Secure Continuous Remote Alcohol Monitor: SCRAM
The purpose of the device is to assess and/or monitor the wearers’ alcohol use.

The device measures Transdermal Alcohol Concentration (TAC).

The device is a semi-quantitative tool for determining Blood Alcohol Concentration (BAC).

- Test results can enable a technician to accurately and reliably determine whether a person consumed a small, moderate or large amount of alcohol.
- The results cannot permit anyone to determine simultaneous BAC.
• People eliminate a small amount of waste products transdermally (through the skin) as perspiration
  – Sensible perspiration: sweat in the liquid phase
  – Insensible perspiration: sweat in the vapor phase (constantly present and unnoticeable)
• Approximately 1% of consumed alcohol is eliminated this way
All SCRAM System Components
How SCRAM Works

• The SCRAM anklet utilizes the same fuel cell technology as some evidential breath testing instruments and most preliminary breath testers
  – Draeger manufactures the fuel cell and uses the device in its Alcosensors
  – Over 50,000 Alcosensors are used worldwide across five continents
The fuel cell is set to measure the ethanol content of vapors to within 10% during calibration.
TAC and BAC

- TAC and BAC are related
- TAC absorption and elimination curves are similar, but not identical, to corresponding BAC curves
- TAC curves are delayed because it takes time for the body to metabolize enough alcohol to begin excreting it through the skin
  - Simultaneous TAC and BAC readings will almost never match
  - TAC peaks typically are lower than BAC peaks
  - A person’s TAC will be elevated for a time after BAC drops to zero
TAC and BAC: Absorption and Elimination Curves

- 2.5 Hour Delay from BrAC Peak to TAC Peak
- 5.75 Hour Delay from BrAC 0.0 to TAC 0.0

BrAC
Elimination Rate = 0.019% / hr

TAC
Elimination Rate = 0.008% / hr
Sensitivity

• SCRAM does not “flag” an event until three consecutive readings exceed 0.02%
  – The average person will not reach a 0.02% TAC unless the person has more than one drink in his or her system
  – This gives the wearer the benefit of the doubt
SCRAM Alcohol Measurement

- Real-World, Social Drinking
- 60+ drinking events on a variety of male subjects, 180 pound average
- Drinks consumed are self-reported
- Type of drink varies
- Existence of food in stomach and amount of food varies
- Duration of drinking varies from 30 minutes to all-day; 2 hour average

- Bracelets set to 60 minute reading intervals
- Any event whose peak TAC is less than 0.02 is not flagged by definition
Confirmation Process Tampers & Consumption

AMS Criteria for Consumption
1) Was zero established?
2) Was absorption rate less than 0.05% P/H?
3) Was a peak established?
4) Was zero re-established?
5) Was elimination rate less than 0.025% P/H (peak < 0.15%) or less than 0.035% P/H (peak >0.15%)?
6) The total elimination time must fit within that produced by an elimination rate from .003% to .025% (peak<0.15%) or 0.035% (peak>0.15%)
7) Does it pass the contaminate test?
Reporting Process

Service Provider

Submit Violation Report to Authority

Client is questioned

Does client have an excuse?

If YES

Provide all relevant Material to AMS

Reviewed by AMS. Is there reason to believe potentially environmental?

If YES

Develop test plan and test environment

Does testing indicate environment could produce a detection?

If YES

Rescind confirmation and notify authority

Violation Stands

If NO

Environmental Claims will be evaluated

1) Work environment and schedule required entry into SCRAMNet.
2) Many environments already evaluated

If NO

Violation Stands
Compliant Subject
Non-Compliant Subject

Subject consumed: 5 Screwdrivers

Absorption Rate = 0.031% per hour
Elimination Rate = 0.010% per hour
Compliant IR Distance Readings

95% of all IR readings should remain within the range identified by the red lines.
Multiple IR Obstructions

- Wet Paper Towel
- Tan Sock
- Aluminum Foil
SCRAM flags potential drinking events
  – It regularly records alcohol levels at predetermined intervals

A trained and experienced technician interprets the reported results to confirm potential drinking events

The process is designed to eliminate false confirmations
Potential Sources of Error

- Tampering
- Interferants
- Mechanical errors
- Human error
Tampering

- SCRAM is designed to be tamper resistant.
- It features a:
  - Tamper strap and securing clip
  - Temperature sensor
  - Infrared sensor to detect obstructions
- The device flags potential tampers
- Technicians confirm tampers
  - They give every reasonable benefit of the doubt to the wearer
  - If they are not sure, they will ask the service provider to interview the wearer and inspect the device
Obstruction Confirmation Criteria

Tamper over:
- 8 hours with the IR voltage deviation equal to or greater than (+)12% of the baseline voltage, and no TAC level.
- 3 hours with the IR voltage deviation equal to or greater than (+)12% of the baseline voltage, and a TAC level present during the same time span.

• Tamper Under:
- 8 hours with the IR deviation equal to or less than (-)17% of the baseline voltage, and no TAC level.
- 3 hours with the IR voltage deviation equal to or less than (-)17% of the baseline voltage, and a TAC level present during the same time span.
Interferants

- Interferants are contaminants that may cause an elevated alcohol concentration reading
- AMS provides users with a list of interferants to avoid
  - Users sign agreements promising to avoid these interferants
- Detecting interferants is relatively easy for trained technicians
  - Consumed alcohol and interferants produce distinctly different alcohol curves
  - Technicians can distinguish consumed alcohol from interferants by examining absorption and elimination rates
Detecting Interferants: Using the Absorption Curve

- Interferants typically produce “absorption” curves between 0.096% and 0.573% per hour
- People usually absorb alcohol more slowly
- AMS will not confirm events where the absorption rate is greater than 0.05% per hour
  - This gives the defendant the benefit of the doubt
Interferant: Un-leaded Gasoline Spilled Indoors

Un-leaded Gasoline Spilled Indoors results:
Peak value: 0.437%
Absorption Rate: 0.514% Per Hour
Elimination Rate: 0.041% Per Hour

Applied 600 mL of Gasoline to towel
Left Garage Environment
Detecting Interferants: Using the Elimination Curve

- Alcohol is eliminated in a fairly linear and predictably slow fashion
  - The average person eliminates between 0.015% to 0.020% per hour
  - An alcoholic can eliminate a bit faster, some as high as 0.035% per hour
- AMS will not confirm events where the elimination rate is greater than 0.025% per hour if the peak TAC is less than 0.15% or 0.035% per hour if the peak TAC is greater than 0.15%.
- Interferants are “eliminated” much more rapidly or much more slowly and produce distinctly different curves
Interferant: “Awesome Cleaner”

Absorption Rate = 0.191% per hour
Absorption Rate = 0.022% per hour
Interferant: “Awesome Cleaner”

Elimination Rate = 0.030% per hour
Elimination Rate = 0.014% per hour
Mistakes can be readily identified
- The wearer’s TAC is regularly recorded, which allows for pattern analysis and recognition
- AMS uploads all SCRAM readings
- The results are charted and available
- The wearer, his or her attorney or expert, and the court can review the data

AMS has tested multiple interferants

AMS strives to give every reasonable benefit of the doubt to the wearers
- AMS will test any alleged contaminants or faulty devices upon request
History of Transdermal Transport and TAC Testing

1936-1980
- Initial studies on transdermal transport

1980-1984
- Research on sensible perspiration and sweat patches

1985-2000
- Studies on insensible perspiration and fuel cell devices

Conclusions:
- Ethanol excreted in sufficient quantities; reliable estimation of BAC
- Transdermal peak values delay behind breath peak values by 30-180 minutes
- No false positives occurred in sober test subjects during daily activity, sleep, or vigorous exercise
Transdermal Transport is Widely Recognized

- Nicotine patches
- Birth control patches
- Scopolamine patches (for seasickness)
- Nitroglycerine for chest pain
- Blood pressure drugs
- Narcotic pain medicines
- Vick’s Vapor Rub
- Muscle relaxants
Transdermal alcohol testing is a generally accepted method to measure alcohol use.
Non-Peer Reviewed Studies Conducted with SCRAM Bracelet

• National Law Enforcement and Corrections Technology Center (NLECTC)- NW in Alaska

• Acadiana Criminalistics Laboratory, LA

• Michigan Department of Corrections (MDOC)
Peer Reviewed Studies Conducted with SCRAM Bracelet

• University of Colorado Health Sciences ("Validity of Transdermal Alcohol Monitoring: Fixed and Self-Regulated Dosing" (Sakai JT (2006) Alcohol Clin. Exp. Res. 30:1, 26-33))

• National Highway Traffic Safety Administration NHTSA – Evaluating Transdermal Alcohol Measurement Devices


• Sam Houston State University ("Quantitative Determination of Caffeine and Alcohol in Energy Drinks and the Potential to Produce Positive Transdermal Alcohol Concentrations in Human Subjects" (Kerrigan, Sarah (2009) Journal of Analytical Toxicology, Vol. 33, 27-33))

• Brown University ("Contingency management for alcohol use reduction: A pilot study using a transdermal alcohol sensor" (Nancy P. Barnett (2011) Drug and Alcohol Dependence vol. 118))
SCRAM Usage

• Alcohol Test Performed: 839,719,758
• Unique Clients Monitored: 220,535
• Monitored Days: 20,448,379
• Highest Daily Number of Monitored Clients: 14,677
• States with Scram Programs: 49 (Not in Hawaii)
• Jurisdictions with SCRAM Programs: 2,000+

*As of the end of March, 2012
Potential Slides for Re-Direct Examination