
# Finding Meaning in Forensic Chemistry

## Chemistry SAC

Jose Almirall, Chair

Feb. 20, 2018

NIST
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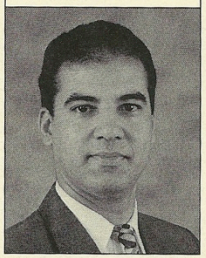
*"The forensic science community anticipates an ever-increasing role of statistical methods of analysis as databases become increasingly available on more evidentiary materials."*

*ASTM Standardization News, April 1995*

by José R. Almirall



José R. Almirall has been a criminalist with the Metro-Dade Police Department Crime Laboratory Bureau in Miami, Fla., for nine years. He has lectured and published on the topic of forensic science. Almirall has been a member of ASTM Committee E-30 on Forensic Sciences since 1994. He has a B.S. degree in chemistry from Florida International University, an M.S. in chemistry from the University of Miami, an M.P.A. from Florida International University, and is a candidate for the Ph.D. degree in the Forensic Science Unit of the University of Strathclyde in Glasgow, Scotland.

# The Evolution, Practice and Future of Science in the Administration of Justice

## The Importance of Standards in Forensic Science

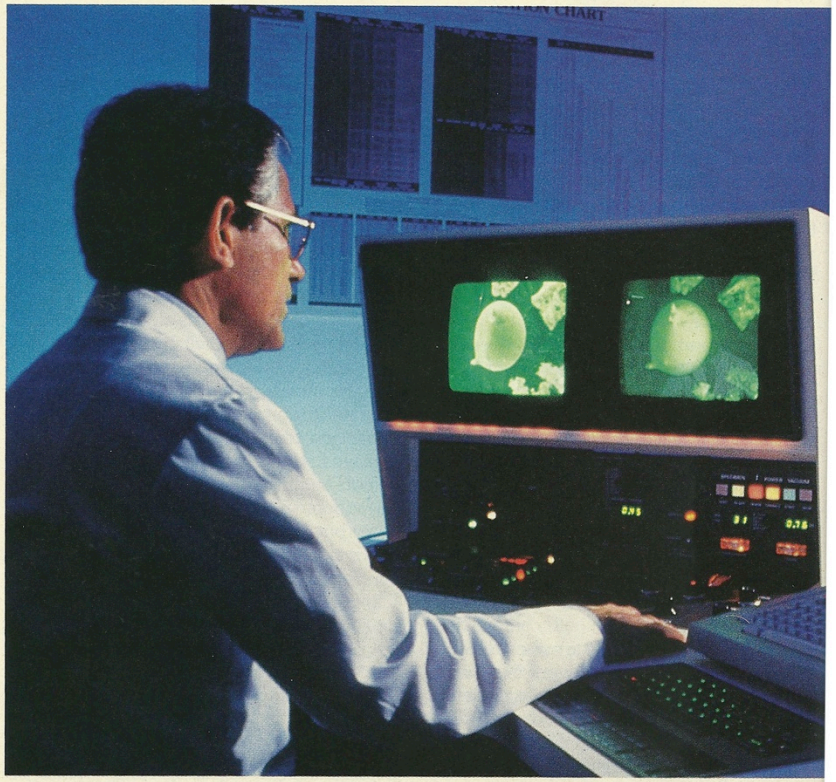


Figure 1 (right)—A criminalist examines a gun shot residue (GSR) particle by using a scanning electron microscope as described in ASTM Standard E 1588, Guide for Gun Shot Residue Analysis by Scanning Electron Microscopy/Energy-Dispersive Spectroscopy. The presence of a GSR particle on the hand of a suspect indicates the recent discharge of a firearm.

While crossing the street, a woman is struck by a speeding car that leaves the scene of the accident. The woman dies at the scene, a quiet street in a residential area. Crime scene technicians collect the physical evidence left by the car after the collision while the only eyewitness is interviewed. The eyewitness states that he is unsure of the make and model of the car but thinks that "it was blue." Broken glass and pieces of plastic are gathered from the roadside and paint chips are found on the victim's clothing.

The driver of the car is eventually identified as a suspect in the hit and run. In addition to a broken headlamp and a cracked front plastic grill, the car has very small bloodstains visible on the hood. The last piece of evidence collected is a fabric impression from the woman's garment that was transferred to the car's rubber bumper. The physical evidence is



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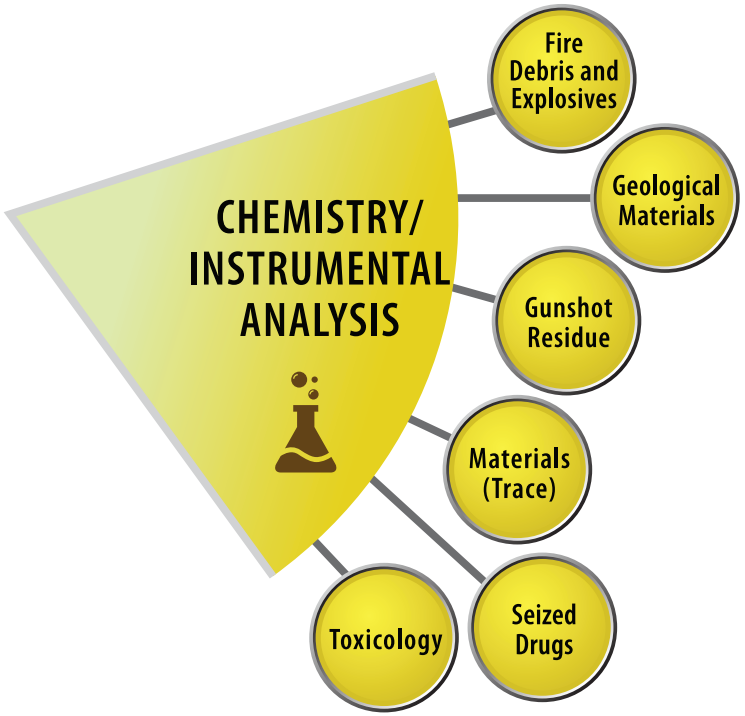
# Chemistry and Instrumental Analysis

https://www.nist.gov/topics/forensic-science/sac-chemistryinstrumental-analysis




- **Forensic Chemistry Disciplines**
- **Recognize existing (SDO) standards and help develop new standards:**
  - **Seized Drugs - 10 existing and 1 new standards**
  - **Fire Debris and Explosives - 11 existing and 4 new**
  - **Geological Materials - 8 new standards**
  - **Materials (Trace) - 13 existing and 7 new**
  - **Gunshot Residue - 1 existing and 3 new**
  - **Toxicology - 7 ASB and 5 new standards**

**Total – 50 (35 in 2017) existing and**
**20 (26 in 2017) new standards**
**70 (61) forensic chemistry standards in SDO**
**(See handout)**

**Additional standards in development within the Chemistry and Instrumental Analysis units.**

# Approved Chemistry SAC Standards on the OSAC Registry

- ASTM E2329-14 Standard Practice for Identification of Seized Drugs (Seized Drugs Subcommittee, January 27, 2016)
- ASTM E2548-11e1: Standard Guide for Sampling Seized Drugs for Qualitative and Quantitative Analysis (Seized Drugs Subcommittee, April 3, 2017)
- ASTM E2926-13: Standard Test Method for Forensic Comparison of Glass Using Micro X-ray Fluorescence (μ-XRF) Spectrometry (Materials Trace Subcommittee, July 19, 2017)

# Chemistry SAC Task Groups (TG)

- Chemistry SAC – Education and Training TG (30 members)
- Chemistry SAC – Proficiency Testing TG (8 members)
- Subcommittee Task Groups
  - **Fire Debris and Explosives – 6 task groups (34 members)**
  - **Geological Materials - 14 task groups (17 members)**
  - **Gunshot Residue - 5 task groups (29 members)**
  - **Materials (Trace) - 9 task groups (40 members)**
  - **Seized Drugs - 6 task groups (23 members)**
  - **Toxicology - 13 task groups (42 members)**

**Total - 55 task groups and 223 members***

***OSAC affiliates serve as TG members / OSAC members may serve on more than one TG**

# Research & Development Needs Identified

https://www.nist.gov/topics/forensic-science/osac-research-development-needs

**Seized Drugs - 2 projects identified**
**Fire Debris and Explosives Analysis - 10 projects identified**
**Geological Materials - 1 project identified**
**Materials (Trace) - 2 projects identified**
**Gunshot Residue - 5 projects identified**
**Toxicology - 4 projects identified**

**Total – 24 specific research projects identified by the Chemistry SAC**

# Chemistry SAC Committee Leadership

| Position | Name | Organization | Term | Email |
|---|---|---|---|---|
| Chair | Jose Almirall | Florida International University, Dept. of Chemistry and Biochemistry | 2019 | almirall@fiu.edu |
| Vice Chair | Chris Bommarito | Forensic Science Consultants Inc. | 2019 | bommarito@forsci.com |
| Executive Secretary | Chris E. Taylor* | Defense Forensic Science Center- US Army Criminal Investigation Laboratory | 2018 | chris.e.taylor.civ@mail.mil |

* New to this position in 2017

# Committee Members

| # | Name | Organization | Term | Email |
|---|---|---|---|---|
| 1 | Carl E. Chasteen | State of Florida/Fire Marshal | 2019 | carl.chasteen@myfloridacfo.com |
| 2 | Adam Negrusz* | US Drug Testing Labs | 2020 | adam.negrusz@usdtl.com |
| 4 | Eric B. Steel | NIST | 2018 | eric.steel@nist.gov |
| 5 | Patrick Buzzini | Sam Houston State University | 2018 | patrick.buzzini@shsu.edu |
| 6 | Scott R. Oulton | DEA | 2017 | scott.r.oulton@usdoj.gov |
| 7 | Stephen L. Morgan | University of South Carolina, Chemistry and Biochemistry | 2018 | morgansl@mailbox.sc.edu |
| 8 | William Guthrie | NIST | 2019 | william.guthrie@nist.gov |
| 9 | Bruce Houlihan (QIC) | Orange County Crime Laboratory / Orange County Sheriff-Coroner | 2017 | bruceh@occl.ocgov.com |
| 10 | Hal R. Arkes (HFC) | Ohio State University (Emeritus) | 2019 | arkes.1@osu.edu |

* New SAC member in 2017-2018

# SAC Committee Members (subcommittee chairs)

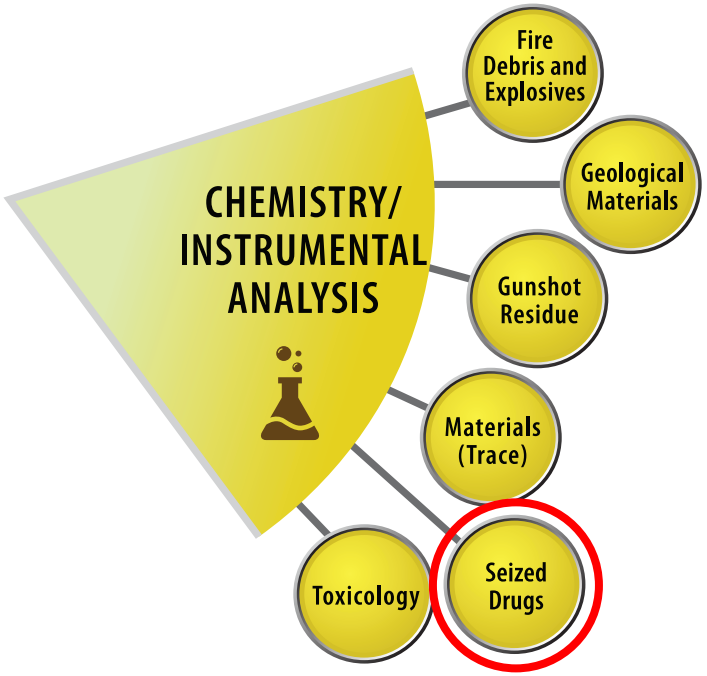
| # | Name | Organization | Term | Email |
|---|---|---|---|---|
| 1 | Sue Hetzel*, Fire Debris and Explosives | SEA Limited | 2018 | sshetzel@sealimited.com |
| 2 | Andrew M. Bowen, Geological Materials | US Postal Inspection Service Laboratory | 2020 | AMBowen@uspis.gov |
| 3 | Rodney Simmons*, Gunshot Residue | Wyoming State Crime Laboratory | 2019 | rodney.simmons@wyo.gov |
| 4 | Diana Wright*, Materials (Trace) | FBI | 2020 | dmwright@fbi.gov |
| 5 | Sandra E. Rodriguez-Cruz, Seized Drugs | DEA | 2019 | sandra.e.rodriguez-cruz@usdoj.gov |
| 6 | Marc A. LeBeau, Toxicology | FBI | 2019 | marc.lebeau@ic.fbi.gov |

* New SAC member in 2017

# Chemistry SAC Meeting, Sept. 2017

## Tampa, Florida

# Discipline Description




The Seized Drugs Subcommittee will focus on standards and guidelines related to the examination of evidence to identify drugs and related substances.

# Subcommittee Leadership

| Position | Name | Organization | Term | Email |
|---|---|---|---|---|
| **Chair** | Sandra E. Rodriguez-Cruz, Ph.D. | Drug Enforcement Administration | 2/3 | Sandra.E.Rodriguez-Cruz@usdoj.gov |
| **Vice Chair** | David K. Gouldthorpe | Las Vegas Metropolitan Police Department Forensic Laboratory | 3/3 | d13317g@lvmpd.com |
| **Executive Secretary** | Agnes D. Winokur | Drug Enforcement Administration | 2/3 | Agnes.D.Winokur@usdoj.gov |

# Subcommittee Members

| | Name | Organization | Term | Email |
|---|---|---|---|---|
| 4 | Jason Bory | US Customs and Border Protection | 4 | jason.bory@dhs.gov |
| 5 | Claire M. Dragovich | DuPage County Forensic Science Center | 4 | claire.dragovich@dupagesheriff.org |
| **6** | **Adam Fleischer** | **Oregon State Police** | **3** | **adam.fleischer@state.or.us** |
| 7 | Thomas J. Gluodenis Jr., Ph.D. | Agilent Technologies | 3/3 | tom_gluodenis@agilent.com |
| **8** | **Melissa F. Hehir** | **Georgia Bureau of Investigation** | **3** | **melissa.hehir@gbi.ga.gov** |
| 9 | Elzbieta "Ella" Kubicz , Ph.D. | Wyoming State Crime Laboratory | 4 | ella.kubicz@wyo.gov |
| 10 | Benny J. Lum | Broward County Sheriff's Office Crime Laboratory | 4 | benny_lum@sheriff.org |
| **11** | **Jackeline H. Moral** | **Houston Forensic Science Center** | **3** | **jmoral@houstonforensicscience.org** |

*** new members**

# Subcommittee Members

| | Name | Organization | Term | Email |
|---|---|---|---|---|
| 12 | Gina Nano | University of Massachusetts Medical School, Drugs of Abuse Laboratory | 3/3 | gina.nano@umassmed.edu |
| 13 | Jason Nawyn | US Defense Forensic Science Center | 3 | jason.r.nawyn.civ@mail.mil |
| 14 | Charlene Rittenbach | North Dakota Office of Attorney General Crime Laboratory | 3 | crittenbach@nd.gov |
| 15 | Sandra B. Sachs, Ph.D. | Oakland Police Department Criminalistics Laboratory | 2/3 | ssachs@oaklandnet.com |
| 16 | Amanda Shanbaum | Illinois State Police | 3 | amanda_shanbaum@isp.state.il.us |
| 17 | Annie Smith | Kentucky State Police | 3 | annm.smith@ky.gov |
| 18 | Ruth Smith, Ph.D. | Michigan State University | 2 | rwaddellsmith@gmail.com |
| **19** | **Casper Venter, Ph.D.** | **West Virginia University** | **3** | **Casper.Venter@mail.wvu.edu** |

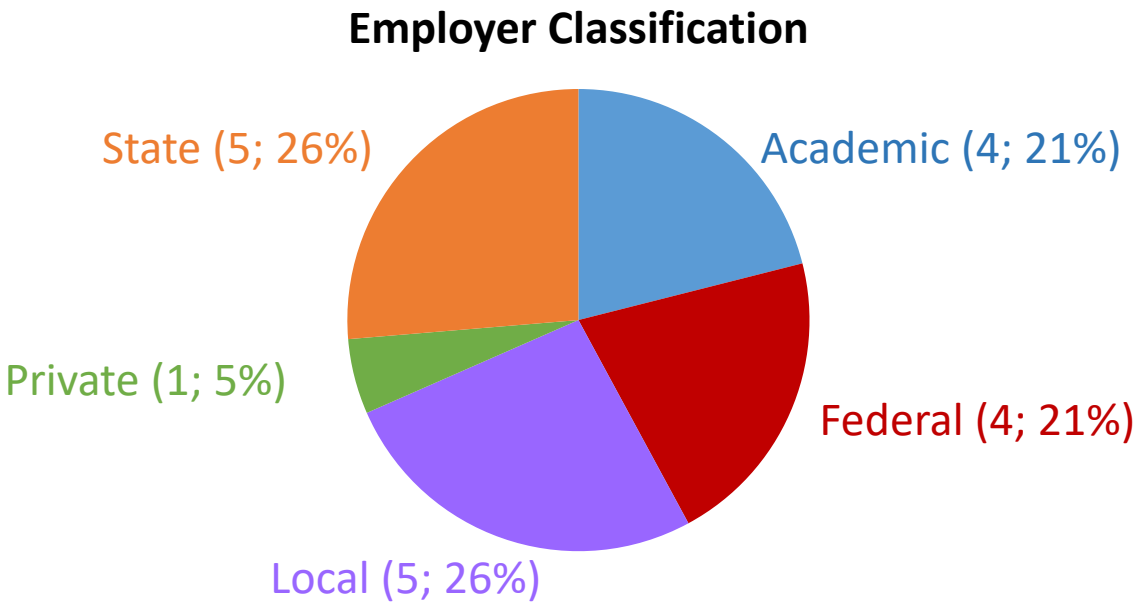
*** new members**

# Affiliates

| # | Name | Organization | Email |
|---|---|---|---|
| 1 | Garth Glassburg | Northeastern Illinois Regional Crime Laboratory | gglassburg@nircl.org |
| 2 | Thomas A. Brettell, Ph.D. | Cedar Crest College | Tabrette@cedarcrest.edu |
| 3 | Glen P. Jackson, Ph.D. | West Virginia University | glen.jackson@mail.wvu.edu |
| 4 | David J. Koppenhaver | Virginia Department of Forensic Science | david.koppenhaver@dfs.virginia.gov |
| 5 | Christian C. Matchett | US Defense Forensic Science Center | christian.c.matchett2.civ@mail.mil |
| 6 | Richard A. Paulas | Illinois State Police | rapaulas@gmail.com |
| 7 | Tiffany A. Ribadeneyra | Nassau County Office of the Medical Examiner | tribadeneyra@nassaucountyny.gov |

# Subcommittee Membership

- **2014** – Inaugural year (20 members)
- **2016** – 5 new members
- **2017** – 4 new members (starting October 2017)



# OSAC Registry Documents

- **E2329-14** (January 2016)

  Standard Practice for Identification of Seized Drugs

- **E2548-11** (March 2017)

  Standard Guide for Sampling Seized Drugs for Qualitative and Quantitative Analysis

# Current Subcommittee Projects

| ASTM Documents | |
|---|---|
| **E2764-11** | Standard Practice for Uncertainty Assessment in the Context of Seized-Drug Analysis |
| **E2882-12** | Standard Guide for Analysis of Clandestine Drug Laboratory Evidence |

**Status:** Under revision with SDO (ASTM) and sub-committee task group members.

# E2764-11:
# Standard Practice for Uncertainty Assessment in the Context of Seized-Drug Analysis

Key Components of Standard:

- Qualitative analysis
- Quantitative measurements
- Estimation of Measurement Uncertainty for Quantitative Determinations
- Reporting of Uncertainty
- Training

# E2882-12:
# Standard Guide for Analysis of Clandestine Drug Laboratory Evidence

Key Components of Standard:

- Terminology
- Safety issues
- Sampling of CL evidence
- Analysis
- Yield and capacity calculations
- Conclusions and reporting
- Training

# Current Subcommittee Projects

**DRAFT Document**

Standard Practice for Assessment of Gas Chromatography - Electron Ionization Mass Spectrometry (GC-MS) Data for Qualitative Analysis of Seized Drugs

**Status:**

- Currently being reviewed by SAC Chemistry members
- Will be available for public comments soon via the Seized Drugs webpage

# Additional Items of Interest

- **Seized Drugs** Representatives to SAC Interdisciplinary Groups :
  - Terminology
  - Proficiency Testing
  - Education/Training
  - Quality Assurance

Seized Drugs

# OSAC Toxicology Subcommittee

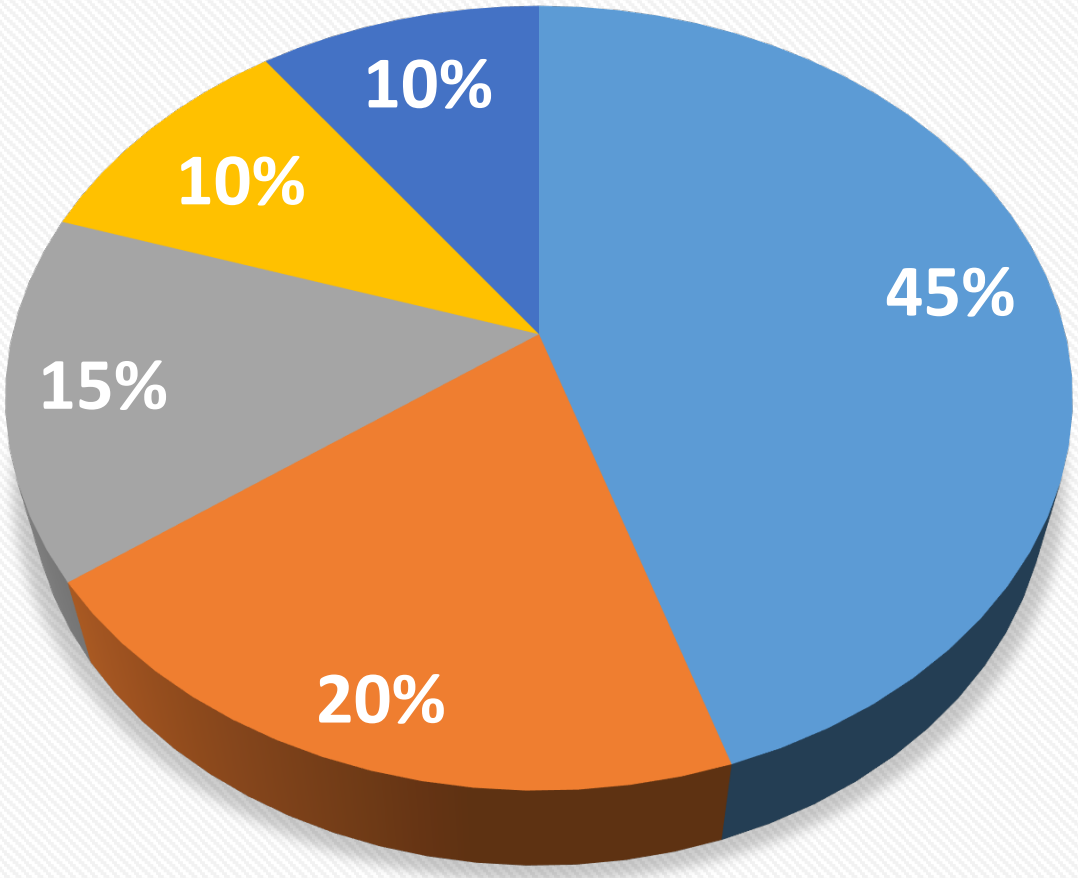
*The OSAC Subcommittee on Toxicology will focus on standards and guidelines related to the analysis of biological samples for alcohol, drugs, or poisons, and the interpretation of these results.*

- Picks up where SWGTOX stopped
- Focus is on foundational documents
- Improve existing SWGTOX documents

# OSAC Toxicology Subcommittee Members

- Dan Anderson
- Sabra Botch-Jones
- Dan Dunsworth
- Fiona Couper
- Ken Ferslew
- Marilyn Huestis
- Robert Johnson
- Matt Juhascik
- Melissa Kennedy
- Jen Limoges
- Marc LeBeau
- Laura Liddicoat
- Rob Middleberg
- Madeline Montgomery
- Suman Rana
- Jeri Ropero-Miller
- Mark Ruefenacht
- Robert Sears
- Ruth Winecker
- Tate Yeatman

# Membership Breakdown




- State/ Local Practitioners
- Researchers/Academicians
- Federal Practitioners
- Private Practitioners
- R&D Technology Partners

# Summary of Standards/Guidelines Under Draft by OSAC Toxicology Subcommittee

- Standard for Uncertainty of Measurement in Forensic Toxicology
  - Define minimum requirements for establishing measurement uncertainty in forensic toxicology
- Standard for Mass Spectrometry Data Evaluation in Forensic Toxicology
  - Establish minimum standard for setup of mass spectrometry analyses and evaluation of mass spectral data
- Standard for Minimum Testing Requirements in Forensic Toxicology
  - Define minimum expectations for testing in different subdisciplines of forensic toxicology
- Standard for Identification Criteria in Forensic Toxicology
  - Establish an identification point system to allow forensic toxicology laboratories to any combination of validated methods to confidently identify analytes
- Standard for Breath Alcohol Measuring Instrument Specifications
  - Define minimum instrument specifications


- Accredited by the American National Standards Institute (ANSI)
  - Conforms to ANSI's due process requirements for national standards
- ASB members appointed by AAFS
- Consensus Bodies (CB) responsible for technical content of documents
  - Application to become CB member
  - Balance and lack of dominance
- All CB meetings open to all interested parties

- Opportunity for public to comment on ASB documents
  - Comments are adjudicated and all comments are resolved
- ANSI approved documents become national standards
  - ASB documents will be available free-of-charge
  - Considered by OSAC for inclusion on OSAC registry

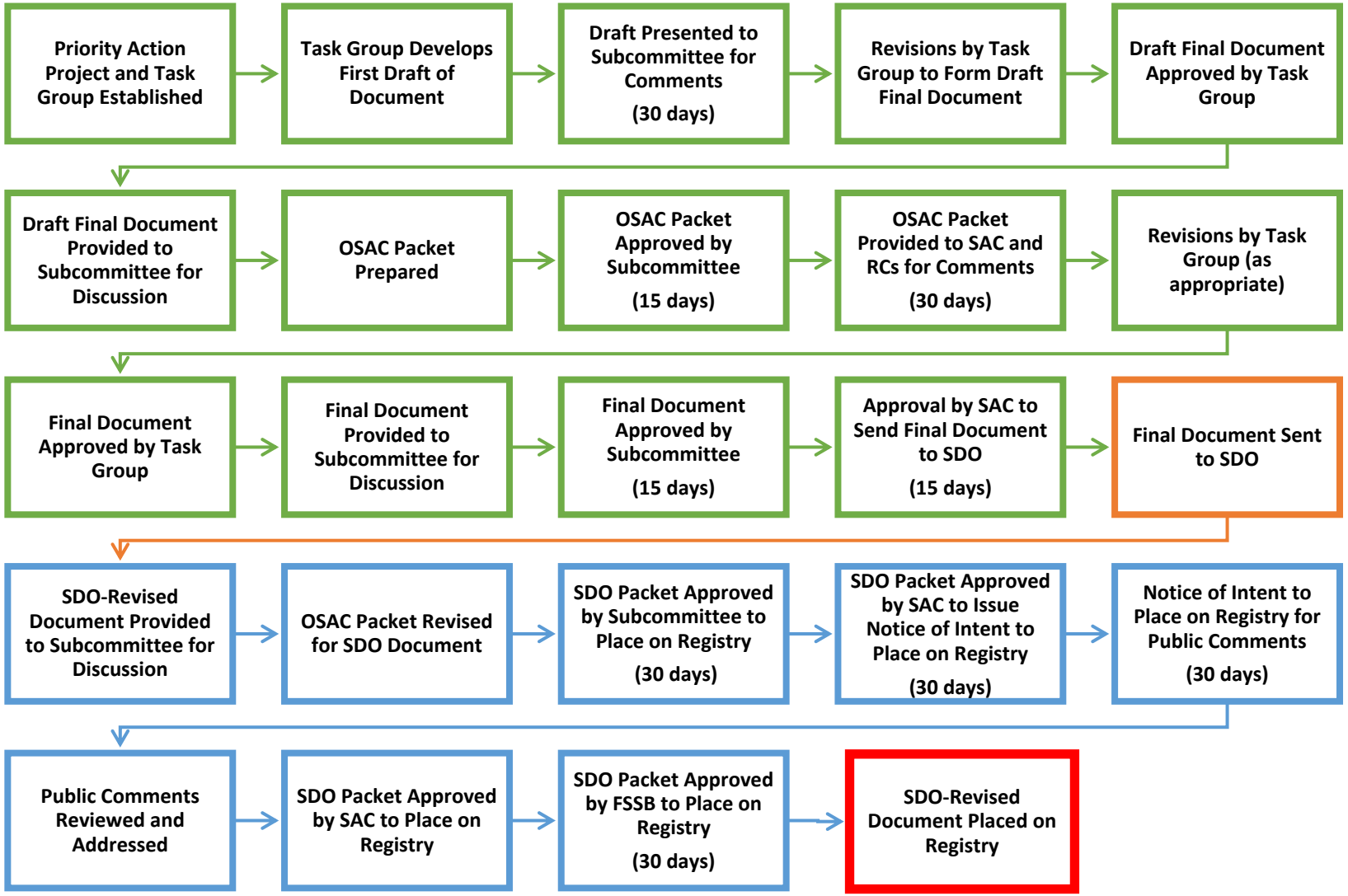
# Summary of Standards/Guidelines Drafted by OSAC Toxicology Subcommittee and Forwarded to ASB

- Standard Practices for Measurement Traceability in Forensic Toxicology
  - Minimum requirements for establishing measurement traceability in forensic toxicology laboratories
- Standard Practices for Method Validation in Forensic Toxicology
  - Minimum standards of practice for validating analytical methods in the field of forensic toxicology
- Standard Practices for a Quality Control Program in Forensic Toxicology Laboratories
  - Minimum standards of practice for quality control in forensic toxicology laboratories

# Summary of Standards/Guidelines Drafted by OSAC Toxicology Subcommittee and Forwarded to ASB

- Standard for Report Content in Forensic Toxicology
  - Minimum requirements for forensic toxicology report content
- Guidelines for Opinions and Testimony in Forensic Toxicology
  - Guidance on practices in forensic toxicology opinions and testimony
- Standard for Breath Alcohol Measuring Instrument Calibration
  - Delineate minimum standard for calibrating breath alcohol measuring instruments for evidentiary purposes

# OSAC Process



# Summary of Standards/Guidelines Finalized by ASB and Proposed for OSAC Registry

# Other Standards/Guidelines to be Drafted by OSAC Toxicology Subcommittee

- Standard for Content of Forensic Toxicology Standard Operating Procedures
- Guideline for Specimen Collection and Storage in Forensic Toxicology
- Standard for Proficiency Testing in Forensic Toxicology
- Guidelines for Education and Training in Forensic Toxicology Laboratories
- Guidelines for Education and Training in Breath Alcohol Laboratories
- Guidelines for Accrediting Bodies of Forensic Toxicology Laboratories
- Standard for Blood Alcohol Calculations

# OSAC Toxicology Roadmap

- Standard Practices for Measurement Traceability in Forensic Toxicology
- Standard for Uncertainty of Measurement in Forensic Toxicology
- Standard for Mass Spectrometry Data Evaluation in Forensic Toxicology
- Standard Practices for Method Validation in Forensic Toxicology
- Standard Practices for a Quality Control Program in Forensic Toxicology Laboratories
- Standard for Minimum Testing Requirements in Forensic Toxicology
- Standard for Identification Criteria in Forensic Toxicology
- Standard for Content of Forensic Toxicology Standard Operating Procedures
- Guideline for Specimen Collection and Storage in Forensic Toxicology
- Standard for Proficiency Testing in Forensic Toxicology
- Standard for Report Content in Forensic Toxicology
- Guidelines for Opinions and Testimony in Forensic Toxicology
- Guidelines for Education and Training in Forensic Toxicology Laboratories
- Guidelines for Accrediting Bodies of Forensic Toxicology Laboratories
- Standard for Breath Alcohol Measuring Instrument Calibration
- Standard for Breath Alcohol Testing Methods
- Standard for Breath Alcohol Instrumentation Specifications
- Standard for Blood Alcohol Calculations

# Research Gaps Identified

- Emerging Drugs of Abuse and Therapeutic Agents
  - *Develop analytical methods, evaluate existing and novel sample preparation techniques, epidemiological studies, metabolite identification, post-mortem distribution, pharmacodynamics/pharmacokinetic studies*

- Herbal and Dietary Supplements and Plant-based Toxins
  - *Develop analytical methods, improve understanding of toxicity*

# Research Gaps Identified

- Human Factors Impact on Forensic Toxicology
  - *Determine whether cognitive and contextual biases impact how cases are analyzed and conclusions made, impacts of motivational issues, fitness for duty (e.g. fatigue, visual acuity), scientific culture, group dynamics and error management*

- Postmortem Distribution and Redistribution
  - *Comprehensive tissue distribution studies to provide data on relationship between tissue and blood drug/metabolite concentrations, further characterization of chemical/biological mechanisms of PMR, specific chemical markers to provide evidence of PMR, development of mathematical relationships to evaluate PMR*


# Progress and Updates

## Gunshot Residue (GSR) Subcommittee

Chemistry/Instrumental Analysis SAC

Rodney M. Simmons Subcommittee Chair

February 20, 2018

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National Institute of
Standards and Technology
U.S. Department of Commerce

# Gunshot Residue (GSR) Subcommittee Leadership

| Position | Name | Organization | Term | Email |
|---|---|---|---|---|
| Chair | Rodney Simmons | Wyoming State Crime Laboratory | 3 | rodneymsimmons@gmail.com |
| Vice Chair | Thomas White | Texas Department of Public Safety | 3 | thomas.white@dps.texas.gov |
| Executive Secretary | Emily Weber | Hamilton Co. Coroners Lab | 3 | emily.weber@hamilton-co.org |

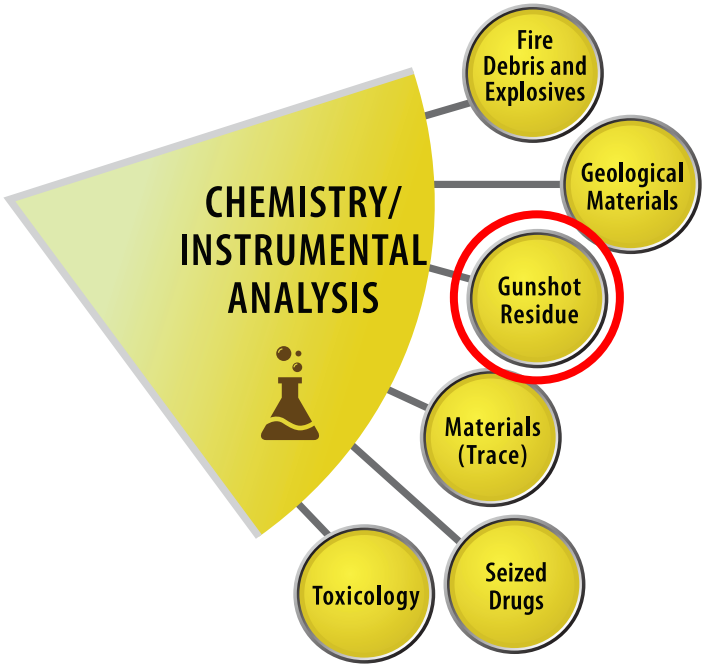
# Subcommittee Members

| # | Name | | Organization | Term | Email |
|---|---|---|---|---|---|
| 1 | Debra | Gibson | LA Co. ME | 3 | dgibson@coroner.lacounty.gov |
| 2 | Doug | DeGaetano | Virginia Dept. of Forensic Science | 3 | Doug.DeGaetano@dfs.virginia.gov |
| 3 | Candice | Bridge | University of Central Florida | | cbridge@ucf.edu |
| 4 | Koren | Powers | West Virginia Sate Forensic Lab | 4 | koren.k.powers@wvsp.gov |
| 5 | Nicholas | Ritchie | NIST | 4 | nicholas.ritchie@nist.gov |
| 6 | David | Freehling | North Carolina St. Crime Lab | 3 | Dfreehling@ncdoj.gov |
| 7 | Jesse | Brown | Defense Forensic Science Center | | jesse.d.brown50.civ@mail.mil |
| 8 | Robert | Berk | Illinois State Police | 3 | berkrob@isp.state.il.us |
| 9 | John | Drugan | Massachusetts State Police Forensic | 4 | john.drugan@massmail.state.ma.us |
| 10 | Dave | Edwards | JEOL USA, Inc. | 3 | dedwards@jeol.com |
| 11 | Jason | Schroeder | Harris Co. ME | 4 | Jason.Schroeder@ifs.hctx.net |
| 12 | Trevor | Gillis | Santa Clara Co. DA Crime Lab | 3 | tgillis@crimelab.sccgov.org |
| 13 | Clifford | Spiegelman | Texas A&M University | | cliff@stat.tamu.edu |
| 14 | Richard | Brown | MVA Scientific Consultants | | rbrown@mvainc.com |

# Affiliates

| # | Name | | Organization | Term | Email |
|---|---|---|---|---|---|
| 1 | James | Garcia | Defense Forensic Science Center | | james.d.garcia1.civ@mail.mil |
| 2 | Lawrence | Gunaratnam | National Bureau of Investigation Finland | | lawrence.gunaratnam@poliisi.fi |
| 3 | Nigel | Hearns | Royal Canadian Mounted Police | | nigel.hearns@rcmp-grc.gc.ca |
| 4 | Monica | Joshi | West Chester University | | mjoshi@wcupa.edu |
| 5 | Karl | Lueftl | Bavarian State Criminal Police Office | | karl.lueftl@polizei.bayern.de |
| 6 | Michael | McVicar | Centre of Forensic Sciences | | mjmcvicar@hotmail.com |
| 7 | Ludwig | Niewoehner | Bundeskriminalamt (Federal Criminal Police Office) Germany | | Ludwig.Niewoehner@bka.bund.de |
| 8 | Jimmie | Oxley | University of Rhode Island | | joxley@chm.uri.edu |
| 9 | S. | Platek | US FDA - Forensic Chemistry Center | | frank.platek@fda.hhs.gov |
| 10 | Peter | Ross | Victoria Police | | peter.ross@police.vic.gov.au |
| 11 | Angela | Shaw | Forensic Firearms Consultancy Ltd | | enquiries@forensicfirearmsconsultancy.com |
| 12 | Jay | Tobin | Stevenson University | | jtobin@stevenson.edu |
| 13 | Michael | Trimpe | Hamilton County Coroner's Office | | trimpegolf@gmail.com |
| 14 | Steffen | Uhlig | QuoData Quality and Statistics GmbH | | uhlig@quodata.de |
| 15 | J. Matney | Wyatt | US Army Criminal Investigation Laboratory | | john.m.wyatt20.civ@mail.mil |

# Gunshot Residue (GSR) Subcommittee




- The OSAC Subcommittee on Gunshot Residue will focus on standards and guidelines related to analyses of evidence that results from the deposition of or physical transfer of small or minute quantities of gunshot residue.

# GSR Subcommittee Members/Affiliates

Task Groups within the SCs
current, planned

- GSR - Competency and Training Task Group
- GSR - Methodology & Research Task Group
- GSR - Organic GSR Task Group
- GSR - Report Writing and Interpretation Task Group
- GSR - Testimony and Ethics Task Group
- GSR - Validation and Performance Task Group

## Work Products

documents completed, in progress, open for public comment, planned

- **Training TG:**
- Addressing the ASTM comments on the training document. Plan to start working on a collection document.
- **Report Writing TG**
- This TG is attempting to address comments and concerns offered as part of a ballot response within the GSR - SC
- **Methodology TG:**
- A literature review of GSR analysis by SEM/EDS is being conducted with searchable keywords to provide a list of variables to be used in future experimental designs and meta data analysis. The goal is to create statistically sound experimental designs in the future that will generate data that can be used to determine the best statistical approach to interpretation of GSR findings. The approaches to be evaluated would be the current frequentist approach v. Bayesian or likelihood ratio approaches.

## Work Products

documents completed, in progress, open for public comment, planned

- **Organic GSR:**
- The TG has identified several short and long-term goals and several potential research projects that address the OGSR issue. Currently, the team is:
  - working on a position paper for the combined use of IGSR and OGSR in forensic analysis and evaluating the literature to determine if there is enough published information to develop a GC-MS and LC-MS analytical protocol for OGSR analysis.
- **Testimony:**
- The Testimony and Ethics task group is in the process of finishing up a draft document: Standard Practice for Testimony Pertaining to Interpretation of Inorganic Gunshot Residue Analysis by Scanning Electron Microscopy/Energy Dispersive X-Ray Spectrometry.
- **Validation and Quality Assurance:**
- Task group is working on a detailed document to verify performance of SEM and EDS.

***Challenges and/or Hurdles Being Addressed (Particular attention to this item within each SC)***

- The GSR – SC experienced a change in leadership with a rapid transition to a new Subcommittee Chair and Vice Chair. Due to the term definitions, this coincided with a fair amount of turnover at the member level. Some difficulties have resulted.
- Some documents which have passed the approval of the SC have been stalled at the SDO level.
- The ASTM 1588 is a critical document for the GSR community and has undergone significant review within the OSAC process.

# Lessons Learned

- It is imperative that the SC Chair develop an open and interactive relationship with the other SC leadership positions, and with the Task Group chairs. It is also imperative that meetings of the whole SC occur at a greater frequency.
- Succession planning should be a priority within the SC.
- This model should lead to a more fluid transition as roles become vacant and are filled. Continuity is necessary for success, and it is the onus of current leadership to help establish such an environment.

# Forward Progress/Highest Priorities/SC Roadmaps

- GSR SC meetings are now planned as part of regular business. Roles have been defined and shared within the leadership to insure a sharing of ideas and to develop some level of "institutional knowledge" that will support continued growth and a more streamlined process for future members and for SC progress.
- The ASTM 1588-17 pursuit to the OSAC Registry has been reinvigorated. This will receive the entire SC attention at the March – in person – meeting, and a sincere effort to address QIC/ STG comments will be a top priority.

# Research & Development Needs Identified

- Comprehensive Feasibility of Organic Gunshot Residue Analysis
- Comprehensive GSR Persistence Study
- Development of Characterized Reference Stubs
- Fundamental Research into Mechanisms of Particle Formation
- Specific Identification of Shooters


# Progress and Updates

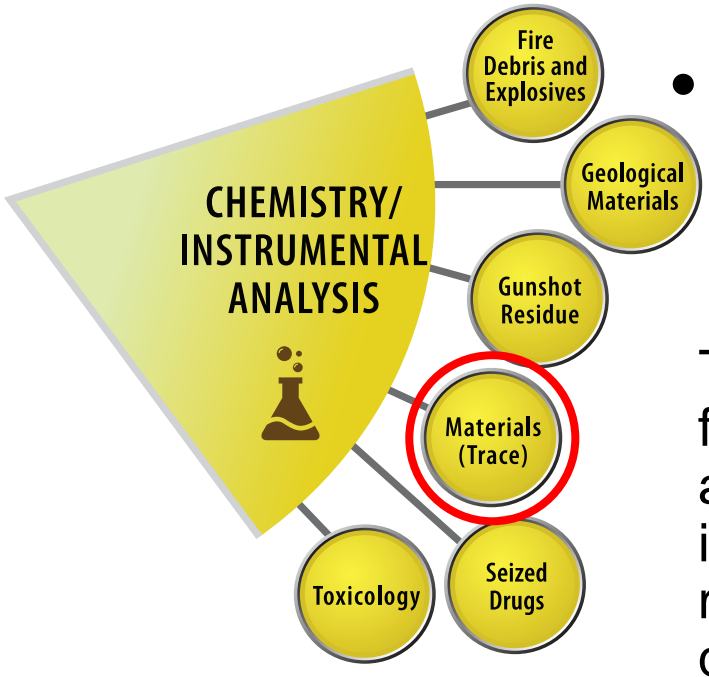
## Materials (Trace) Subcommittee

February 20, 2018

NIST
National Institute of
Standards and Technology
U.S. Department of Commerce

# Materials (Trace) Subcommittee

# Materials Subcommittee




- Diana Wright, Chair

The Materials (Trace) subcommittee is focused on creating and revising standards and guidelines related to examination and interpretation of physical evidence that may result from the transfer of small or minute quantities of materials (e.g., hairs, fibers, paint, tape, glass).

# Subcommittee Leadership

| Position | Name | Organization |
|---|---|---|
| Chair/Research TG | Diana Wright | Federal Practitioner |
| Vice Chair/Kavi liaison | Chantelle Taylor | State Practitioner |
| Executive Secretary | Kathleen Boone | State Practitioner |

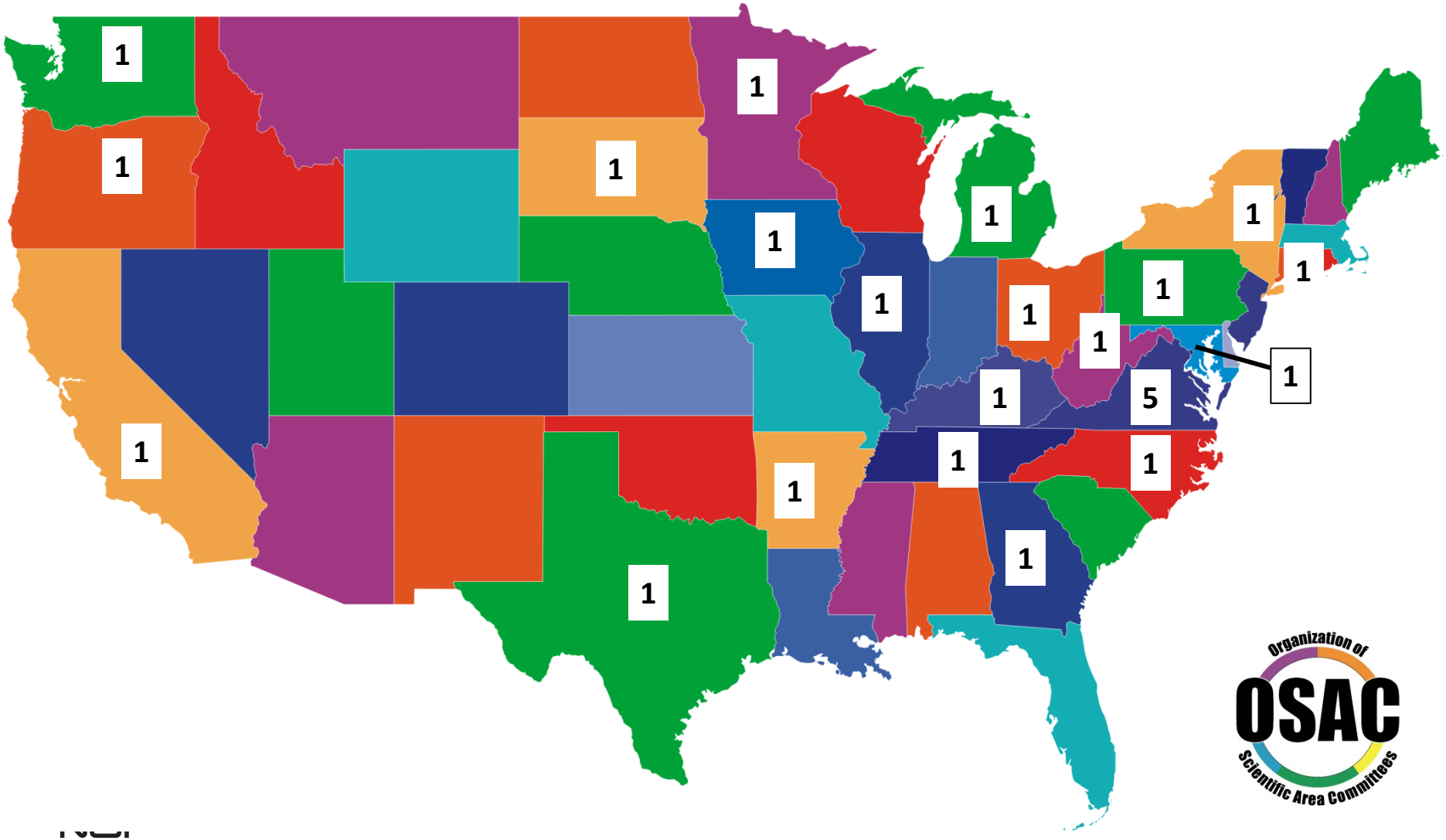
# Subcommittee Task Group Chairs

| # | Name | Task Group Name |
|---|---|---|
| 1 | Celeste Grover | Fibers |
| 2 | Tatiana Trejos | Glass |
| 3 | Sandra Koch | Hair |
| 4 | Robyn Weimer | Paint |
| 5 | Tammy Jergovich | Tape |
| 6 | Andria Mehltretter | Interpretation |
| 7 | Sandy Parent | Outreach |
| 8 | Diana Wright | Research |
| 9 | Amanda Forster | Terminology |

# Remaining Subcommittee Members

| # | Name | Membership breakdown | Term |
|---|---|---|---|
| 1 | Candie Shegogue | Federal Practitioner | 3 |
| 2 | Cedric Neumann | Researcher/Academician | 3 |
| 3 | Cheryl Lozen | State/Local Practitioner | 3 |
| 4 | Christopher S. Palenik | Private Practitioner | 4 |
| 5 | David A. Green | State/Local Practitioner | 4 |
| 6 | David Northrop | State/Local Practitioner | 3 |
| 7 | Edward M. Pollock "Chip" | State/Local Practitioner | 4 |
| 8 | Jennifer L. Remy | State/Local Practitioner | 3 |
| 9 | Jerome Workman | Researcher/R&D Technology Partner | 3 |
| 10 | Jodi Blakely Webb | Federal Practitioner | 4 |
| 11 | John Reffner | Researcher/Academician | 3 |
| 12 | Lara Mosenthin | State/Local Practitioner | 3 |
| 13 | Randall Nelson | State/Local Practitioner | 3 |
| 14 | Susan Gross | State/Local Practitioner | 3 |

# Where the Materials subcommittee members are from:

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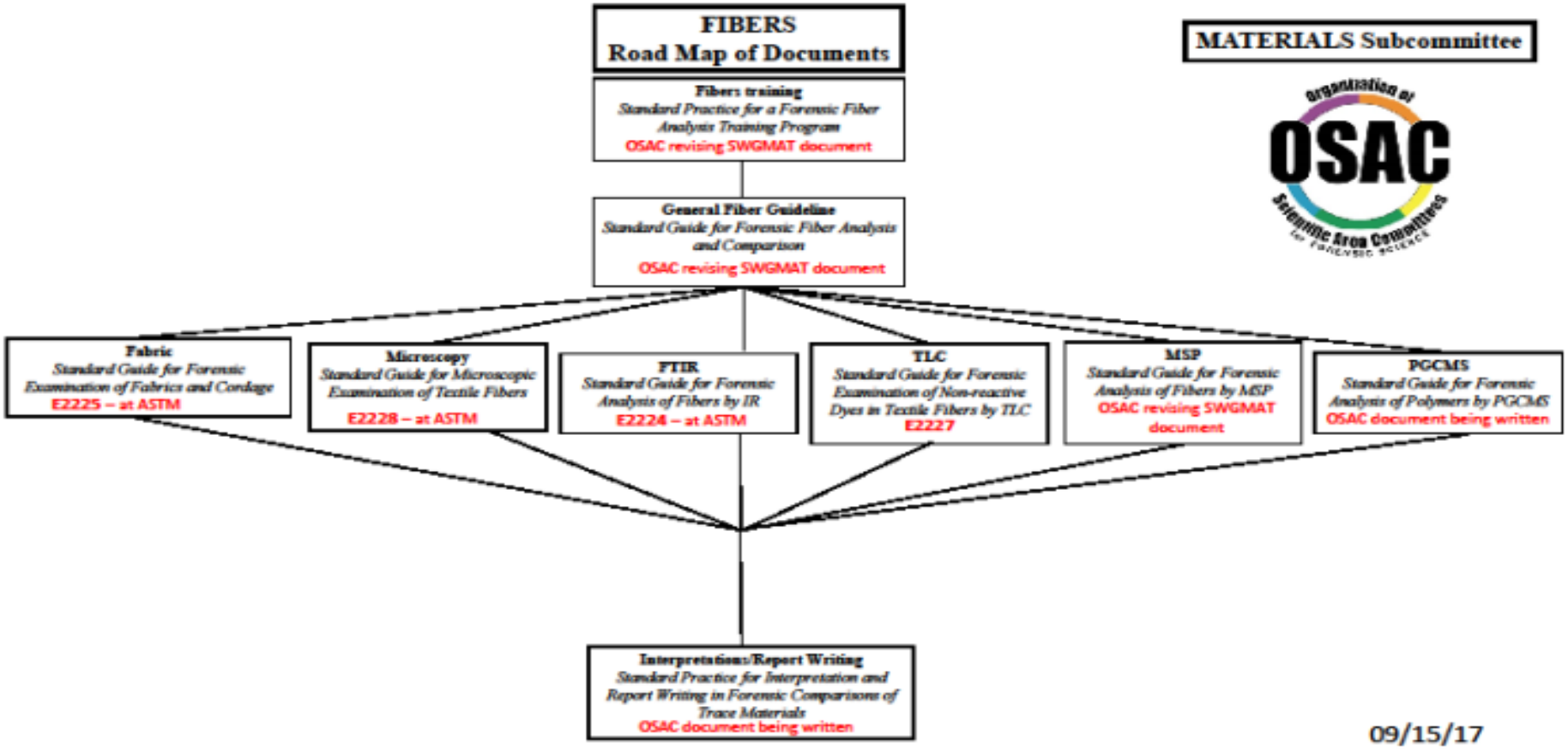
# Affiliates

| # | Name | Task Group |
|---|---|---|
| 1 | Cyril Muehlethaler | Paint – Researcher/Academician |
| 2 | Gavin Edmondstone | Paint – Internat'l Fed Practitioner |
| 3 | David Flohr | Interpretation – Federal Practitioner |
| 4 | Paul Martin | Paint – R&D Technology Partner |
| 5 | Muriel Correa | Paint – State Practitioner |
| 6 | Mark Sandercock | Paint – Intenat'l Fed Practitioner |
| 7 | Steven Stone | Paint – State Practitioner |
| 8 | Mary Eng | Interpretation – Local Practitioner |
| 9 | Katherine Igowsky | Hair – State Practitioner |
| 10 | Mark Ahonen | Tape – State Practitioner |
| 11 | Amy Michaud | Hair/Fiber – Federal Practitoner |
| 12 | Peter Weis | Glass – Internat'l Fed Practitioner |

# Example of a Materials Document Roadmap



# Materials Documents on the Registry

| Title | Organization |
| --- | --- |
| Standard Test Method for Forensic Comparison of Glass Using Micro X-ray Fluorescence Spectrometry | ASTM E2926 |

# Documents in Registry Review

| Title | Organization |
|---|---|
| Standard Test Method for Determination of Trace Elements in Soda-Lime Glass Samples Using Laser Ablation Inductively Coupled Plasma Mass Spectrometry for Forensic Comparisons | ASTM E2927 |
| Standard Guide for using Infrared Spectroscopy in Forensic Tape Examinations | ASTM E3085 |
| Standard Guide for Forensic Paint Analysis and Comparison | ASTM E1610 |
| Standard Guide for using Infrared Spectroscopy in Forensic Paint Examinations | ASTM E2937 |

# Documents in Progress with SDO

| Title | Organization |
|---|---|
| Standard Practice for Training in the Forensic Examination of Human Hair | WK56743 |
| Standard Test Method for Determination of Concentrations of Elements in Glass Samples Using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) for Forensic Comparisons | ASTM E2330 |
| Standard Test Method for the Automated Determination of Refractive Index of Glass Samples Using the Oil Immersion Method and a Phase Contrast Microscope | ASTM E1967 |
| Standard Guide for Forensic Examination of Fabrics and Cordage | ASTM E2225 |
| Standard Guide for the Forensic Analysis of Fibers by Infrared Spectroscopy | ASTM E2224 |

# Existing Guidelines being Revised

| Title | Organization |
| --- | --- |
| Standard Guide for Using Scanning Electron Microscopy/X-ray Spectrometry in Forensic Paint Examinations | ASTM E2809 |
| Standard Guide for Microspectrophotometry and Color Measurement in Forensic Paint Analysis | ASTM E2808 |

# New Documents being Drafted

| Title | Status |
|---|---|
| Standard Practice for Training in the Forensic Examination of Tape | Being readied for ASTM submission |
| Standard Practice for Training in the Forensic Examination of Paint | Being readied for ASTM submission |

# Trace Evidence Interpretation

Priority Level: High

- The task group is finalizing a draft document to provide recommendations to the trace evidence community regarding how to interpret and describe the significance of the overall results of a comparative examination.

**Task Group Name:** Trace Evidence Interpretation
**Task Group Chair Name:** Andria Mehltretter
**Task Group Chair Contact Information:**
andria.mehltretter@ic.fbi.gov

# Interpretation Scale Validation Study

- The task group is finalizing a validation study model to be piloted to laboratories that conduct trace evidence examinations. Two analysts per lab would be needed to take part in this study to evaluate the interpretation scale. Contact Andria Mehltretter for further details .

**Task Group Chair Contact Information:**

ahmehltretter@fbi.gov

# Trace Evidence Strategic Plan and Outreach Initiative

Priority Level: High

- Identify the perception, reality and needs of the Trace Evidence (TE) community, which will determine our strategic planning goals.
- Determine opportunities to promote TE by communicating the significance Trace Evidence to ensure the preservation of our field and ultimately move TE forward.
- Create education material to be distributed to various levels of the community (crime scene analysts, law enforcement agencies, labs (without trace), court system, etc.).
- Sent one survey out to lab managers, currently working on another for lawyers and for trace scientists

**Task Group Name:** Trace Outreach
**Task Group Chair Name:** Sandy Parent
**Task Group Chair Contact Information:**
sandy.parent@dps.texas.gov

# Additional Items of Interest

- Research needs for the trace community – we are in the process of revising a list of research projects to list on the OSAC website
- Address resources (Daubert packages, court rulings, articles)
- New documents for other trace areas such as physical match, Raman in trace as well as validation documents, sample selection, photograph/photomicrography document, flowchart for IR interpretation
- Need to write additional standards as most of the documents have been guidelines but this will also include published validation materials
- Evaluate statistical data interpretation

# Challenges Unique to Materials (Trace)

- MANY documents are simultaneously up for 5-year review within ASTM
- OSAC continues to evolve to improve the Registry process overall
  - Can stall specific documents caught between revisions of the process
- Each task group/discipline is at a different phase of document writing
  - Some still need foundational documents and/or training guides written
- Evaluating statistical data interpretation is not a one size fits all for trace


# Progress and Updates

## Fire Debris and Explosives Subcommittee

Chemistry and Instrumental Analysis SAC

Susan Seebode Hetzel

February 20, 2018

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# Subcommittee Leadership

| Position | Name | Organization | Term | Email |
|---|---|---|---|---|
| Chair | Susan Hetzel | SEA Limited | 2018 | shetzel@sealimited.com |
| Vice Chair | Brenda Christy | Virginia Department of Forensic Science | 2019 | brenda.christy@dfs.virginia.gov |
| Executive Secretary | Edward Sisco | National Institute of Standards and Technology | 2019 | Edward.sisco@nist.gov |

# Subcommittee Members

| # | Name | Organization | Term | Email |
|---|---|---|---|---|
| 1 | Phillip Antoci | New York City Police Department | 2018 | philip.antoci@nypd.org |
| 2 | Dr. Andrew T. Armstrong | Armstrong Forensic Laboratory | 2020 | andrew@aflab.com |
| 3 | Marcela Brown | National Institute of Standards and Technology | 2018 | marcela.najarro@nist.gov |
| 4 | Michelle Evans | Bureau of Alcohol, Tobacco, Firearms, and Explosives | 2020 | michelle.r.evans@usdoj.gov |
| 5 | Dr. Adam Hall | Northeastern University | 2018 | a.hall@neu.edu |
| 6 | Christina Henry | Santa Clara County Crime Laboratory | 2019 | CHenry@crimelab.sccgov.org |
| 7 | Dennis C. Hilliard | Rhode Island State Crime Laboratory | 2019 | dch@uri.edu |
| 8 | Dr. Katherine Hutches | Bureau of Alcohol, Tobacco, Firearms, and Explosives | 2020 | katherine.d.hutches@usdoj.gov |
| 9 | Douglas Klapec | Bureau of Alcohol, Tobacco, Firearms, and Explosives | 2018 | doug.j.klapec@usdoj.gov |
| 10 | Dr. Kimberly Kunkler | US Postal Inspection Service | 2020 | KSKunkler@uspis.gov |
| 11 | Wayne Moorehead | Pennsylvania State University | 2018 | criminalistics@hotmail.com |

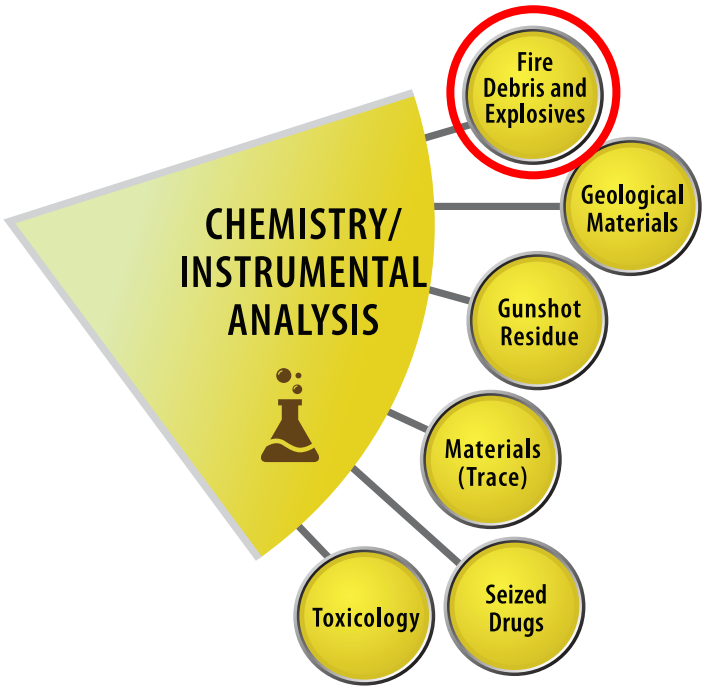
# Subcommittee Members

| # | Name | Organization | Term | Email |
|---|---|---|---|---|
| 12 | Robert F. Mothershead II | Federal Bureau of Investigation | 2019 | robert.mothershead@ic.fbi.gov |
| 13 | Reta Newman | Pinellas County Crime Laboratory | 2019 | rtnewman@co.pinellas.fl.us |
| 14 | William A. Randle | Missouri State Highway Patrol | 2020 | will.randle@mshp.dps.mo.gov |
| 15 | Dr. Michael Sigman | University of Central Florida | 2020 | michael.sigman@ucf.edu |
| 16 | Dr. Larry Tang | George Mason University | 2019 | ltang1@gmu.edu |
| 17 | Lisa Windsor | Tucson Police Department Crime Lab | 2020 | lisa.windsor@tucsonaz.gov |

# Affiliates

| # | Name | Organization |
|---|---|---|
| 1 | Jamie Baerncopf | Bureau of Alcohol, Tobacco, Firearms, and Explosives |
| 2 | Matthew Beardah | UK-Defense Science and Technology Laboratory |
| 3 | Jesse Brown | Defense Forensic Science Center |
| 4 | Inge Corbin | Defense Forensic Science Center |
| 5 | Dr. John Goodpaster | Indiana University-Purdue University Indiana |
| 6 | Jeanet Hendrikse | Netherlands Forensic Institute |
| 7 | Judith L. Hoffman | Montana State Crime Laboratory |
| 8 | Raymond Kuk | Bureau of Alcohol, Tobacco, Firearms, and Explosives |
| 9 | Eamonn McGee | Centre of Forensic Sciences |
| 10 | Natasha Neel | Bureau of Alcohol, Tobacco, Firearms, and Explosives |
| 11 | Dr. Jimmie C. Oxley | University of Rhode Island |
| 12 | Dr. Mark Sandercock | Royal Canadian Mounted Police |
| 13 | Mary Williams | University of Central Florida |

# Fire Debris and Explosives




The OSAC Subcommittee on Fire Debris and Explosives will focus on standards, guidelines, and resources related to the scientific examination and analysis of materials associated with fire and explosion investigations.

# New Documents in Progress

- Standard Guide for a Systematic Approach to the Analysis and Identification of Ignitable Liquids
- Standard Guide for the Forensic Examination and Identification of Intact Explosives
- Standard Guide for the Forensic Examination and Identification of Post Blast Explosives
- Standard Practice for Quality Assurance of Laboratories Performing Analysis of Ignitable Liquids and Ignitable Liquid Residues
- Standard Practice for Validation of Ignitable Liquid Analytical Methods
- Standard Practice for Reporting Results and Opinions of Explosives Analysis
- Standard Practice for Reporting Results and Opinions of Fire Debris Analysis

# Documents Sent to SDO (ASTM)

- Terminology Relating to the Examination of Fire Debris (new)
- Terminology Relating to the Examination of Explosives (new)
- Revisions to ASTM E1412-16 Standard Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Passive Headspace Concentration With Activated Charcoal
- Revisions of ASTM E1413-13 Standard Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Dynamic Headspace Concentration
- Revisions to ASTM E1388-17 Standard Practice for Sampling of Headspace Vapors from Fire Debris Samples – new version approved by SDO and available
- Standard Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Active Headspace Concentration onto an Adsorbent Tube (new)

# Documents in the Registry Approval Process

- **ASTM E2881$^{\epsilon 1}$-13 Standard Test Method for Extraction and Derivatization of Vegetable Oils and Fats from Fire Debris and Liquid Samples with Analysis by Gas Chromatography-Mass Spectrometry**
- **ASTM E2451-13 Standard Practice for Preserving Ignitable Liquids and Ignitable Liquid Residue Extracts from Fire Debris Samples**

# Task Groups

- **Document Development and Evaluation**
  Chair – Michelle Evans
- **QA/QC**
  Chair – Robert Mothershead
- **Reports, Terminology and Testimony**
  Chair – Dr. Katherine Hutches
- **Research and Training**
  Chair – Dr. Kimberly Kunkler
- **E1618 – Path Forward**
  Chair – Michelle Evans

# Challenges – E1618

**See our position statement at;**

https://www.nist.gov/sites/default/files/documents/2017/05/19/osac_fde_subcommittee_-_e1618_position_statement.pdf

**Identified four areas in which to concentrate efforts;**

- **Instrumental Analysis**
- **Ignitable Liquid Classification**
- **Interpretation of GC-MS data for IL/ILR**
- **Report Writing**

Specific topics of each area to be addressed are included in the position statement.

If you or your laboratory have implemented improvements in any of the particular areas listed, please contact us with specific details at E1618.PathForward@gmail.com

# Other Challenges –

- **Instrumental electronic data retention – realities vs. ISO requirements**

- **Time – the subcommittee members know there is work to do to improve the discipline, but we also have jobs to do that are paying our salary, and other life responsibilities.**

# Lessons Learned

- **The process of approving a document for addition to the registry takes significantly longer than originally anticipated.**
  - Back and forth in OSAC and ASTM is tedious and time-consuming
- **Some of the existing documents lack *published* foundational research or validation studies.**
  - Research takes time…
- **There are some great scientists out there, and getting to work with so many is inspiring.**

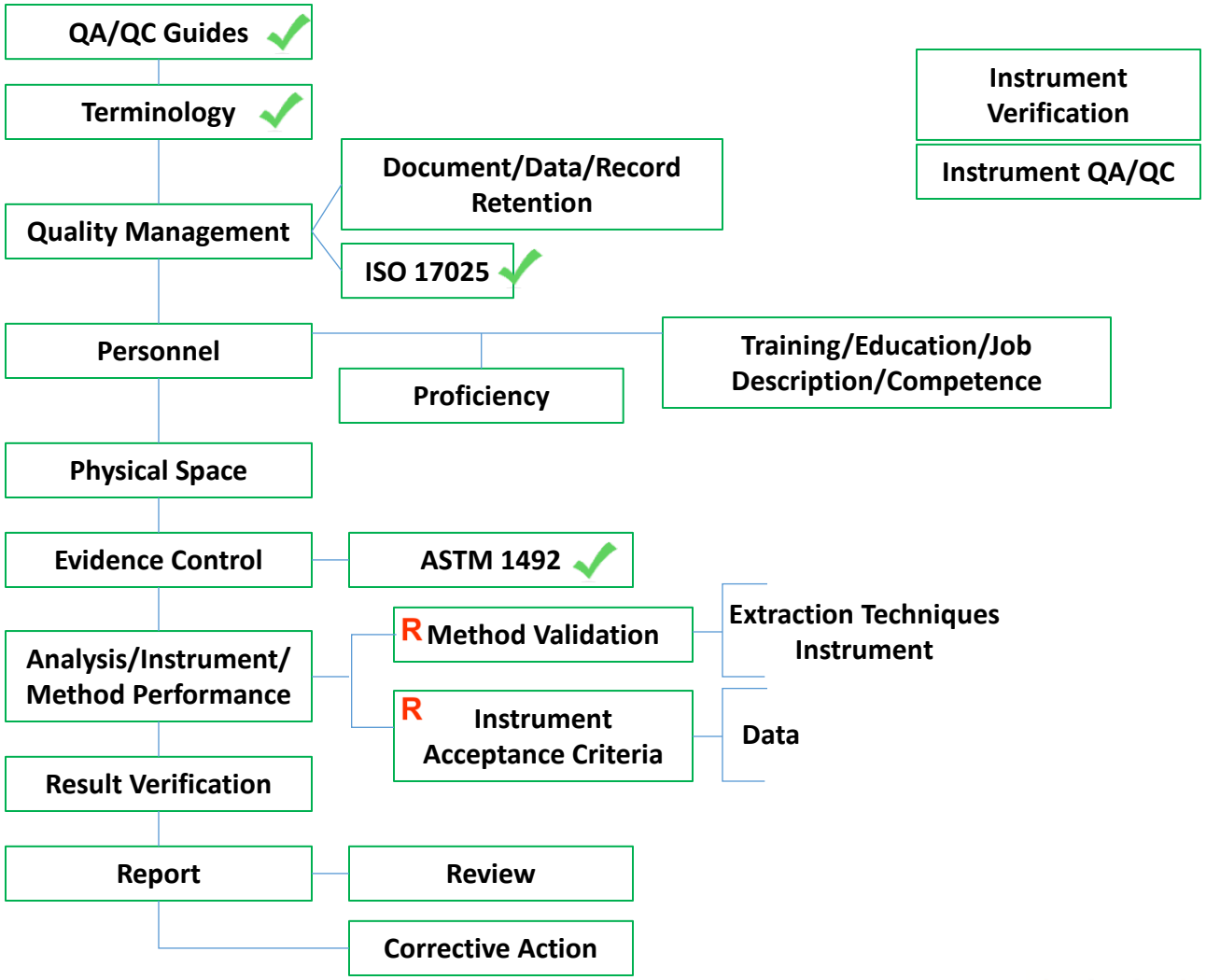
# Forward Progress -
## Documents Nearing SDO Submission

- Standard Guide for a Systematic Approach to the Analysis and Identification of Ignitable Liquids
- Standard Guide for the Forensic Examination and Identification of Intact Explosives
- Standard Practice for Quality Assurance of Laboratories Performing Analysis of Ignitable Liquids and Ignitable Liquid Residues
- Standard Practice for Reporting Results and Opinions of Explosives Analysis
- Standard Practice for Reporting Results and Opinions of Fire Debris Analysis

# Task Groups – Highest Priorities

- **Document Development and Evaluation**
  - Guide to Post Blast Analysis
  - Test Methods for the Analysis of Explosives
- **QA/QC**
  - Validation of Fire Debris Methods
  - QA of Labs Performing Explosives Analysis
- **Reports, Terminology and Testimony**
  - Prepare Daubert packages for both disciplines
  - Support terminology documents through the ASTM process
- **Research and Training**
  - Training guides for fire debris and explosives analysts
- **E1618 – Path Forward**
  - Report writing document

# FD&E Quality Roadmap




R = Needs Further Research

✓ = Some Work Completed

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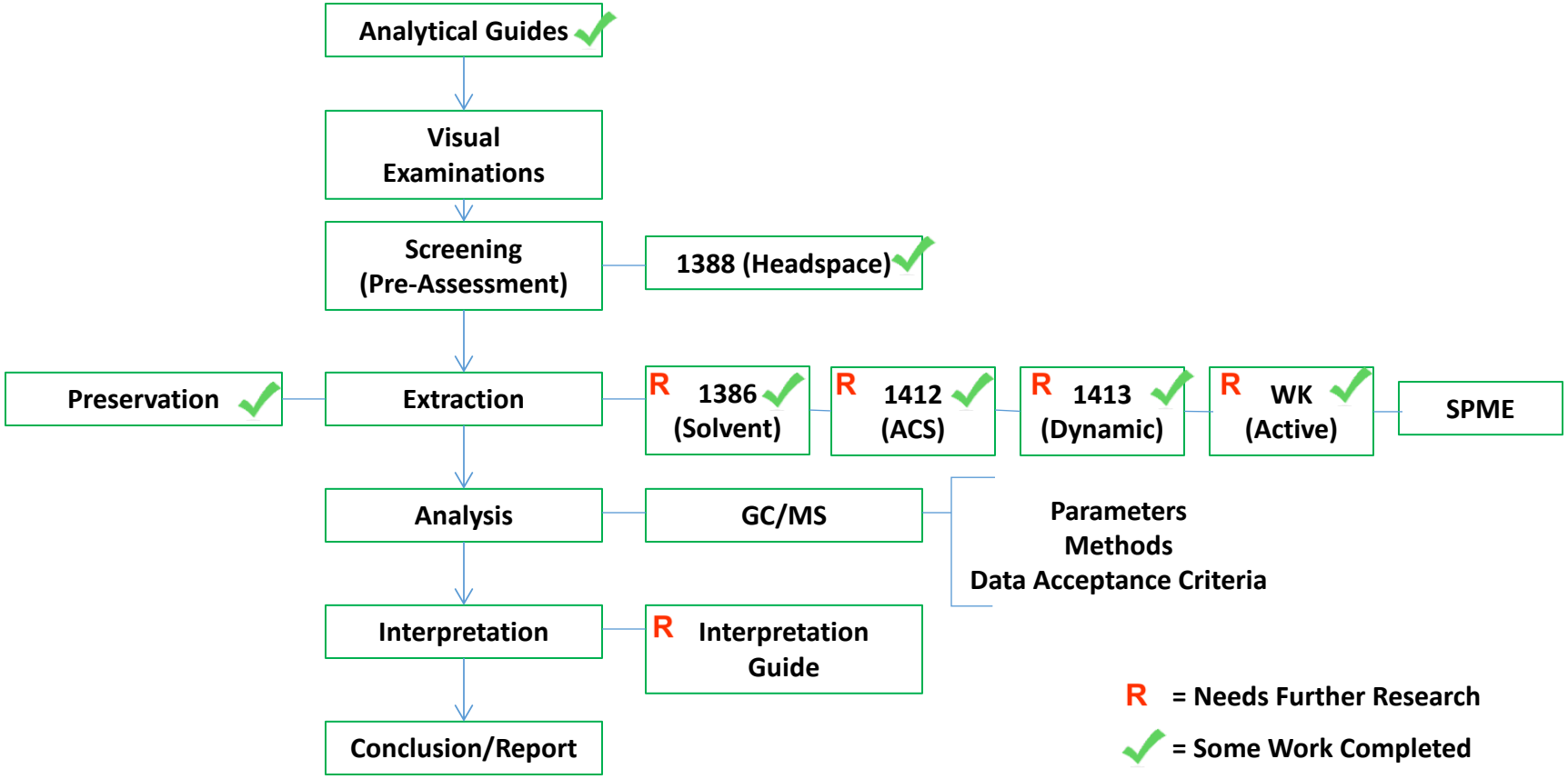
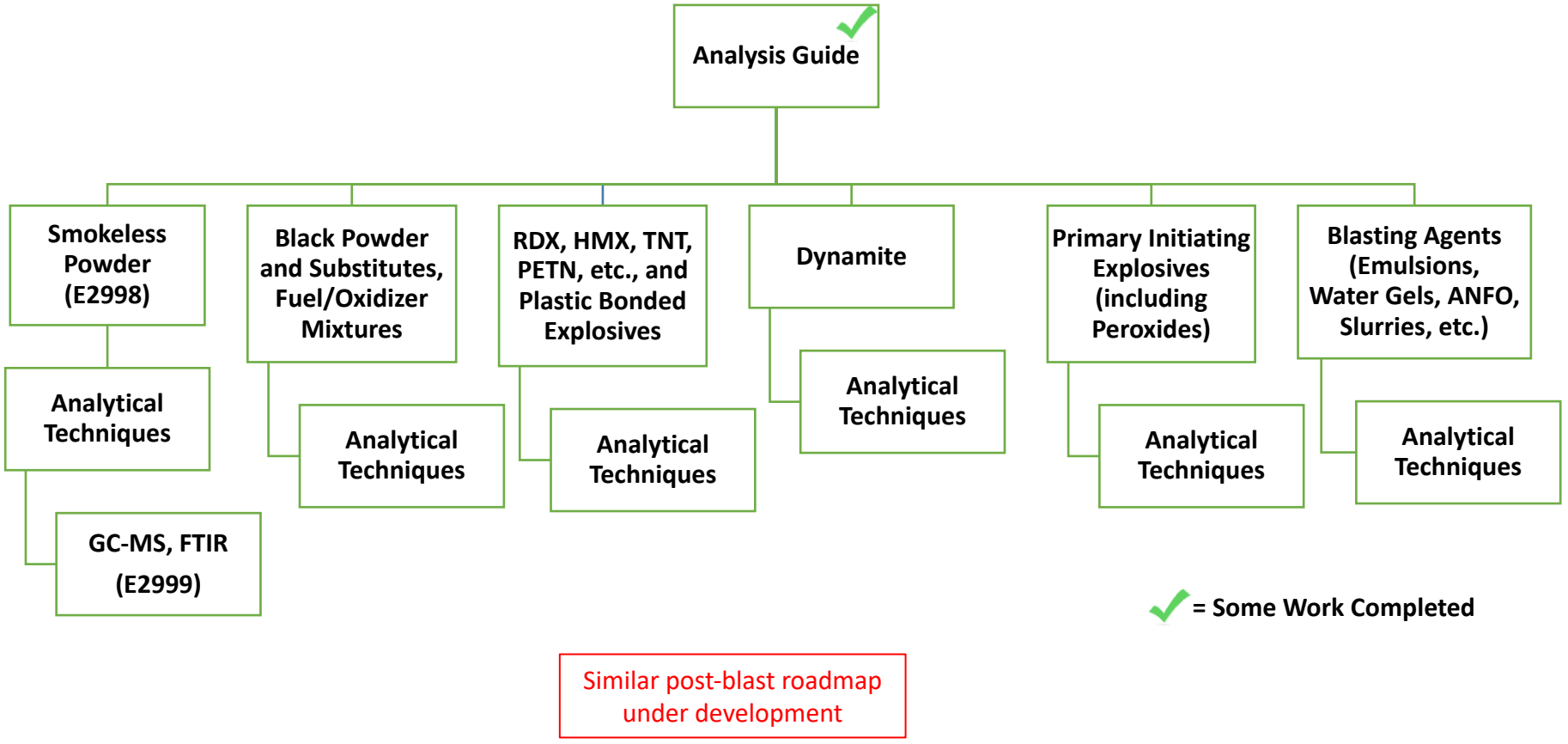
# Analytical Roadmap for Fire Debris



# Analytical Roadmap for Intact Explosives



# Research & Development Needs Identified

- https://www.nist.gov/topics/forensic-science/osac-research-development-needs

## Fire Debris Related

- **General research in support of new standards**
- **Evaluation and Comparison of Different Adsorption/Elution Methodology**
- **Determining the Threshold of Identification for Ignitable Liquids**
- **Source Attribution for Ignitable Liquids from Fire Debris**
- **Preservation of Ignitable Liquid Fire Debris Extracts**

# Research & Development Needs Identified

- https://www.nist.gov/topics/forensic-science/osac-research-development-needs

## Explosives Related

- General research in support of new standards
- Potential transformation of chlorate to perchlorate and visa-versa during explosion
- Concentration of Extracts Containing Volatile/Unstable Explosives
- Identification of Post-blast Residue of Liquid Explosives
- Source Attribution for Post-Blast Residues

# Fire Debris and Explosives Analysis


# Progress and Updates

## Geological Materials

Chemistry/Instrumental Analysis

Andrew M. Bowen

February 20, 2018

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# Geological Materials

# Subcommittee Leadership

| Position | Name | Organization | Term | Email |
|---|---|---|---|---|
| Chair | **Andrew Bowen** | **U.S. Postal Inspection Service** | **3 years** | **ambowen@uspis.gov** |
| Vice Chair | **Brad Lee** | **University of Kentucky** | **4 years** | **brad.lee@uky.edu** |
| Executive Secretary | **Kim Mooney** | **US Army Criminal Investigation Lab** | **3 years** | **kim.e.mooney.civ@mail.mil** |

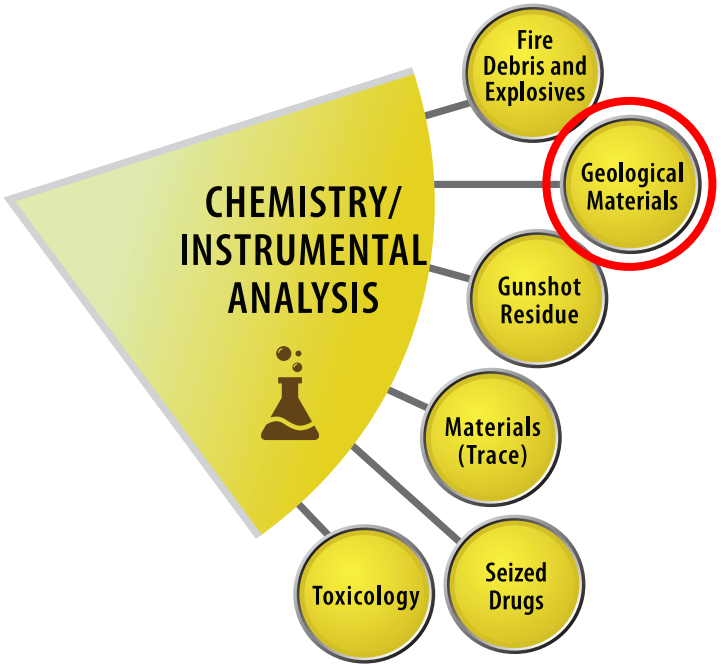
# Subcommittee Members

| # | Name | Organization | Term | Email |
|---|---|---|---|---|
| 1 | Bill Schneck | Washington State Patrol Crime Lab | 4 | bill.schneck@wsp.wa.gov |
| 2 | Andrew Bowen | U.S. Postal Inspection Service | 3 | ambowen@uspis.gov |
| 3 | Kim Mooney | US Army Criminal Investigation Lab | 3 | kim.e.mooney.civ@mail.mil |
| 4 | Maureen Bottrell | Department of Justice, Federal Bureau of Investigation | 3 | maureen.bottrell@ic.fbi.gov |
| 5 | Jack Hietpas | Penn State University | 4 | jzh333@psu.edu |
| 6 | Brad Lee | University of Kentucky | 4 | brad.lee@uky.edu |
| 7 | Skip Palenik | Microtrace LLC | 3 | spalenik@microtracellc.com |
| 8 | Marianne Stam | California Department of Justice | 3 | marianne.stam@doj.ca.gov |
| 9 | David Szymanski | Bentley University | 4 | dszymanski@bentley.edu |
| 10 | Libby Stern | Department of Justice, Federal Bureau of Investigation | 3 | libby.stern@ic.fbi.gov |
| 11 | Wayne Isphording | Self Employed | 3 | isphordingw@bellsouth.net |
| 12 | Christopher Bernhardt | US Geological Survey | 3 | cbernhardt@usgs.gov |
| 13 | Heather Lowers | US Geological Survey | 3 | hlowers@usgs.gov |
| 14 | Andrew Laurence | US Customs and Border Protection | 3 | ANDREW.R.LAURENCE@cbp.dhs.gov |

# Subcommittee Affiliates

| # | Name | Organization | Term | Email |
|---|---|---|---|---|
| 1 | Robert Fitzpatrick | Centre for Australian Forensic Soil Science CAFSS | N/A | rob.fitzpatrick@csiro.au |
| 2 | Alastair Ruffell | Queen's University, Belfast | N/A | alastairruffell@me.com |
| 3 | Duncan Pirrie | Helford Geoscience LLP | N/A | dpirrie@helfordgeoscience.co.uk |
| 4 | Ethan Groves | Microtrace LLC | N/A | egroves@microtracellc.com |

# Geological Materials

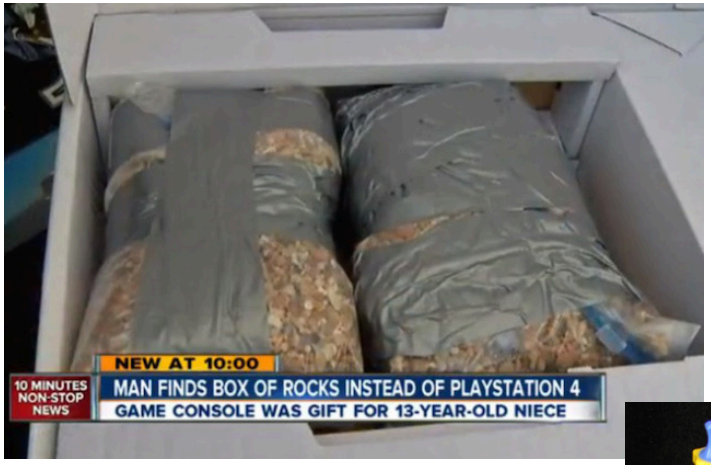



**Develop consensus standards and guidelines for the collection and analysis of soils and other geological materials; create a framework for the interpretation and reporting of analytical results; establish educational and training requirements for forensic practitioners; and foster the publication and presentation of research within the forensic geosciences community.**

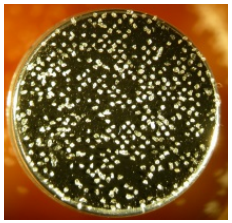
# Areas of Focus for the Geological Materials Subcommittee

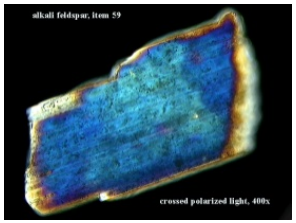
## Field Collection of Soil & Geological Materials

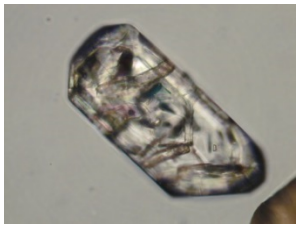
## Geo-sourcing of Materials

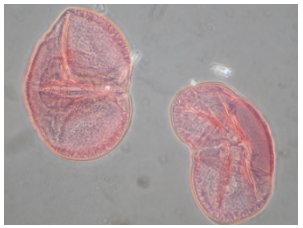



## Laboratory Methods for the Forensic Analysis of Geological Materials







# Geological Materials Task Groups

- Microscopy Task Group (Chair: William Schneck)
- Elemental Analysis Task Group (Chair: Jack Hietpas)
- X-Ray Diffraction Task Group (Chair: Libby Stern)
- Soil Fractionation Task Group (Chair: Kim Mooney)
- Color Analysis Task Group (Chair: Brad Lee)
- Terminology Task Group (Chair: Dave Szymanski)
- Education and Training Task Group (Chair: Brad Lee)
- Research Initiatives Task Group (Chair: Jack Hietpas)

# Geological Materials: *Challenges*

- One significant challenge for the GEO subcommittee is that there are virtually no existing SDO documents in forensic geology, so all of our documents must be created from scratch
- There are relatively few practitioners in this discipline, so our membership pool is limited
- Most progress is made during in-person meetings, while the busy schedules of subcommittee members pose challenges in between those meetings

# Geological Materials: *Lessons Learned*

- Make the most of the in-person meetings
- Take advantage of the entire OSAC:  if other Subcommittees have templates / drafts / work products that are relevant to topics you are working on, use those as a resource

# Summary of Standards/Guidelines Priority Actions

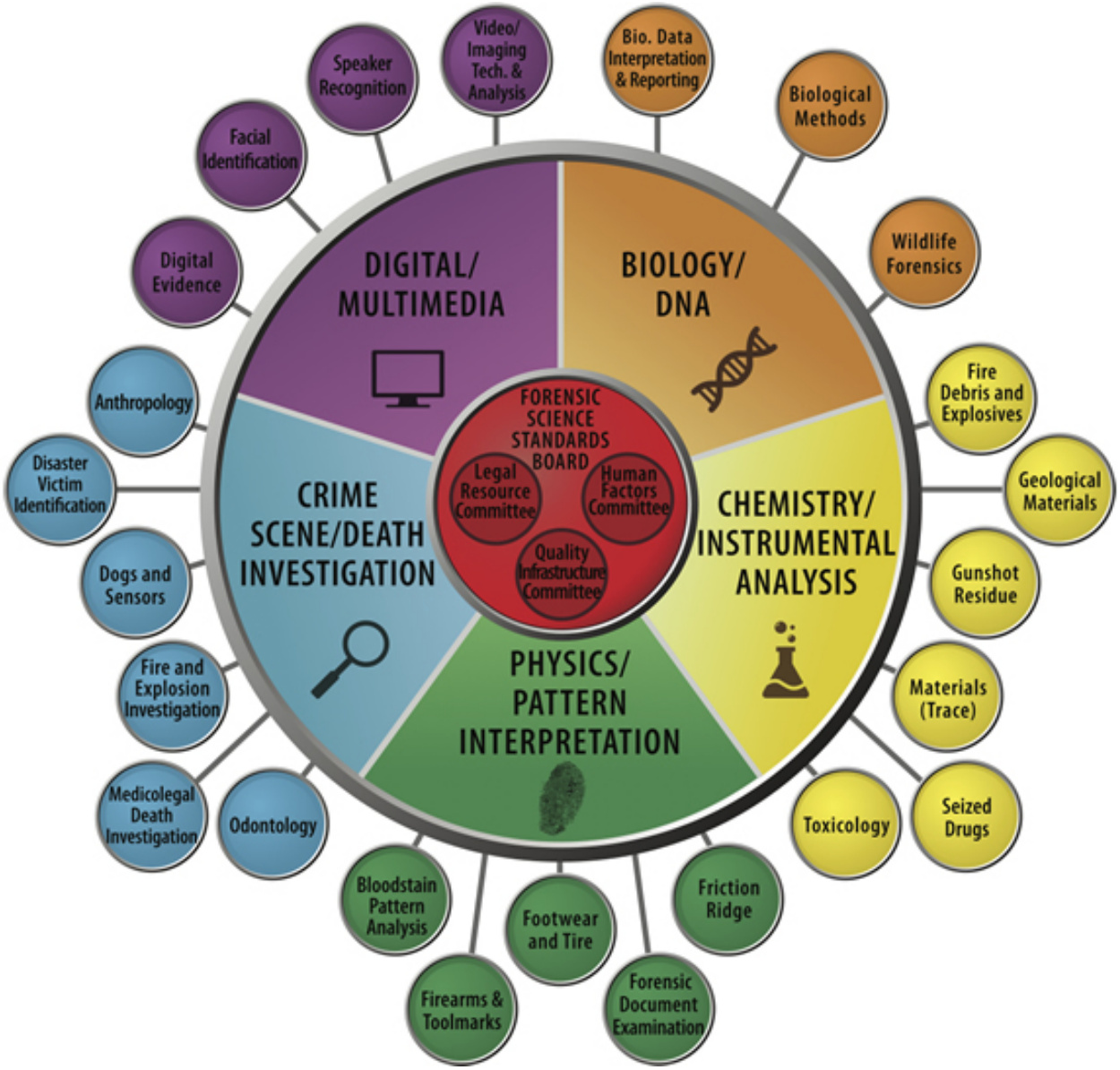
| Priority | OSAC Process | Working Title of Document |
|---|---|---|
| High | SDO-200 | Standard Guide for the Collection of Soils and Other Geological Evidence for Forensic Applications |
| High | SDO-200 | Standard Guide for the Forensic Analysis of Soils and Geological Materials |
| Medium | SDO-200 | Standard Guide for the Polarized Light Microscopy of Soils and Geological Materials for Forensic Applications |
| Medium | SDO-200 | Standard Guide for SEM/EDS Analysis of Soils and Geological Materials for Forensic Applications |
| Medium | SDO-200 | Standard Guide for X-Ray Diffraction of Soils and Geological Materials for Forensic Applications |
| Medium | SDO-200 | Standard Guide for the Analysis of Color in Soil Evidence |

# Geological Materials Document Roadmap

- Standard Guide for the Collection of Soils and Other Geological Evidence for Forensic Applications
- Standard Guide for the Forensic Analysis of Soils and Geological Materials
- Standard Guide for the Collection of Dust for Forensic Applications
- Standard Guide for Opinions and Testimony in Forensic Geology
- Standard Guide for the Collection and Analysis of Pollen for Forensic Applications
- Standard Guide for the Fractionation of Soil Evidence
- Standard Guide for X-Ray Diffraction of Soils and Geological Materials for Forensic Applications
- Standard Guide for SEM/EDS Analysis of Soils and Geological Materials for Forensic Applications
- Standard Guide for X-Ray Fluorescence of Soils and Geological Materials for Forensic Applications
- Standard Guide for the Analysis of Color in Soil Evidence
- Standard Guide for the Polarized Light Microscopy of Soils and Geological Materials for Forensic Applications
- Standard Guide for Raman Spectroscopy Analysis of Soils and Geological Materials for Forensic Applications
- Standard Guide for FT-IR Spectroscopy Analysis of Soils and Geological Materials for Forensic Applications
- Standard Practice for Education and Training in Forensic Geology
- Standard Terminology for the Forensic Analysis of Soils and Geological Materials
- Standard Practice for a Forensic Soil / Geology Training Program

# Geological Materials
# Research & Development Needs Identified

- Research is needed to determine whether it is possible to anticipate scales of compositional heterogeneity of surface soils across a particular region.
- Research is needed to investigate the effects of different variables on the relative abundance of soil components after transfer.
- Development and evaluation of quantitative methods of soil analysis for forensic comparisons.


DIGITAL/ MULTIMEDIA
BIOLOGY/ DNA
CHEMISTRY/ INSTRUMENTAL ANALYSIS
PHYSICS/ PATTERN INTERPRETATION
CRIME SCENE/DEATH INVESTIGATION
FORENSIC SCIENCE STANDARDS BOARD
Legal Resource Committee
Human Factors Committee
Quality Infrastructure Committee
Video/ Imaging Tech. & Analysis
Bio. Data Interpretation & Reporting
Biological Methods
Wildlife Forensics
Fire Debris and Explosives
Geological Materials
Gunshot Residue
Materials (Trace)
Seized Drugs
Toxicology
Friction Ridge
Forensic Document Examination
Footwear and Tire
Firearms & Toolmarks
Bloodstain Pattern Analysis
Odontology
Medicolegal Death Investigation
Fire and Explosion Investigation
Dogs and Sensors
Disaster Victim Identification
Anthropology
Digital Evidence
Facial Identification
Speaker Recognition


# Questions?

## Chemistry / Instrumental Analysis SAC

Jose Almirall, Chair

almirall@fiu.edu

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