SmartCap Fatigue Levels

…at a glance

The SmartCap system provides information to assist equipment operators in the management of fatigue through their shift. This document provides an inside look at how SmartCap fatigue levels are calculated, and what they represent.

Fatigue as a concept is somewhat grey. Terms such as vigilance, alertness, tiredness and fitness to perform are often used in place of fatigue – all with the same sentiment, but subtly different definitions, and none of which consistently correlate with how a person is feeling.

What the SmartCap Measures

The SmartCap measures something very specific – an **individual's ability to resist sleep**.

Microsleeps only occur when we fail to resist sleep; they don't occur when we choose to rest. For people operating equipment, resisting sleep is a natural, sometimes subconscious behaviour. It is when our ability to resist sleep diminishes that we become at risk of a microsleep. This is why *ability to resist sleep* is the most relevant safety measure for equipment operators.

How Fatigue Levels are calculated

The underlying measurement behind the SmartCap levels is brain activity. Often referred to as EEG (or electroencephalogram), brain activity has been the golden standard in sleep science for over 30 years. The SmartCap measures this activity and determines a high resolution frequency profile of the signal which spans the delta, theta, alpha and beta frequency bands of EEG. All frequency information is analysed using EdanSafe's proprietary Universal Fatigue Algorithm to determine a level of alertness.

A number of confirmation steps are required, including the analysis of at least 17 seconds of EEG information, before a fatigue level can be shown on the SmartCap screen. Even more confirmation is required when significant impairment related to fatigue is suspected. Once significant impairment is suspected, the SmartCap system shows a level 3+. Calculations continue, with new levels being determined at regular intervals. If strict criteria are met over a period of approximately 4-6 minutes, the SmartCap system will confirm its highest level; a level 4.

Interpreting SmartCap Fatigue Levels

The SmartCap Fatigue levels are shown as numbers on the SmartCap display, with higher numbers indicating an increased risk of microsleep.

Level 2: This is a normal level of alertness, where the SmartCap is not detecting any signs of a lowered ability to resist sleep.
Level 3: This is a normal level of alertness, where the SmartCap is detecting the first signs of a lowered ability to resist sleep.
Level 3+: Suspected impairment related to fatigue
Level 4: Significant impairment related to fatigue, associated with an increased risk of microsleep.

*It's important to note that a Level 4 does not mean a microsleep occurred, nor does it mean that a microsleep was imminent. **A level 4 indicates an increased risk of microsleep**. That risk is further heightened by a low stimulus environment, and is best reduced by operator action and activity.*

Maintaining Privacy

Although EEG is used to determine an individual's ability to resist sleep, no EEG information is recorded by the SmartCap system. Once the calculations are performed, all EEG information is discarded. EEG information is never stored by the SmartCap system. Also, no EEG information is ever sent by Bluetooth to the SmartCap display.

As such, the SmartCap cannot determine if you are happy or sad, or anything else. It measures one thing only, your ability to resist sleep.