SCRAM CAM: Evidence You Can Rely On

Abstract

In an article entitled, “Challenging SCRAM Continuous Alcohol Monitor Evidence as Unreliable and Insufficient,” which first appeared in the National Association of Criminal Defense Lawyers’ publication, *The Champion*, in November 2021, Juliana DeVries argues that, despite the device’s proven track record in both research studies and courtrooms across the United States and around the world, alcoholic consumption evidence gathered by the SCRAM® Continuous Alcohol Monitoring® (SCRAM CAM®) device should be challenged on the basis of flawed science, faulty technology, and a long list of assumptions used to confirm drinking events.

This response will address Ms. DeVries’ arguments and show that transdermal alcohol detection science is both documented and well-established, and that the technology and methodology for determining if a person consumed alcohol by using the SCRAM CAM device has been extensively tested and validated by the courts and the scientific community.

Confirmation of Alcoholic Consumption

In her article, Ms. DeVries’ asserts that SCRAM Systems relies on a series of “assumptions” to decide that a TAC detection is an alcoholic consumption event. In truth, SCRAM Systems relies on no assumptions. A TAC Alert must meet six strict criteria that have proven to be effective at minimizing false positives before the event will be confirmed as alcoholic consumption:

1. A zero (0.000) TAC must be established at the start of the event.
2. A peak TAC must be established.
3. A zero TAC must be re-established at the end of the event.
4. The absorption rate must be less than 0.100 TAC per hour.
5. The elimination rate must be less-than-or-equal-to 0.035 TAC per hour.
6. The event must pass the *Environmental Contaminant Test*.

Given these criteria, let’s address each of Ms. DeVries assumptions individually:

- It assumes any ethanol in the sweat is there because the wearer consumed alcohol rather than, for example, used a product that contains an alcoholic compound.
- It assumes any ethanol picked up by the device comes from the wearer’s skin rather than from the air.

> Deciding that the TAC reading reflected in the graph shows that the wearer consumed alcohol requires a series of assumptions. It assumes any ethanol in the sweat is there because the wearer consumed alcohol rather than, for example, used a product that contains an alcoholic compound. It assumes any ethanol picked up by the device comes from the wearer’s skin rather than from the air. It assumes there is nothing significant about the wearer’s skin properties or body chemistry that might throw off the correlation between the reaction in the fuel cell and the concentration of alcohol in the person’s body. It assumes, of course, that the device is working properly. And it assumes the correlations the SCRAM company uses between the electrical signal and its TAC determination are correct and properly applied. Each of these assumptions — and likely others — provides a way to challenge the TAC reading’s reliability and adequacy as a basis for imposing increased punishment.

DeVries Article Excerpt 1

Both of the above assertions are false. Fumes from volatile chemicals in the environment *will* react with the device’s internal fuel cell. However, environmental contaminants react with the fuel cell very rapidly, whereas consumed alcohol will follow the slow absorption and elimination rates set forth in the confirmation criteria. Additionally, the SCRAM CAM device uses a patented *Environmental Contaminant Test* to analyze the ambient air in the internal test chamber for the presence of alcohol *before* drawing a sweat vapor sample. If there is too much alcohol detected in the environment throughout the event, then the event will fail the Environmental Contaminant Test and it will *not* be confirmed as alcohol consumption.

- It assumes there is nothing significant about the wearer’s skin properties or body chemistry that might throw off the correlation between the reaction in the fuel cell and the concentration of alcohol in the person’s body.

This statement is also false. The absorption and elimination rates used in SCRAM Systems’ confirmation criteria

are based on numerous peer-reviewed research studies and thousands of person-days of testing – research and testing which consisted of a wide variety of test-subject skin types and environmental conditions. Events with absorption *or* elimination rates faster than the rates outlined in the criteria are not confirmed as consumption. Since the SCRAM CAM device is not attempting to determine *how much* alcohol was consumed and only *that* alcohol was consumed, minor differences in skin properties and environmental conditions from one wearer to another, which may result in slight variances in TAC levels between two individuals, are irrelevant.

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Again, the assertion that SCRAM Systems makes assumptions about the "health" of its devices is false. Every eight hours the SCRAM CAM bracelet runs self-diagnostic tests on its internal hardware and software to ensure the equipment is functioning at optimal efficiency and reporting data accurately. Additionally, there is an annual equipment maintenance alert generated by the monitoring system to inform service providers the equipment is due to be returned for reconditioning and calibration. Whether it is a new device coming off the manufacturing line, or a device returned for reconditioning, the methodology used to calibrate SCRAM CAM is identical to calibrations performed on law enforcement and evidential alcohol breath-testing equipment.

Water

Ms. DeVries points to information found in the 2009 SCRAM Systems patent of its second-generation (G2) alcohol monitoring device to identify water damage as a potential angle with which to question the reliability of the device. Again, we will address her challenges individually:

- …in the version of the device created before this patent issued in 2009, water coming into the device from the atmosphere had the potential to damage the SCRAM device's internal components and impact the TAC reading.

It is true that the first-generation (G1) SCRAM CAM device suffered from internal condensation and moisture accumulation issues, and some G1 devices did experience degradation of their internal components over time.

What Ms. DeVries fails to mention is, the recorded TAC readings *declined* over time for devices affected by the moisture issue. Lower TAC readings would potentially *benefit* a client wearing the device under a court order, especially if the readings are low enough that they do not generate an alert. All of this is moot now, as ***there are no G1 SCRAM CAM devices in use any longer***.

- The patented invention attempted to solve this problem in part by taking "advantage of gravity, allowing any water droplets that form to flow out of [the device] while the subject is in an upright position (walking or standing)."

In this statement, Ms. DeVries is again providing only part of the total picture. To mitigate the internal condensation and moisture accumulation issue, SCRAM CAM G2 incorporates a fresh air inlet at the base of the device faceplate. When the device draws a sweat vapor sample to test it for the presence of alcohol, it also draws a small amount of dry ambient air through this inlet, to decrease the total relative humidity of the sample and reduce the likelihood of internal condensation. This inlet *also* acts as a "drain," as she highlights.

SCRAM Systems has acknowledged that "[c]ondensation of moisture into water droplets within an alcohol monitor can eventually damage internal components, thus reducing the service life of the alcohol monitor."[7] In other words, at least in the version of the device created before this patent issued in 2009, water coming into the device from the atmosphere had the potential to damage the SCRAM device's internal components and impact the TAC reading.

The patented invention attempted to solve this problem in part by taking "advantage of gravity, allowing any water droplets that form to flow out of [the device] while the subject is in an upright position (walking or standing)."[8] The issue with this so-called solution is obvious: to avoid water damage, the wearer must be walking or standing, which individuals do not do 24 hours a day. So there seems to be a potential reliability issue if the wearer was lying down when the device alerted to the presence of alcohol or if the person was lying down more than usual in the days or weeks before the alert.

DeVries Article Excerpt 2

The act of drawing in ambient air does increase the chances of environmental alcohol being introduced into the sample, but again, environmental alcohol reacts with the device's internal fuel cell very rapidly, whereas consumed alcohol will follow the slow absorption and elimination rates set forth in the confirmation criteria. Couple this with the aforementioned *Environmental Contaminant Test* – also in the confirmation criteria – and consumed alcohol can reliably be distinguished from environmental contaminants.

The TAC Curve

Juliana DeVries cites the case of Angel Carrillo, in which the defense called on expert witness, Dr. Joseph C. Anderson, to provide testimony regarding transdermal alcohol absorption and elimination.

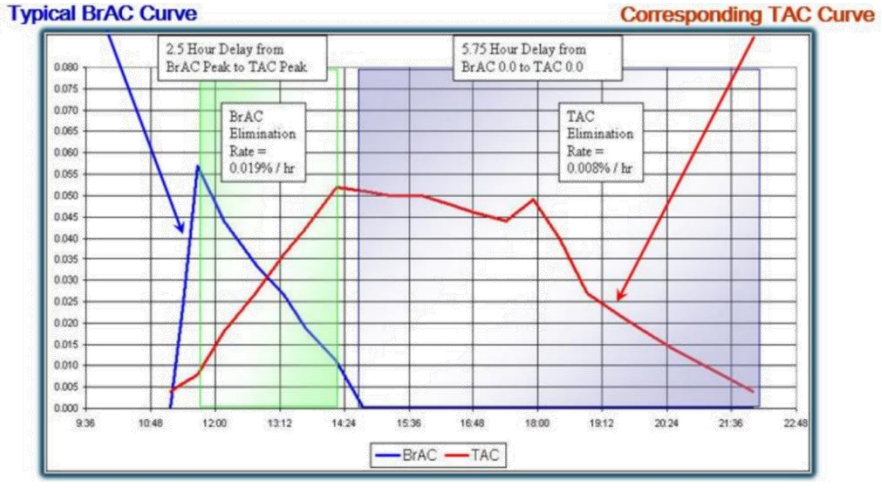
- The defense called Dr. Anderson, who testified that the TAC graph in Ms. Carrillo's non-compliance report showed a saw-toothed pattern inconsistent with alcohol consumption. The graph should have been smooth and continuous if it showed a true alcohol consumption event.

As monitored individuals move around during the course of their daily routines, the device faceplate may move slightly away from the skin and then back into contact. These movements arbitrarily cause additional fresh air to be drawn into the test chamber, thereby diluting the insensible perspiration sample. This can result in a zig-zagging type of sub-pattern in the TAC curve as it rises and falls. For this reason – and per the strict confirmation criteria – when calculating absorption and elimination rates, SCRAM Systems looks at the overall trend of the curve from zero TAC to peak TAC and back to zero TAC, and not from individual reading to individual reading.

- The defense also introduced evidence from an Ignition Interlock Device showing zero Blood Alcohol Content at the time when the SCRAM device showed an elevated TAC reading.

The court upheld the defense's arguments in this particular case; however, TAC test results will *almost never* match BrAC or BAC test results.

Skin is made up of multiple layers of dense tissue and as such has different pharmacokinetic properties than internal organ membranes. TAC levels will register lower than BAC or BrAC levels for the same drinking event because of these pharmacokinetic differences. Furthermore, if you plot alcohol concentration levels on a graph over time, the TAC curve will always be delayed by comparison to BrAC or BAC curves – this is referred to as "**transdermal lag**."



TAC and BrAC Curves Measure Different Pharmacokinetic Properties

> Take, for example, the case of Angel Carrillo. Ms. Carrillo was accused of violating a no-drinking condition based on a "SCRAM System Non-Compliance Report" alleging she drank alcohol. At the hearing on the alleged violation, prosecution witnesses testified that Ms. Carrillo's SCRAM device was properly calibrated and working correctly at the time of the alert. The defense called Dr. Anderson, who testified that the TAC graph in Ms. Carrillo's non-compliance report showed a saw-toothed pattern inconsistent with alcohol consumption. The graph should have been smooth and continuous if it showed a true alcohol consumption event.
>
> The defense also introduced evidence from an Ignition Interlock Device showing zero Blood Alcohol Content at the time when the SCRAM device showed an elevated TAC reading. Ms. Carrillo testified she had not drunk alcohol but that, at the time of the SCRAM alert, she had been hosting a birthday party for her son where a bottle of vodka broke. In cleaning up the mess, she spilled vodka on her skin. On these facts, the court found that the prosecution did not sustain its burden to prove by a preponderance of the evidence that Ms. Carrillo drank alcohol.[15]

DeVries Article Excerpt 3

In practice, transdermal lag yields some unexpected results for those who are unfamiliar with transdermal science. Specifically, toward the end of a drinking event – in the elimination phase – a breath test may result in a zero BrAC, but a transdermal test may still register a TAC value. This does not invalidate SCRAM CAM evidence, as Ms. DeVries asserts in the Carrillo case example; it simply demonstrates the ~1% of ingested alcohol that is eliminated by the skin occurs "lower and slower" than alcohol eliminated by the liver, lungs, and kidneys.

Hand Sanitizer and Other Environmental Contaminants

In a continuation of her argument that SCRAM CAM evidence should be challenged because alcoholic compounds exist in the environment around all of us, Ms. DeVries lists a variety of products that contain alcohol and calls special attention to hand sanitizer.

- Hand sanitizer is everywhere, especially since the COVID-19 pandemic, and typically contains at least 60% ethanol.

SCRAM Systems is aware that program participants may use hand sanitizer during the pandemic as a preventive healthcare measure. Some program participants may even attempt to exploit hand sanitizer usage as an excuse for positive alcohol detection to conceal alcoholic beverage consumption.

In late 2020 during the height of the COVID-19 pandemic, SCRAM Systems performed an internal evaluation to examine the ability of the SCRAM CAM detection and confirmation system to differentiate between the use of alcohol-based hand sanitizer and the consumption of alcohol.

The evaluation results indicated that SCRAM CAM can effectively differentiate between consumed alcohol and the topical application of alcohol-based hand sanitizer. Specifically, in cases where hand sanitizer was used in the ordinary and expected manner, SCRAM CAM was able to identify it as an environmental contaminant with 100% accuracy. Additionally, in this evaluation the SCRAM CAM system accurately identified abstinence from alcohol, consumption of alcohol, hand sanitizer use, and the presence of hand sanitizer on the bracelet.

> These alcoholic compounds are ever-present in daily life. It is therefore no answer to tell the SCRAM device wearer that they must simply avoid all potential sources of alcohol. Common beauty and household products, industrial products, foods, and medicines all contain alcoholic compounds that could create an elevated TAC reading in the SCRAM device. Menthol is in, for example, breath mints and menthol cigarettes. Hand sanitizer is everywhere, especially since the COVID-19 pandemic, and typically contains at least 60% ethanol. Even a piece of decaying fruit releases ethanol into the atmosphere. These compounds are so ubiquitous that people accused of SCRAM non-compliance may not even know what created their false positive, even if they know they did not drink.

DeVries Article Excerpt 4

Tamper Technology

In her article, Ms. DeVries mistakenly compares the SCRAM CAM infrared (IR) sensor to the IR sensors used in medical pulse oximeters. She implies that skin color may affect their operation, which could in turn indicate racial bias in the device's design. Whereas pulse oximeters pass an IR light *through* the skin to a sensor opposite the light, the SCRAM CAM IR sensor measures the intensity with which IR light *reflects* the wearer's skin.

When the SCRAM CAM bracelet is initially placed on a client, the device takes 12 tests, five minutes apart, within the first hour of being installed. These initial tests establish a baseline reflective IR voltage reading for that particular client. Additionally, a rolling baseline is established every eight hours thereafter, whereby the bracelet drops the oldest baseline reading and replaces it with a new one, thus adjusting itself.

Since the baseline is established by measuring the IR reflectivity of each individual client's skin, it does not matter what color skin the client has. Deviations from that client's unique baseline reflectivity voltage reading are what help determine if something has been placed between the client's skin and the device faceplate. This design of measuring IR reflectivity, and the methodology of establishing a custom, self-adjusting baseline reading for each individual wearer, and then measuring deviations from that baseline, makes the SCRAM CAM device skin-tone-neutral, and by extension, racially unbiased.

> Like the pulse oximeter, the SCRAM device uses an infrared reading taken against the skin. It is therefore plausible that skin tone may affect the infrared reading in the SCRAM device, which is used to allege tampering with the device. There do not appear to be any studies that have assessed whether the SCRAM infrared reading is subject to racial bias. But there may be room for defense attorneys to request discovery related to this topic, such as to request that a defense expert be given access to the device used in the case to determine whether skin tone variability might have impacted the client's infrared reading. This issue would be most relevant when the client has an elevated infrared reading that the prosecutor is using as a basis for alleging a violation rather than in a case in which only the TAC reading is at issue.

DeVries Article Excerpt 5

Conclusion

SCRAM CAM has been the subject of or used to monitor alcohol in over 40 peer-reviewed research studies, amounting to thousands of “monitored days” of independent testing across hundreds of unique test participants. Based on these independent research studies, the SCRAM CAM device, in conjunction with SCRAM Systems’ strict confirmation criteria, accurately detected and confirmed alcoholic consumption events – true positives – 72% of the time. Because these criteria are designed to give the wearer every benefit of the doubt, these studies therefore yielded a 28% false negative (unconfirmed drinking events) rate.

False positives in these studies were very nearly non-existent with a rate of 0.3%, leaving true negatives at 99.7%. Researchers in one study that showed false positives attributed them to reporting errors amongst the participants as opposed to a failure of the device or the confirmation process. The extremely low occurrence of false positives supports the reliability of the SCRAM CAM device, as well as SCRAM Systems’ alcoholic consumption confirmation process.

Because of its proven reliability, SCRAM CAM has been validated in court since 2003, including 35 Daubert, Frye, or hybrid admissibility rulings. It is generally accepted by the relevant scientific community, professional community, and courts to be a reliable method of determining if a person consumed alcohol.