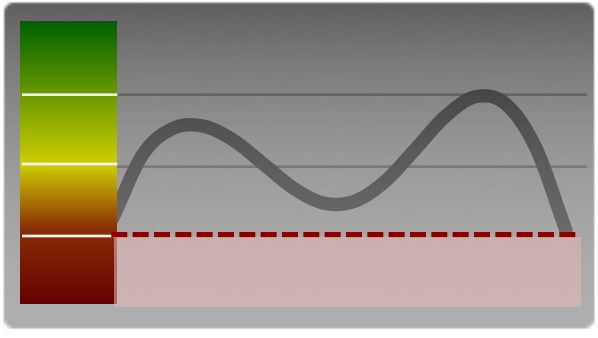


Minimum 72 hours of sleep data, capturing critical nuances such as:

- Sleep Timing
- Sleep Quantity
- Wake Episodes
- Geo / Time Zone
- Onset Variance
- Wake Variance

SAFTE

Predictive Fatigue Assessment



Validated and objective score providing a time-series assessment of fatigue for the upcoming 18 hours of wakefulness.

SAFTE™ represents fatigue's impact on **reaction time, lapse likelihood,** and **cognitive effectiveness** – the factors that make it dangerous to drive under the influence.

US Army Research Lab

Federal Aviation Administration

US Department of Transportation

SAFTE Score	Lapse Likelihood	Reaction Time Increase	BAC Equivalent (%)
90	1.5x	11%	0
77	3.7x	30%	0.05%
70	5.2x	43%	0.08%

US Department of Transportation, Validation and Calibration of a Fatigue Assessment Tool, for Railroad Work Schedules, Summary Report, October 2006

To make all this work, workers **simply wear our lightweight Readiband 4** wristband, which syncs seamlessly to any authorized mobile device.

Readiband™ 4

PSG-Validated Sleep Tracker

Instant, automatic syncing.

No action required.

Bluetooth

33'

Waterproof

30 day battery

Upon syncing, Readiband 4 **seamlessly passes sleep data** to the SAFTE model, in order to generate validated **fatigue predictions for the day ahead.**

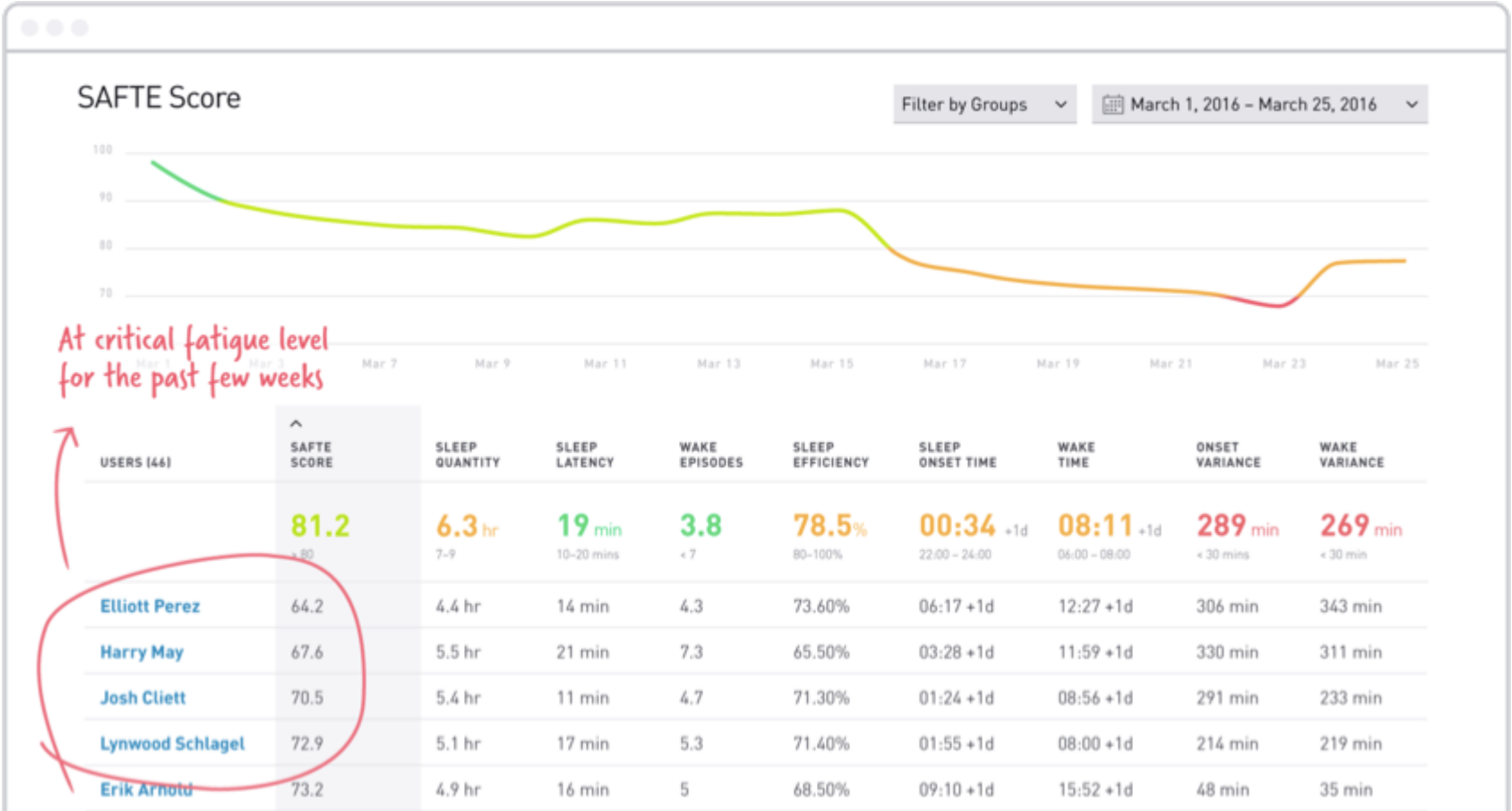
Readibands sync sleep data to cloud via Bluetooth, with no action required by the worker.

SAFTE calculates each worker's present and upcoming fatigue risk levels.

Workers' SAFTE scores are presented via personal mobile app (for individual workers) and secure web dashboard (for risk managers).

Using our dashboard, supervisors can **identify fatigue-impaired workers** at check-in, as well as those workers who will become impaired later in their shift.

Additionally, health staff can use insights from our data to provide workers with **personalized guidance** to help them overcome sleep problems.

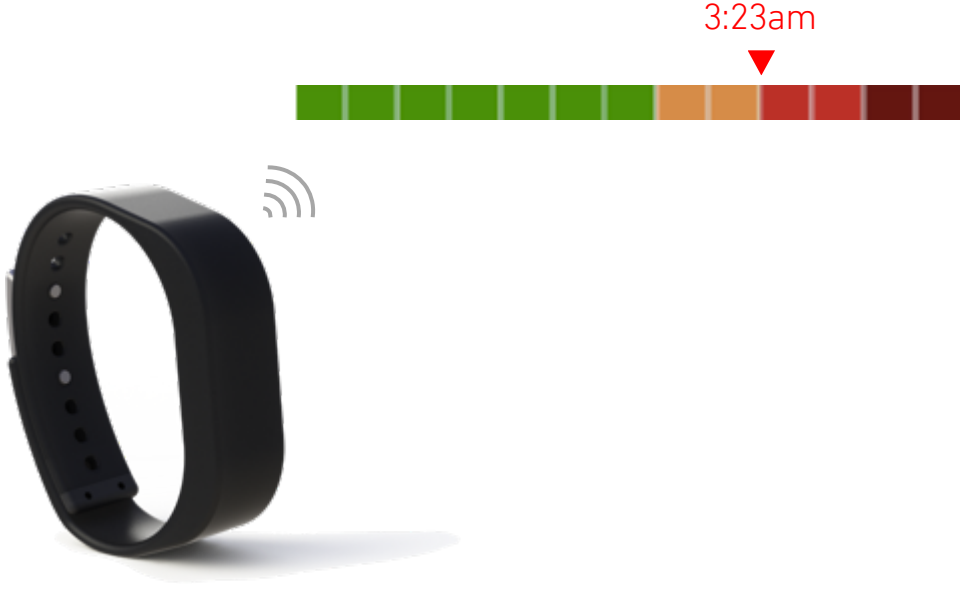


With our app, workers can **visualize their fatigue for the day ahead**, and raise concerns before they begin high-risk duties.

And those who **self-manage** their workload can be empowered to make informed decisions.

Current mobile app enables syncing and real-time SAFTE score viewing.
Version 1.1 to be released Sept. 1 will reveal projection for day ahead, as shown above.

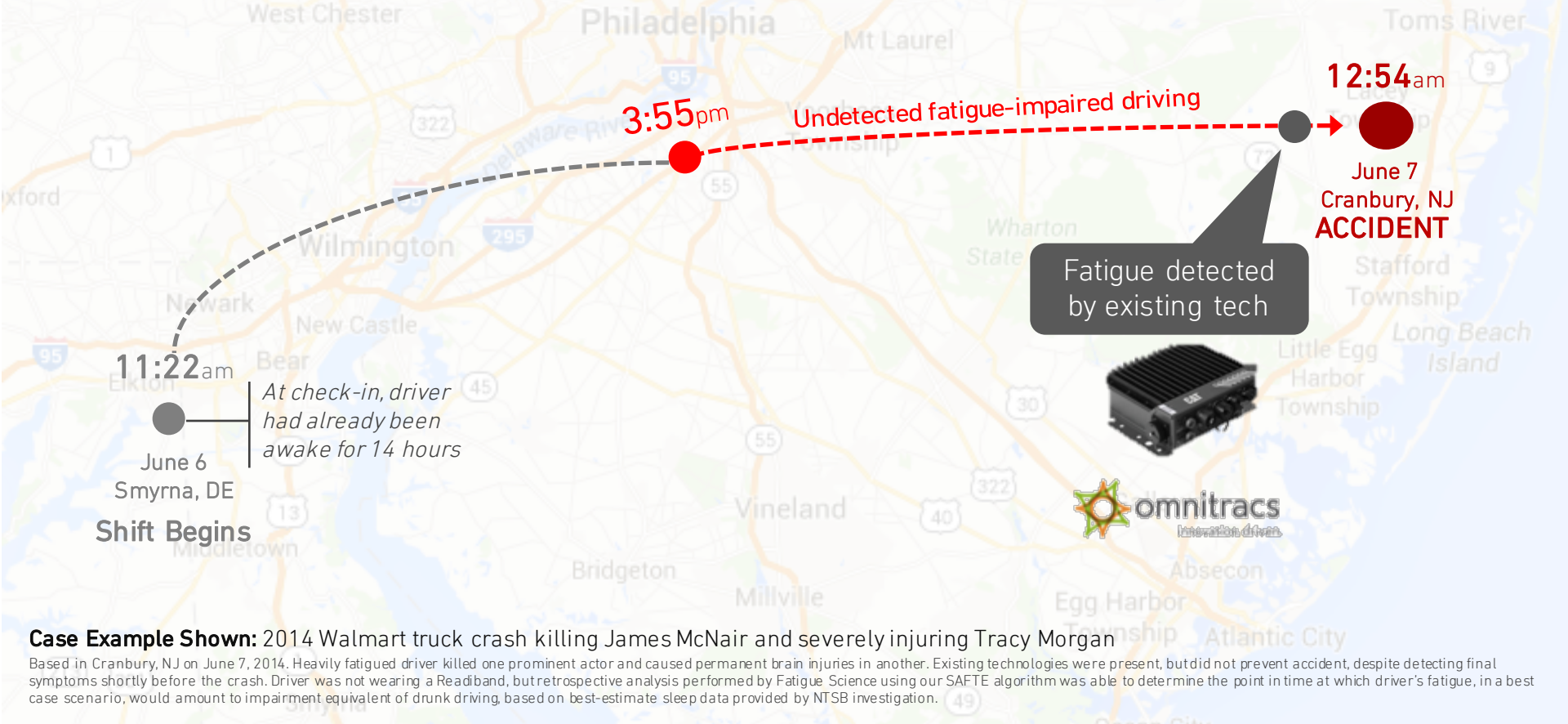
With these data, **life-saving interventions** are now possible, preventing this impaired operation before it starts.



Case Example: Walmart Crash, June 2014

In June 2014, a **fatigue-impaired Walmart trucker** caused a collision that killed one and seriously injured four others.

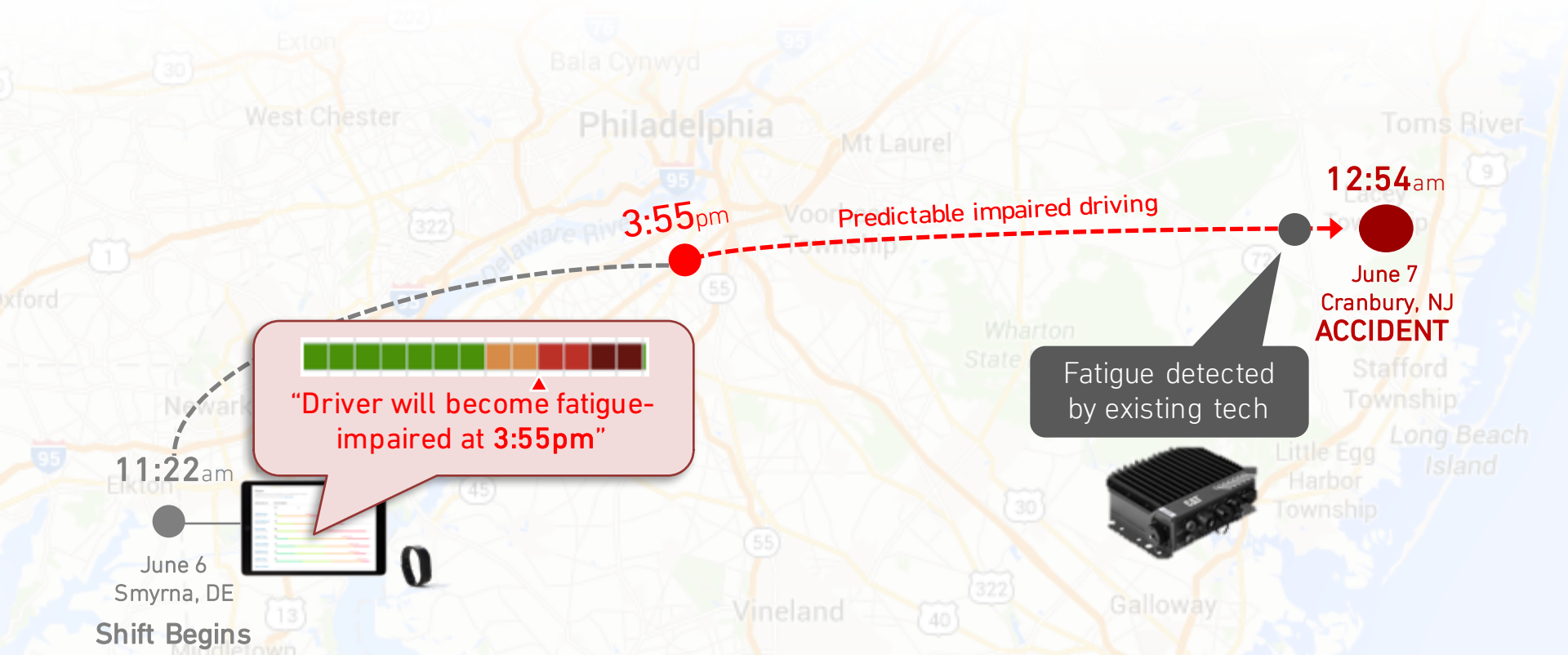
- The driver's fatigue impairment went undetected as he began his shift, and traditional in-cab technologies only detected signs of impairment in the final moments before the accident – **too late for intervention**.



Case Example Shown: 2014 Walmart truck crash killing James McNair and severely injuring Tracy Morgan

Based in Cranbury, NJ on June 7, 2014. Heavily fatigued driver killed one prominent actor and caused permanent brain injuries in another. Existing technologies were present, but did not prevent accident, despite detecting final symptoms shortly before the crash. Driver was not wearing a Readiband, but retrospective analysis performed by Fatigue Science using our SAFTE algorithm was able to determine the point in time at which driver's fatigue, in a best case scenario, would amount to impairment equivalent of drunk driving, based on best-estimate sleep data provided by NTSB investigation.

With our Predictive Fatigue Monitoring Solution, this driver's fatigue impairment would have been predictable **before he got behind the wheel**, enabling life-saving intervention.



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Leaders in transportation, mining, industry, and construction **rely on our technology** to keep their workers safe.

Companies that implement our Readiband technology have achieved a **material reduction in their accident risk**.

RioTinto

"Because of these [Readiband] findings, Rio Tinto introduced new safety guidelines that prevent workers from operating heavy machinery if they've been awake for 14 hours straight or more. Once those rules were put into place, those **fatigue-related accidents faded**. The workers also reported feeling better, which improved moral and **helped with overall productivity**."

MAINLAND MACHINERY

Mainland Machinery Steel & Mining Service Report, "Fatigue Being Studied with Readiband", January 2014

ARROW
Arrow Transportation Systems

We saw **upwards of a 50% reduction in major incidents** in our Northern divisions [using the older generation Readiband as] part of an overall Safety Management System and on-board technology solution.

Dan de Palma, GM, Northern Operations, Arrow Transportation

Alberta Oil Sands – Worker Study

"....findings from [an earlier generation] Readiband deployment revealed that a 1-hour change in worker start time was associated with a resulting **46% fewer work hours** operating **in a highly fatigue-impaired range**."

Fatigue Science client, July 2013

Queensland Rail

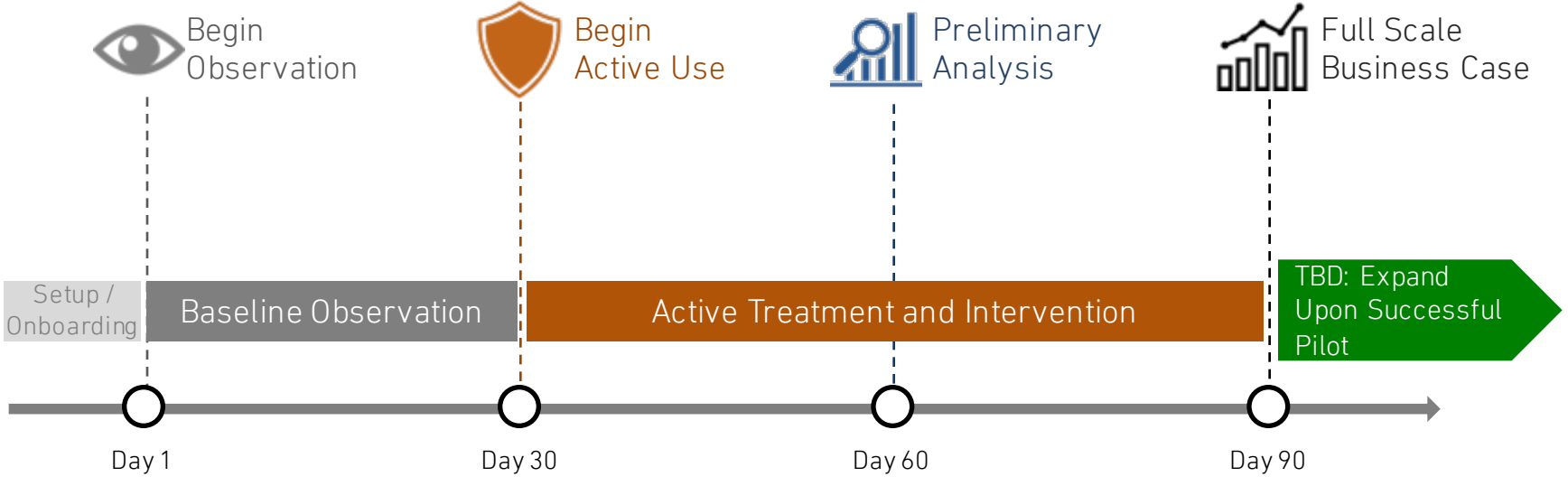
As a result [of using Readiband technology], one rail car control centre **reduced fatigue-related risk by 39%** while also improving productivity."

HR Reporter

HR Reporter, the National Journal of Human Resource Management, "New Tools, New Rules", Oct 2014

Pilot Program

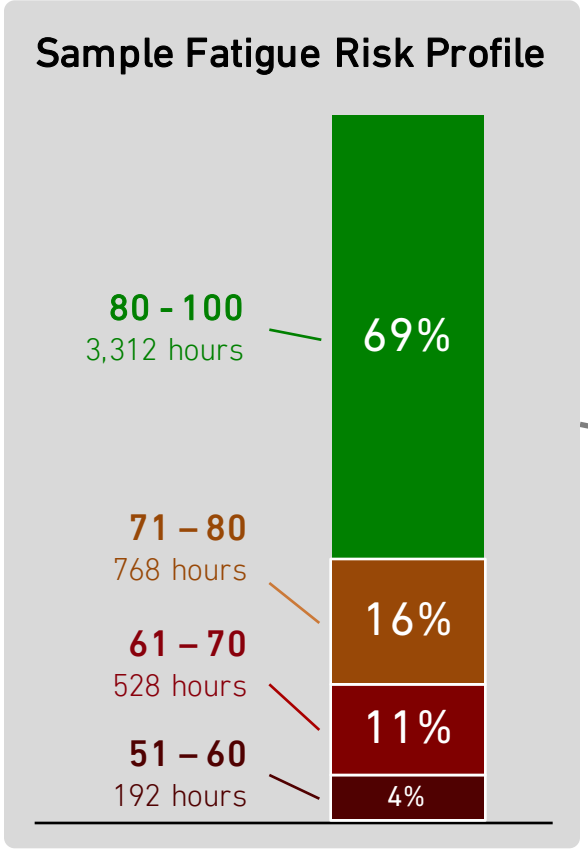
- 90-day Pilot of Solution
- Limited Initial Scope (~30 - 100 workers)
- During pilot, Fatigue Science will work with you to build a custom business case in support of a large-scale deployment based on risk reduction successes of pilot.



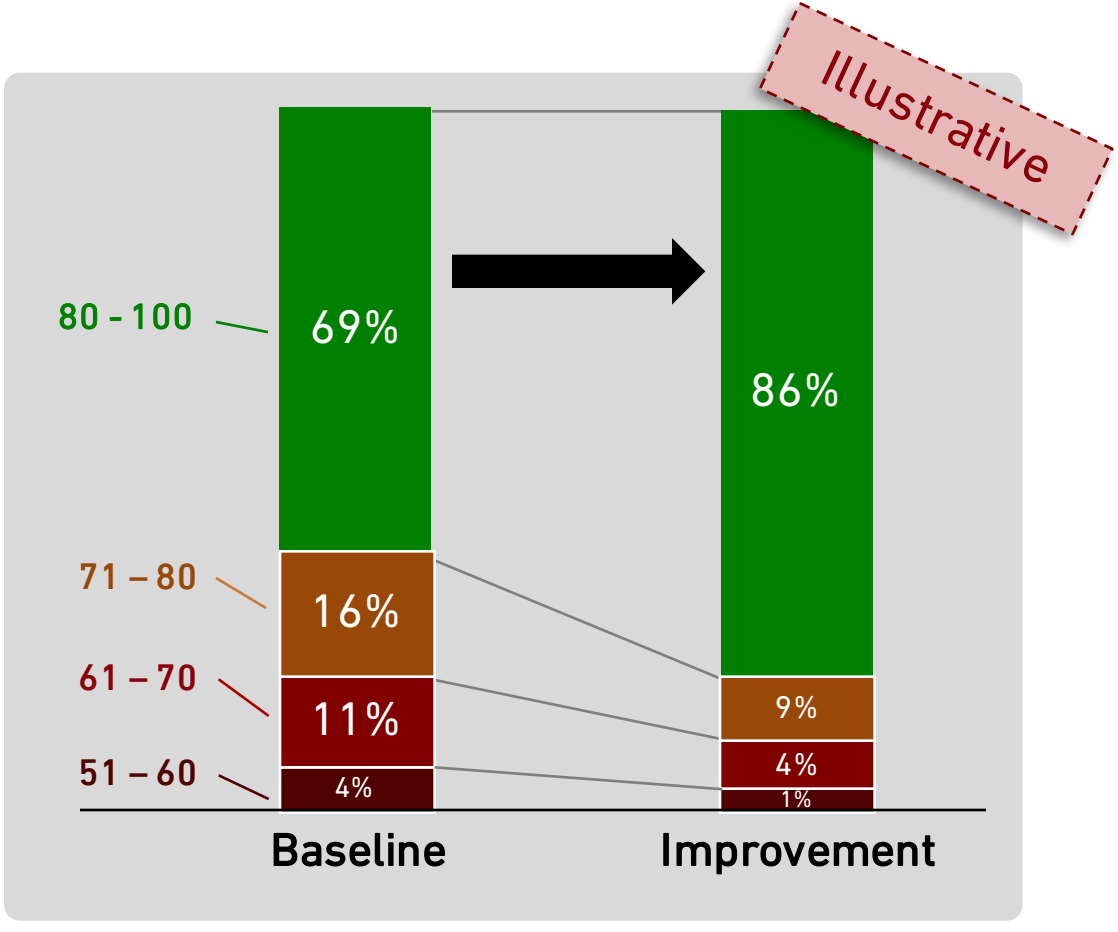
Our solution will help you **reduce fatigue-related accidents** in your organization.

And **we'll prove it**.

During the first month of your pilot, our initial analysis will construct a **Baseline Fatigue Risk Profile** of your sample, which may look like this:



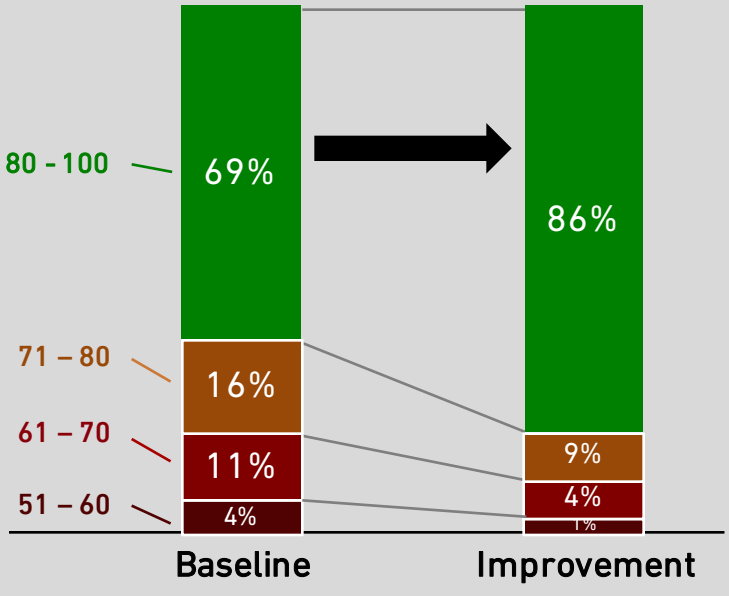
The pilot's goal will be to **improve your fatigue risk profile** over the subsequent 60 days, through the treatments and interventions enabled by our technology.



At the pilot's conclusion, we will present your team with an analysis based on a **comparison of fatigue risk profiles**, pre- and post-pilot.

Pilot Outcomes: Projected Impact on Workforce-Wide KPIs

Illustrative

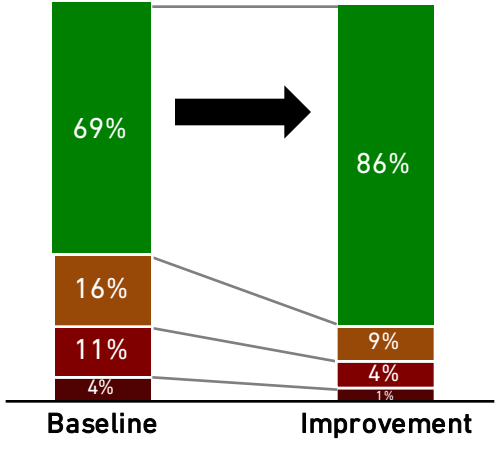


Baseline	# of Working Hours	Implied # of FR-Accidents	Implied Cost of FR-Accidents
90 - 100	138M	0	$0M
70 - 80	32M	331	$90M
60 - 70	22M	477	$130M
0 - 60	8M	772	$210M
Total	**200M**	**1,488**	**$405M**

Improvement	# of Working Hours	Implied # of FR-Accidents	Implied Cost of FR-Accidents
90 - 100	172M	0	$0M
70 - 80	18M	186	$51M
60 - 70	8M	173	$47M
0 - 60	2M	194	$54M
Total	**200M**	**553**	**$150M**
Delta		**(953)**	**($255M)**

Tying these risk profiles to associated KPIs, this analysis will form the basis for an **ROI-based investment case** for an workforce-wide rollout of our technology upon the conclusion of our pilot.

Pilot Risk Profile Improvement



Projected Workforce-wide KPI Improvements

- Reduced Collisions
- Reduced Fatalities
- Reduced Costs

Basis for Workforce-wide Investment Case

Predict Fatigue. **Prevent Accidents Today.**

FATIGUE SCIENCE

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