Secure Continuous Remote Alcohol Monitor: SCRAM

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

Transdermal Alcohol

- 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

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Fuel Cell Accuracy

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

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TAC and BAC: Absorption and Elimination Curves
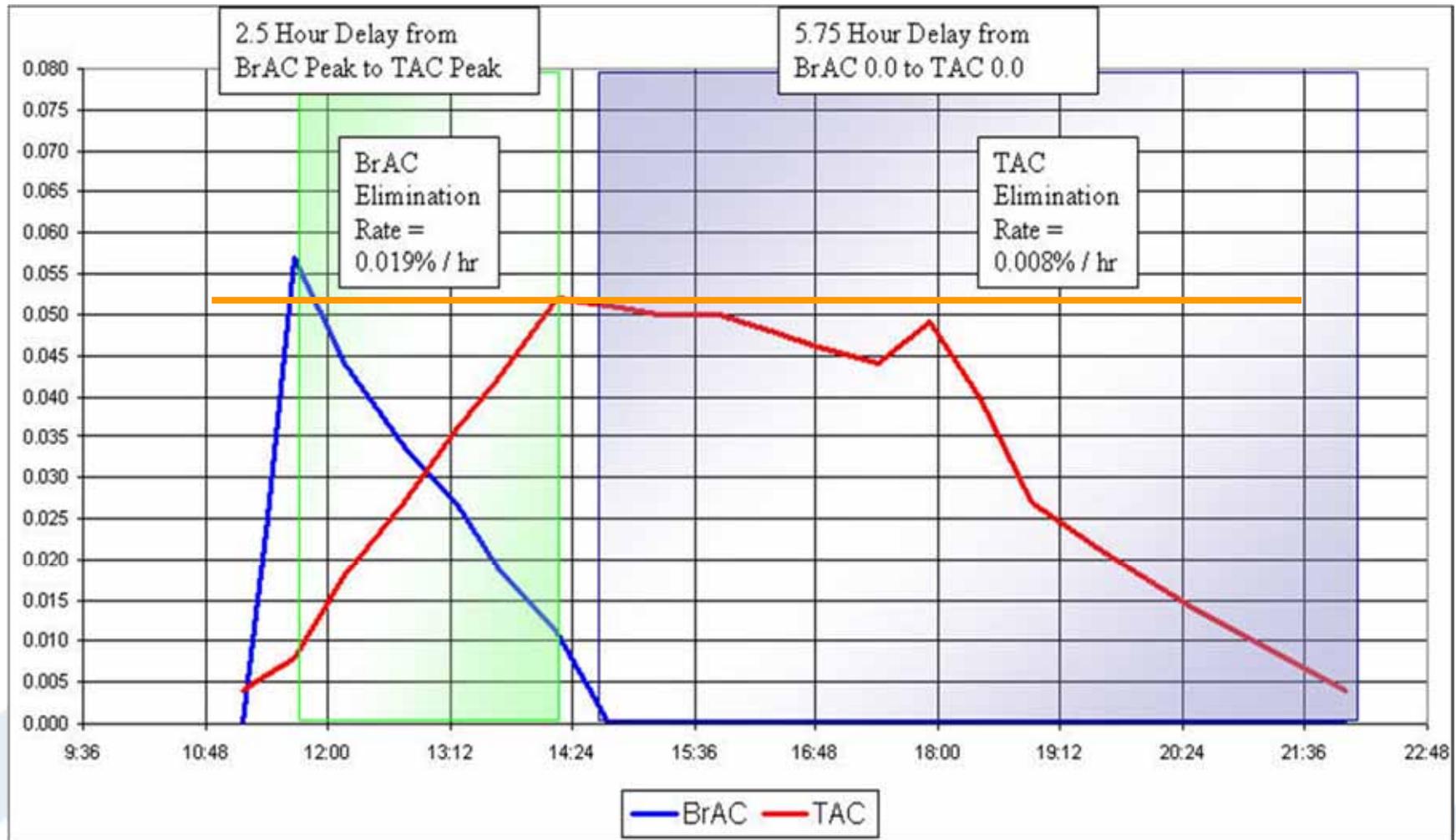
Sensitivity

- 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
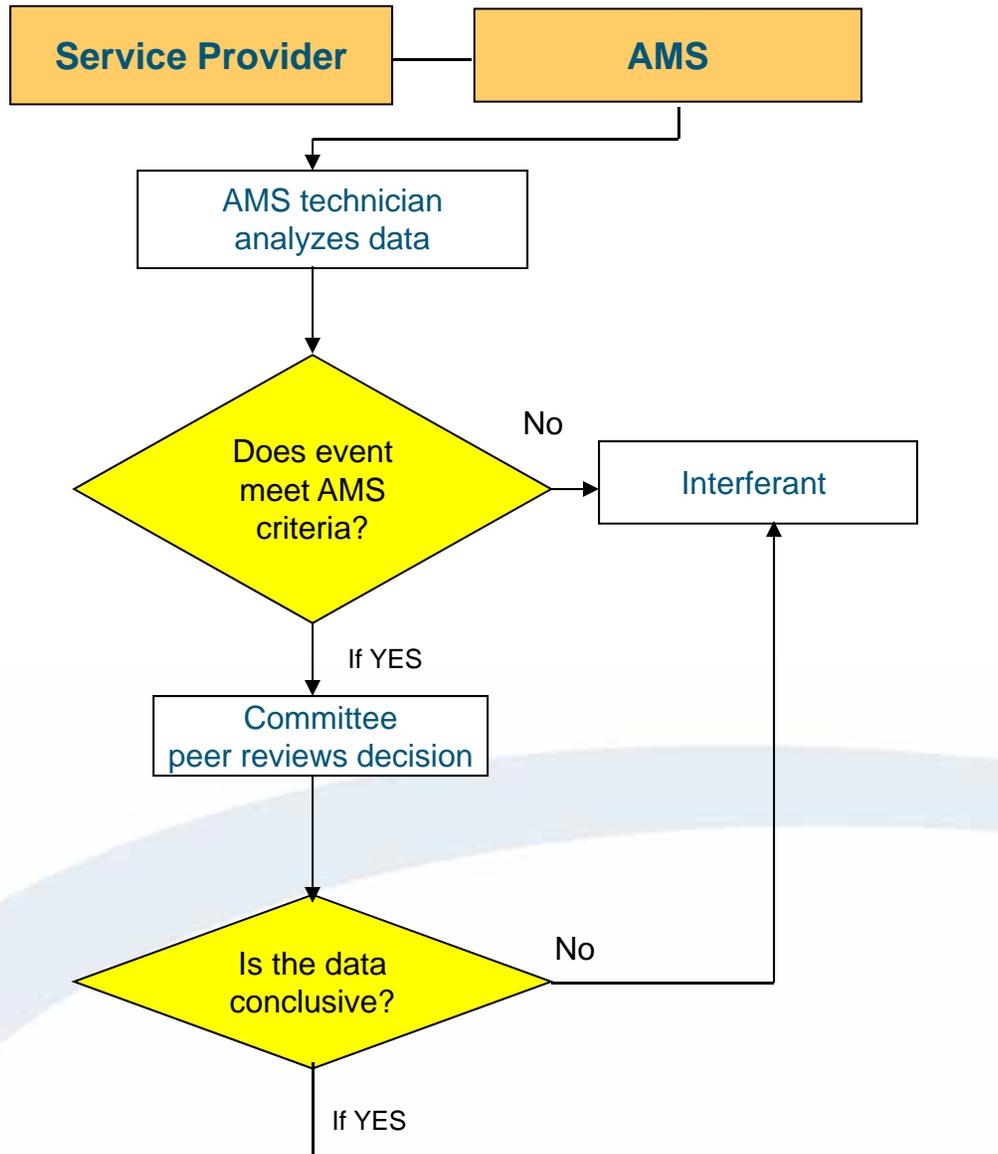 - This gives the wearer the benefit of the doubt

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SCRAM Alcohol Measurement

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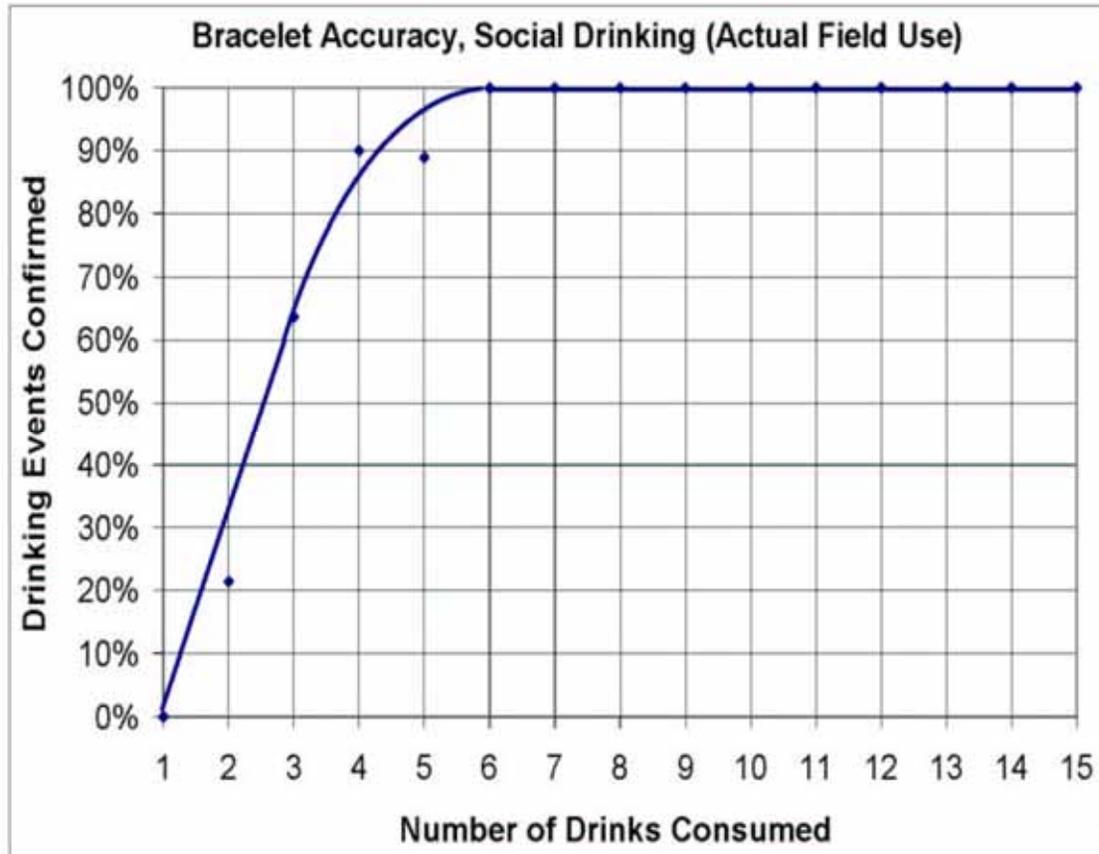
- Real-World, Social Drinking
- 60+ drinking events on a variety of male subjects, 180 pound average
- Drinks consumed are self-reported
- Type of drink varies
- Existence of food in stomach and amount of food varies
- Duration of drinking varies from 30 minutes to all-day; 2 hour average

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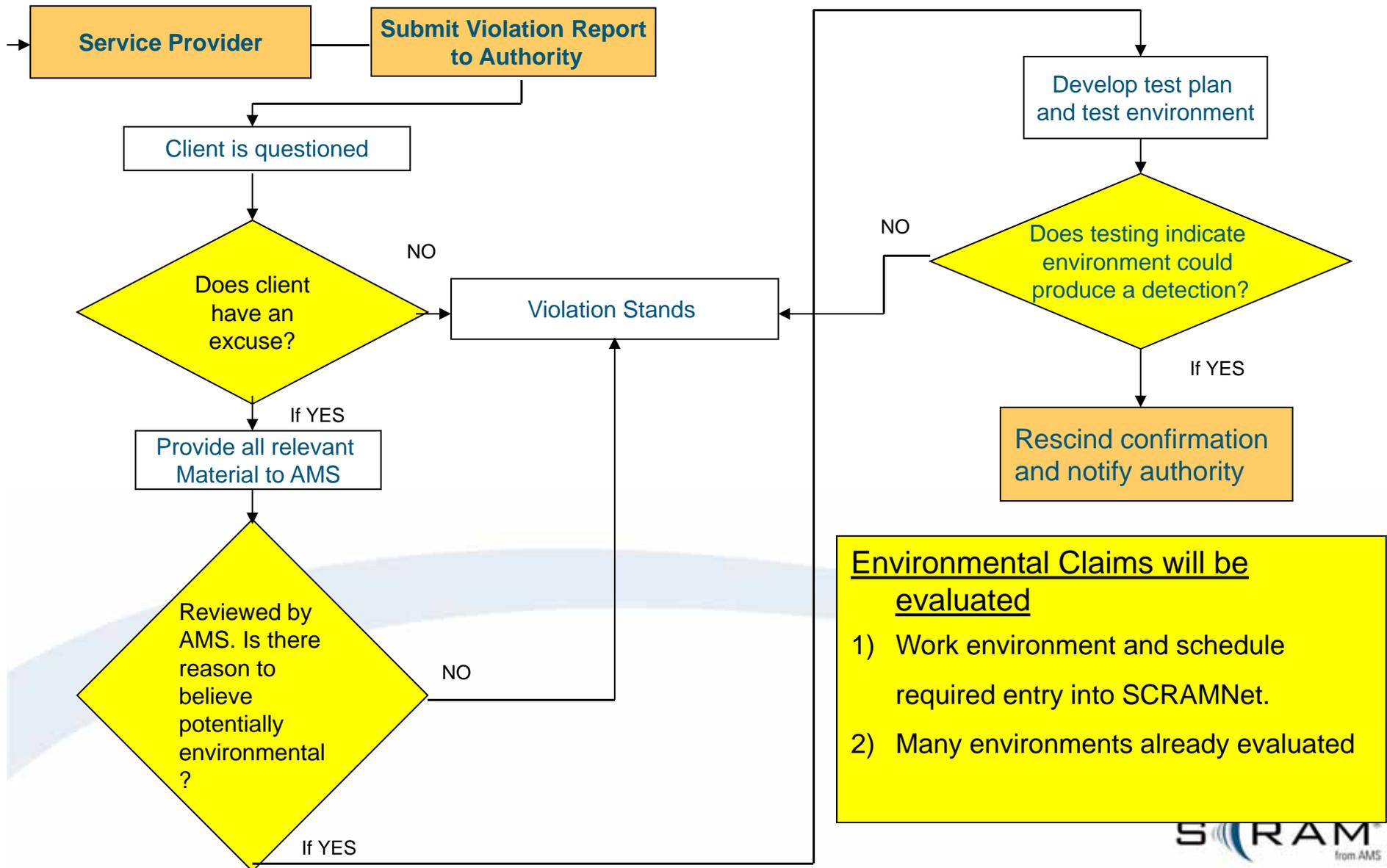- Any event whose peak TAC is less than 0.02 is not flagged by definition
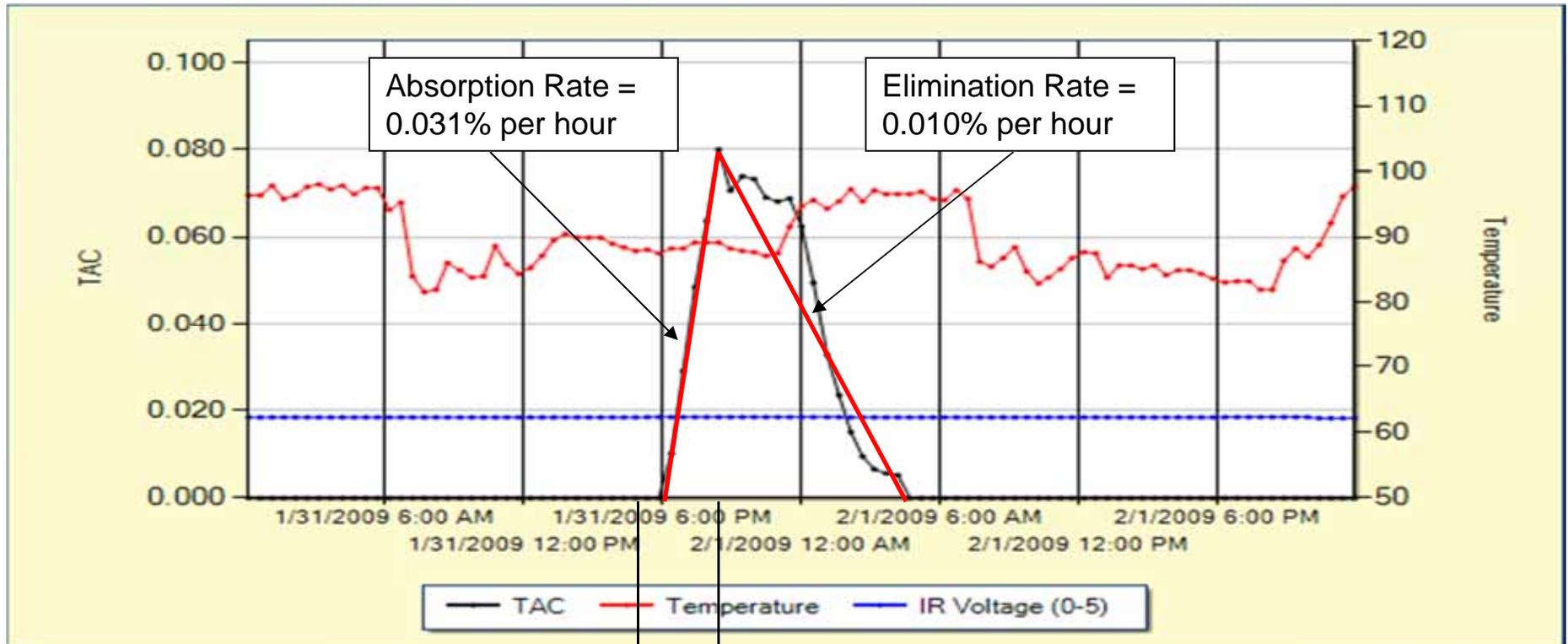
Confirmation Process Tampers & Consumption

Service Provider   **AMS**

AMS technician analyzes data

Does event meet AMS criteria? — No → Interferant

If YES

Committee peer reviews decision

Is the data conclusive? — No → Interferant

If YES

Confirm violation

Service Provider

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? — NO → Violation Stands

If YES ↓

Provide all relevant Material to AMS

↓

Reviewed by AMS. Is there reason to believe potentially environmental? — NO → Violation Stands

If YES ↓

Develop test plan and test environment

↓

Does testing indicate environment could produce a detection? — NO → Violation Stands

If YES ↓

Rescind confirmation and notify authority

Environmental Claims will be evaluated

1) Work environment and schedule required entry into SCRAMNet.

2) Many environments already evaluated

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Compliant Subject

Non-Compliant Subject

Absorption Rate = 0.031% per hour

Elimination Rate = 0.010% per hour

Subject consumed: 5 Screwdrivers

TAC   Temperature   IR Voltage (0-5)

Compliant IR Distance Readings

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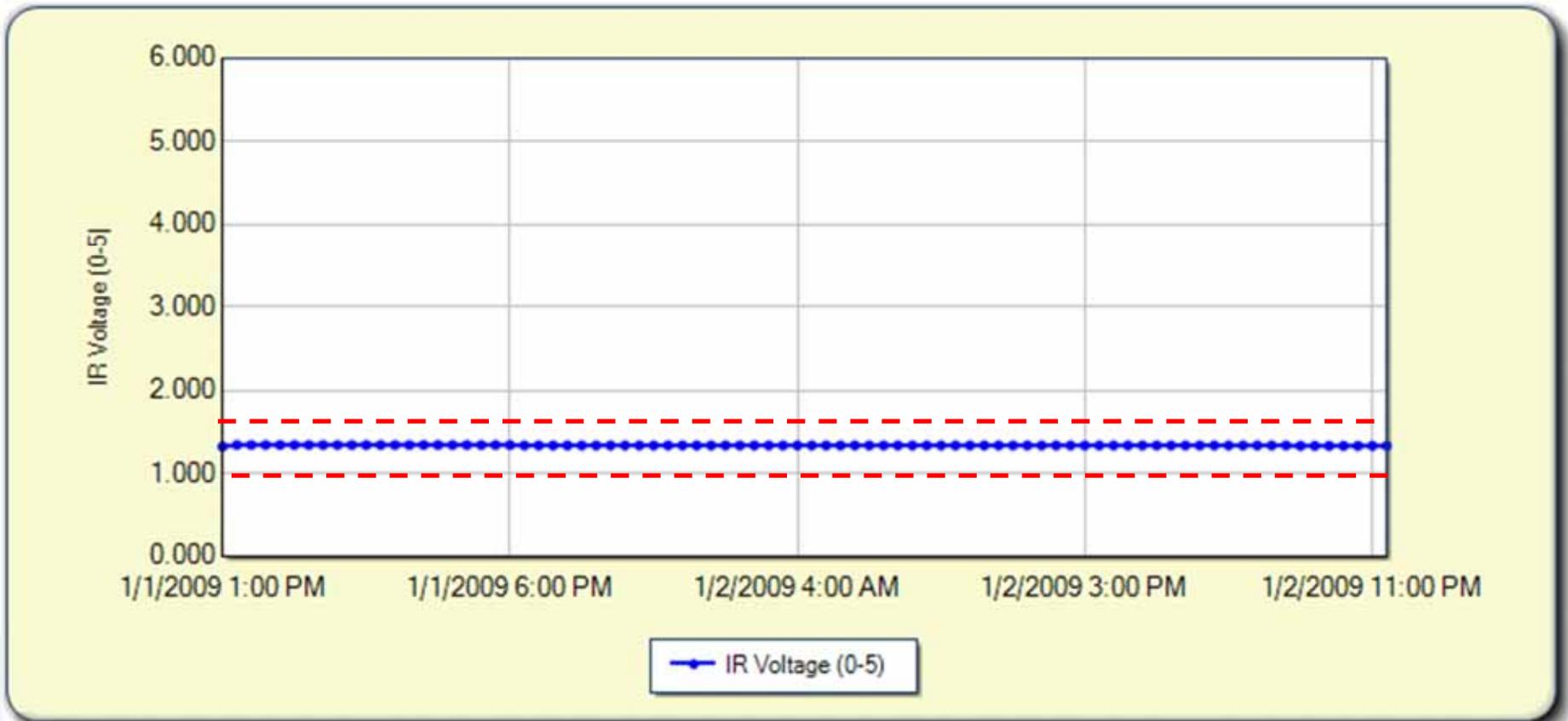
Multiple IR Obstructions
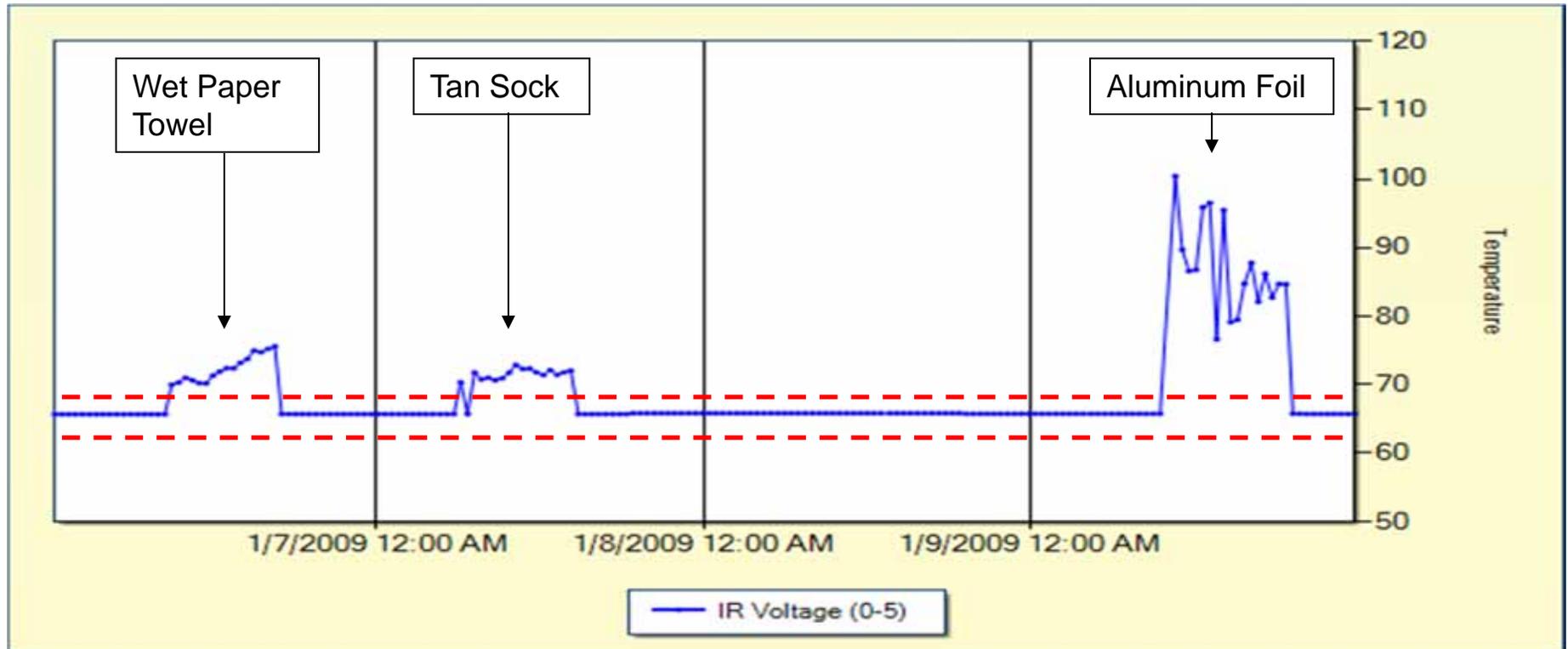
Confirmation

- SCRAM flags potential drinking events

  – It regularly records alcohol levels at pre-determined intervals

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

- The process is designed to eliminate false confirmations

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Potential Sources of Error

- Tampering
- Interferants
- Mechanical errors
- Human error

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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

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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.

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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

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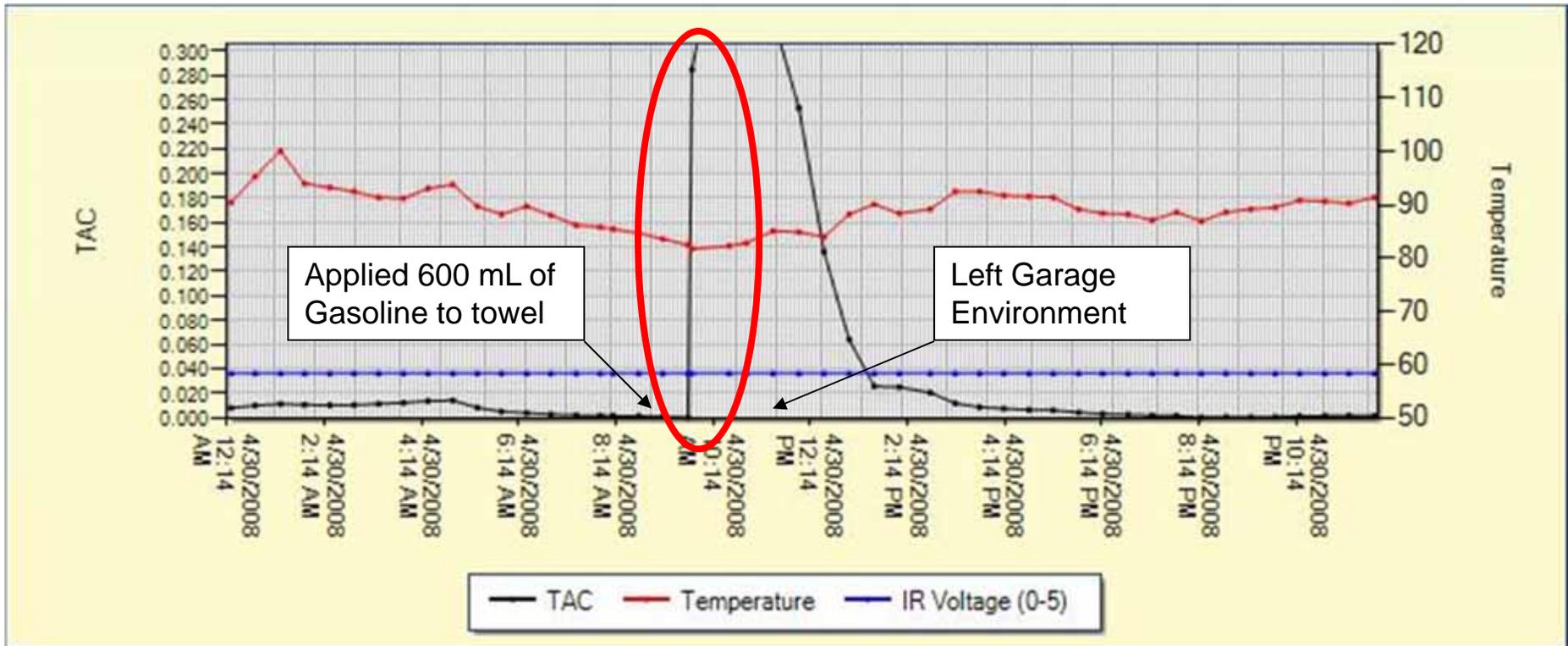
Un-leaded Gasoline Spilled Indoors results:
Peak value: 0.437%
Absorption Rate: 0.514% Per Hour
Elimination Rate: 0.041% Per Hour

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%.
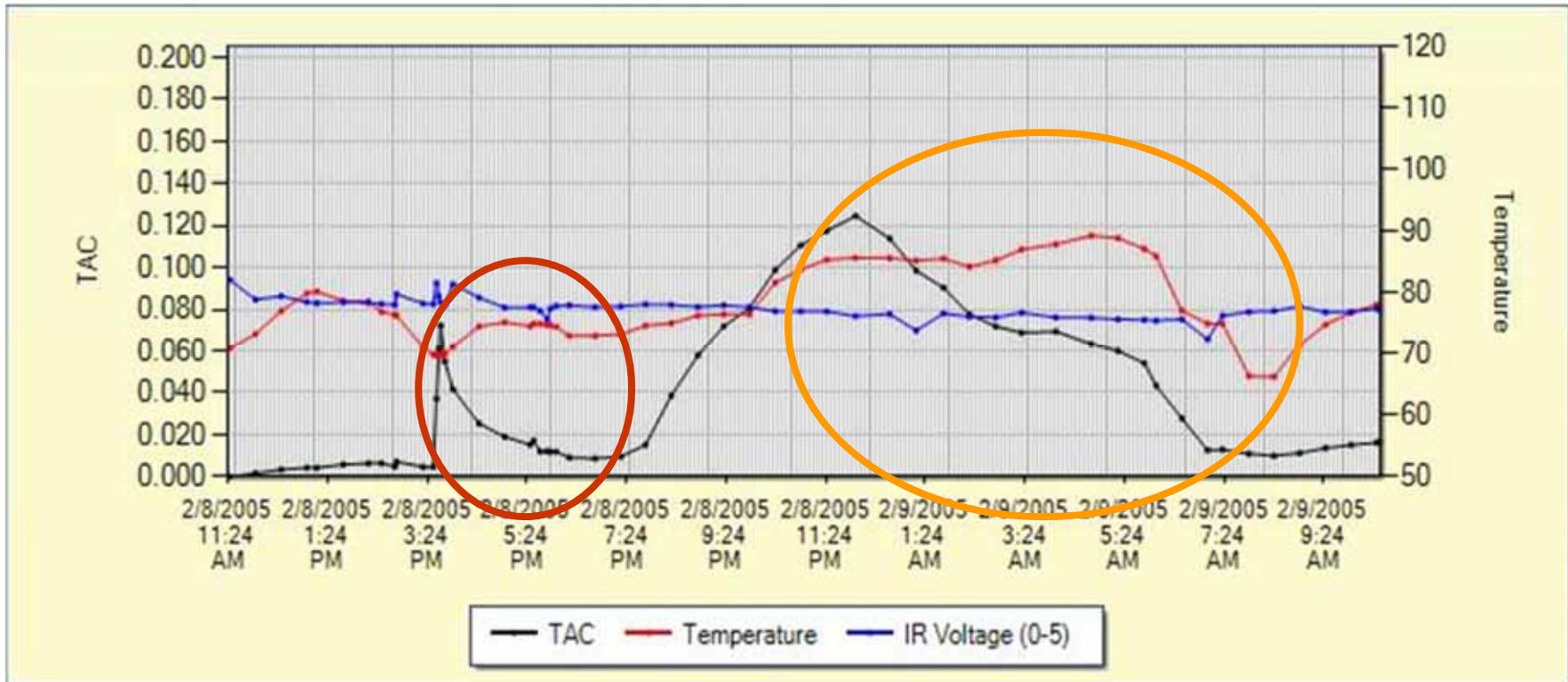- Interferants are "eliminated" much more rapidly or much more slowly and produce distinctly different curves

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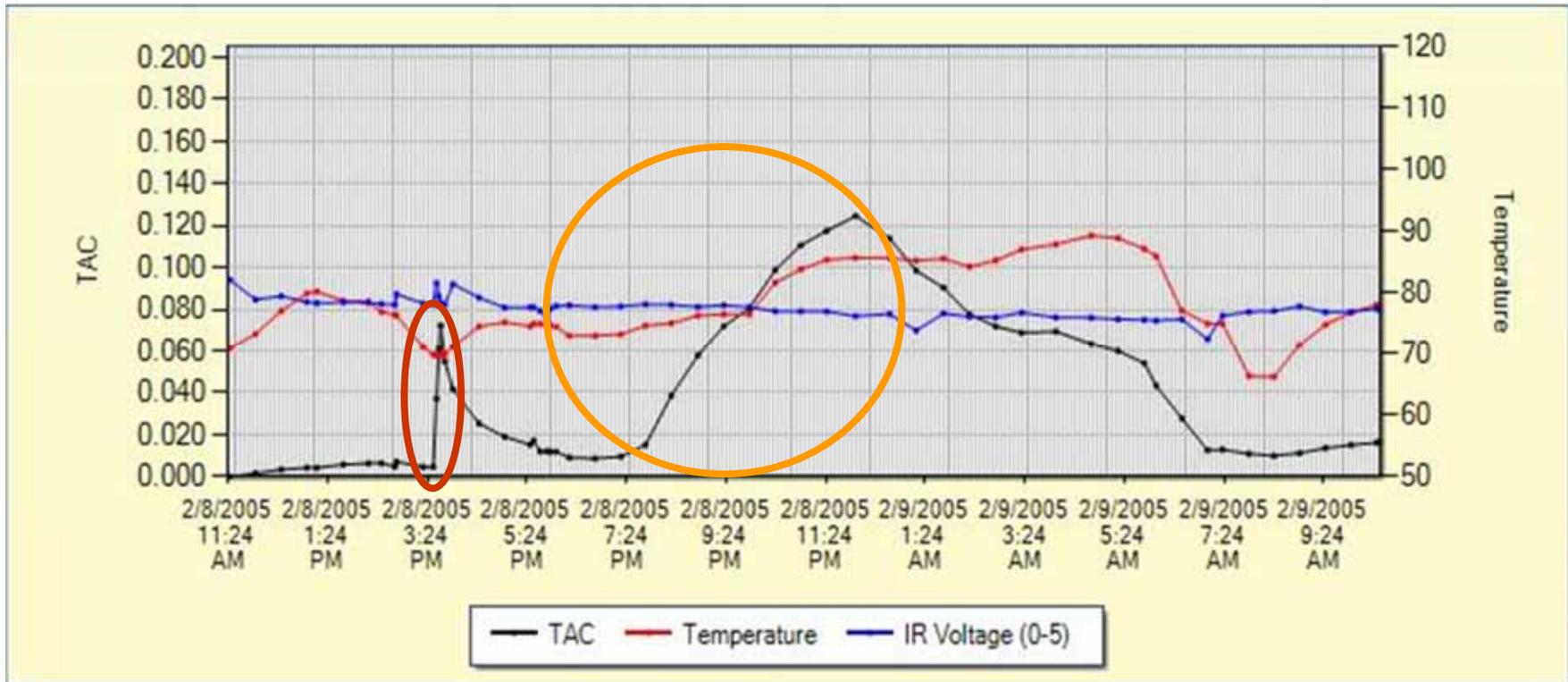
Absorption Rate = 0.191% per hour   Absorption Rate = 0.022% per hour

Interferant: "Awesome Cleaner"

Elimination Rate = 0.030% per hour   Elimination Rate = 0.014% per hour

Safeguards and Assurances

- 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

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History of Transdermal Transport and TAC Testing

1936-1980   1980-1984   1985-2000

Initial studies on   Research on   Studies on insensible
transdermal   sensible   perspiration and fuel cell
transport   perspiration and   devices
                     sweat patches

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**

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Transdermal Transport is Widely Recognized

- Nicotine patches
- Birth control patches
- Scopalomine patches (for seasickness)
- Nitroglycerine for chest pain
- Blood pressure drugs
- Narcotic pain medicines
- Vick's Vapor Rub
- Muscle relaxants

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TAC Testing is Generally Accepted

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

- "Field and laboratory Alcohol Detection With 2 Types of Transdermal Devices"(*Marques PR (2009) Alcohol Clin. Exp. Res. 33:4, 703-711*)

- 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