DEPARTMENT OF FORENSIC SCIENCE
METHOD VALIDATION SUMMARY FORM

Section: Trace Evidence

Method: Gasoline Sufficiency - data interpretation method

Results recorded? ✔

Procedure documented? ✔

Method fit for use? ✔

Approved by: *Rob Weimer* Date: 03/15/23

Incorporated into SOP Rev 16 as 4.8.8 and Sufficiency Workbook added as controlled doc in Qualtrax. Both released 03/03/23.

Rob Weimer

Resources removed from ∧access in the Trace Shared Folder that were uncontrolled. RBW   RBW 3/15/23

100-F106 Method Validation Summary Form
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Qualtrax Revision 2
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MEMORANDUM

To: Robyn Weimer, Chemistry Program Manager

From: Brenda Christy

Date: February 14, 2022

Subject: Gasoline Sufficiency, internal validation and training

The gasoline sufficiency workflow was created, tested, and published by Trace Evidence examiners at the DFS. This workflow provides a mechanism to systematically and statistically evaluate a sample for support for a gasoline identification. Although, this workflow does not draw a conclusion on a sample, any sample that has points that fall into the negative region, would not have support to identify gasoline, and those in the non-complex region have sufficient support to identify gasoline. The samples that fall into the complex region would need transparent documentation supporting the conclusion drawn. The plot values, and graph showing the plotted values with the decision lines, serve as a portion of this documentation.

The workbook has been protected from alteration to the maximum extent allowable by Microsoft Excel and the protected version placed on the Trace Shared drive. The retention time worksheets cannot be protected, but only collect raw data including retention times and peak heights (either from a copy/fit to column or by manual calculation and entry. If protected the fit to column function will not work and the worksheet would not allow for manual entries. Every other worksheet including all of those with formulas and the sufficiency graph are protected from alteration. The master copy is password protected.

The publication can be found:

> Brenda Christy, Kelsey Winters, Alexandria Rossheim, Reta Newman, Larry Tang, "A foundational study of fire debris interpretation using quantitative measures of chromatographic features in gasoline and the use of graphical display to demonstrate data sufficiency", *Forensic Chemistry*, Volume 24, 2021, 100337, ISSN 2468-1709, https://doi.org/10.1016/j.forc.2021.100337.
> (https://www.sciencedirect.com/science/article/pii/S2468170921000333)

As mentioned in the publication, the DFS fire debris examiners were involved in several iterations of the reproducibility study. This work assisted in identifying areas requiring clarification and further direction. Throughout the iterations, the additional developed guidance and training allowed the examiner results to cluster closer together. An overview of the developed guidance was published in the paper for reference by additional users.

Internal examiner training included:

December 16, 2019 – All day, in-person training at the Eastern Laboratory. This training included an overview of the project to date and detailed training on the Foray software and Adobe platforms. Examiners were asked to practice 2-3 known gasoline samples.

April 2020 – individualized phone and computer-based training on the sufficiency workbook and its use was provided by Alex Rossheim to Chad Schennum, Katie Hafer, and Michelle Drake. Instructions were emailed to each of these individuals.

May 5, 2020 – a meeting was held to discuss the results of the first set of samples with all of the participating examiners.

May 21, 2020 – A question/answer session was facilitated between Foray and DFS examiners. This session specifically addressed the use of the Foray software and Adobe platforms.

Reproducibility study during the research process:

First samples assigned April 10, 2020.

A second round of samples were assigned May 4, 2020. Results from the second round clustered closer together demonstrating a cohesive understanding of the process by all examiners.

Practice samples following the research publication:

March 23, 2021 – Examiners were requested to analyze known gasoline samples and ensure that the resulting sufficiency values plotted into the non-complex gasoline "green" region. The results from this activity were not collected, however each examiner reported successfully completing this activity.

April 27, 2021 – Kelsey Winters made a folder in the Trace shared drive called Gasoline Workflow. The folder contained:

- Agilent ChemStation macros needed for this process and instructions for installation
- A PowerPoint Presentation that explains the excel template and the steps involved in processing a sample
- Automated Processing Template (Master Copy) – for others to copy to their computer
- Peak maps for the TIC and EIPs
- A filled out excel workbook and the gasoline data file as a completed example
- Retention Time Worksheet –the use of is optional
- Guidance for using the sufficiency method
- Formula Documentation - A detailed document listing all of the formulas used in the excel workbook, with some brief explanations

The fire debris examiners each assigned three practice samples, including one that contained very little matrix contribution, one with a minor amount of matrix contribution, and one with significant matrix contribution.

October 10, 2021 – The results from the assigned practice samples were collected and evaluated. Each examiner successfully completed this activity with minimal questions.

January 21, 2022 – Extensive peer reviewed research was conducted to create a statistically supported, more objective method to evaluate samples for the potential presence of gasoline. This process is well documented in the publication and supporting materials are available to DFS fire debris examiners on the Trace Shared Drive.

At this point, each examiner has had an opportunity to complete numerous practice samples and has demonstrated competence. It is recommended that the data analysis methods be incorporated into the Trace Evidence SOP for any samples suspected to contain gasoline that show matrix contribution. Further, it is recommended that the case file for the sample contain, at a minimum, a print out of the plot values for the sample on the sufficiency graph with the decision lines.

RESULTS from unpublished practice samples –

April 2021 assigned samples – VMS1, either VMS 16 or 30, VMS 28 or 29.

VMS1	EIP	TIC
Kelsey	64	41
Michelle	63	41
Brenda	63	43
Katie	64	38
Chad	63	40
Previously determined average	60	42

VMS16	EIP	TIC
Kelsey	55	32
Brenda	60	32
Previously determined average	62	33

VMS30	EIP	TIC
Michelle	58	34
Katie	59	35
Chad	65	34
Previously determined average	61	34

VMS28	EIP	TIC
Kelsey	63	31
Previously determined average	63	31

VMS29	EIP	TIC
Michelle	62	30
Brenda	60	28
Katie	61	30
Chad	65	34
Previously determined average	62	30