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joint meeting
KALAHARI RESORTS



Forensic Drug Chemistry Session

Location: Kilimanjaro Ballroom Suite 9

NEAFS

Joanna Urban, Chemistry Session Chair

MAAFS

Emily Wilkinson, Chemistry Section Chair

Steve Hokanson, Chemistry Section Chair-Elect

Thursday, October 8

- 9:00 am** **Opening Remarks**
- 9:10 am** **Characterized Authentic Drug Samples for Forensic Method Validation**
Sarah A. Shuda, Katya A. Beltran, Edward Sisco - National Institute of Standards and Technology
- 9:25 am** **Are You Using a Green Solvent? How do you know?**
Thomas A. Brettell, Ph.D., GKE-ABC - Cedar Crest College
- 9:40 am** **Differentiation of Synthetic Tryptamines Using Direct Analysis in Real Time Time-of-Flight Mass Spectrometry (DART-TOF)**
Margaret Garrett¹ and Kevin Zencak² - ¹West Virginia University, ²Virginia Department of Forensic Science
- 10:00 am** **Break**
- 10:45 am** **Money Laundering: Cleaning Drugs From Currency Before Returning it to Next-Of-Kin**
Lisa Mundy and Emily Murphy - Philadelphia Medical Examiner's Office Toxicology Lab
- 11:00 am** **Split Injection GC/MS Method for the Analysis of Phenethylamines**
Joshua Rosenthal - New York City Police Department Police Laboratory
- 11:30 am** **Investigating the Stability and Degradation of Psilocybin in Mushroom Gummies: Implications for Forensic Analysis**
Marianne Staretz, Alyssa Ricca, Thomas A. Brettell, Mia Bercier - Cedar Crest College
- 11:45 am** **Tracking the Shift: NIST's RaDAR Program and the Evolving Drug Landscape**
Meghan G. Appley, Sarah A. Shuda, Edward Sisco - National Institute of Standards and Technology
- 12:00 pm** **Lunch**
- 2:00 pm** **Identification of Cannabidiol (CBD) and THC in Designer Cannabis Products using 2D "Dirty" NMR**
Rachel Green and Ling Huang, PhD - Hofstra University



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- 2:15 pm** **These drugs are so last year, what's trending now?**
Holly Fox, Justin Hoang, Emily Frey - Cumberland County DA's Office Forensic Laboratory
- 2:45 pm** **Investigation of a Portable Combination Raman and Surface-Enhanced Raman Spectroscopy (SERS) Instrument for the Analysis of Forensic Drug Samples**
Katya A. Beltran and Sarah A. Shuda - The National Institute of Standards and Technology
- 3:00 pm** **Supporting Forensic Drug Identification with a Comprehensive In-House Standard Database**
Katherine Harkins and Alyssa Reyes - Baltimore Police Department
- 3:15 pm** **Greener Color Test for Designer Cannabis Product Detection**
Christopher Collins; Kolby Vautour; Nanette M. Wachter, PhD.; Robert B. Cody PhD.; Ling Huang PhD. - Hofstra University
- 3:30 pm** **Break**
- 4:00 pm** **Evaluating Portable Spectrometry for Field-Based Detection and Identification of Synthetic Opioids**
Lauryn Cammarata, B.S.¹; Pauline E. Leary, Ph.D.²; Seth Fisher³; Eric Wallis³; Brooke W. Kammrath, Ph.D.¹ - ¹University of New Haven, ²Noble, ³1st Detect Corporation
- 4:15 pm** **Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) Update**
Tiffany Ribadeneyra, M.S., ABC-CC¹, Jennifer Bonetti, Ph.D, ABC-DA², Jaclyn Iera, Ph.D³ - ¹Nassau County Office of the Medical Examiner, ²Virginia Department of Forensic Science, ³U.S. Drug Enforcement Administration

Friday, October 9

- 9:00 am** **Opening Remarks**
- 9:10 am** **Adulterant Trends in the Illicit Drug Supply Across the Northeast and Mid-Atlantic Regions**
Alexis Quinter - The Center for Forensic Science Research and Education
- 9:25 am** **Using Direct Analysis in Real Time Triple Quadrupole Mass Spectrometry (DART-TQ-MS) to Generate and Compare Compositional Profiles of Authentic Fentanyl Samples**
Joel E.R. Moss, Joshua S. DeBord, Nicholas Khorozev, Alexis Quinter, Heather L. Harris - Center for Forensic Science Research and Education
- 9:40 am** **Analysis of Physical Drug Evidence in Suspected Overdose Cases**
Ashley Dillard - Allegheny County Office of the Medical Examiner
- 10:00 am** **Break**
- 10:45 am** **Going Grey During Your Forensic Career: A Senior Scientist's Take On LC-MS/MS Troubleshooting for a Drug Chemistry Application.**
Richard T. Ramsey - Allegheny County Office of the Medical Examiner



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- 11:00 am** **Evaluation of Direct Analysis in Real Time-Triple Quadrupole-Mass Spectrometry (DART-TQ-MS) for Rapid Multi-Class Drug Screening**
Nicholas Khorozov, M.S., Joshua DeBord, PhD, Alex Krotulski, PhD, Barry Logan, PhD - Center for Forensic Science Research and Education
- 11:15 am** **Detecting the Next Emerging Drug: The Role of Full-Scan GC/MS in Forensic Drug Surveillance**
Alexandra Kuchinos, MSFS, Mia Borrelli, MSFS, Amanda L.A. Mohr, MSFS, Barry K. Logan, PhD - Center for Forensic Science Research and Education



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Characterized Authentic Drug Samples for Forensic Method Validation

Sarah A. Shuda, Katya A. Beltran, Edward Sisco - National Institute of Standards and Technology

Method development and validation in forensic chemistry laboratories requires access to characterized authentic samples to ensure methods are fit for purpose. This can be challenging for research and forensic laboratories. The Characterized Authentic Drug Samples (CADS) project provides real-world samples that have been analyzed using a variety of techniques including DART-MS, FTIR, GC/MS, GC/FID, color tests, and lateral flow immunoassay test strips to practitioners and researchers. The data generated from these analyses is also made available for those requiring real world data for the development of data analysis tools. The project aims to aid in the development of new technology and help ensure quality in methods in forensic chemistry laboratories.

Are You Using a Green Solvent? How do you know?

Thomas A. Brettell, Ph.D., GKE-ABC - Cedar Crest College

The importance of solvent choice cannot be overemphasized for sample preparation in the forensic chemistry laboratory. While solvent consumption in forensic science is a fraction of what is used in the overall general industry, the cumulative volumes are still substantial. With increasing stringent regulations of solvent usage and disposal, the chemical and pharmaceutical analytical laboratories are shifting towards the use of greener solvents to reduce the environmental impact and toxicity of sample analysis. For decades solvent selection in forensic chemistry has lacked clear evidence-based guidelines tailored to the specific needs of evidential analysis. While solvent guides exist, they are essentially being ignored. This presentation will bring awareness to available solvent guides that can be used by the forensic chemist and toxicologist to choose and assess greener solvents for their analyses.



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Differentiation of Synthetic Tryptamines Using Direct Analysis in Real Time Time-of-Flight Mass Spectrometry (DART-TOF)

Margaret Garrett¹ and Kevin Zencak² - ¹West Virginia University, ²Virginia Department of Forensic Science

Over the past few years, there has been a rise in psilocyn/psilocybin food products. However, these products frequently contain unlisted synthetic tryptamines that may or may not be controlled. These compounds function similarly to psilocyn as hallucinogens. Due to these synthetic tryptamines being isomers and analogs to each other, they have similar mass spectra and retention times. This research uses Direct Analysis in Real Time Time-of-Flight (DART-TOF) Mass Spectrometry in order to differentiate between these tryptamine isomers and analogs.

Money Laundering: Cleaning Drugs From Currency Before Returning it to Next-Of-Kin

Lisa Mundy and Emily Murphy - Philadelphia Medical Examiner's Office Toxicology Lab

In Philadelphia, it is not uncommon to encounter drug death scenes where the decedents were snorting drug powders through rolled dollar bills. Our investigators will bring the money into the office as evidence, though it is rarely tested. This presentation describes a proof-of-concept method for cleaning drug residue from currency using a sodium hydroxide solution, and a liquid-liquid extraction followed by GC/MS analysis, to ensure the currency is safe to return to the next of kin. Further research is also proposed.

Split Injection GC/MS Method for the Analysis of Phenethylamines

Joshua Rosenthal - New York City Police Department Police Laboratory

The New York City Police Department Police Laboratory has historically analyzed phenethylamines such as amphetamine, methamphetamine, and MDMA in chloroform, however it has been observed that breakdown products in the chloroform can react with primary and secondary amines such as these substances, causing potential issues identifying the components of a seized drug sample. The laboratory's current splitless injection GC/MS method has a run time of 12 minutes and produces optimal chromatography when these substances are prepared in chloroform, but poor chromatography when prepared in methanol. A new split-injection method with an eight minute runtime has been developed to analyze these substances in methanol, which will reduce the possibility of solvent-related issues and increase the efficiency of the laboratory.



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Investigating the Stability and Degradation of Psilocybin in Mushroom Gummies: Implications for Forensic Analysis

Marianne Staretz, Alyssa Ricca, Thomas A. Brettell, Mia Bercier - Cedar Crest College

Psychedelic mushrooms are increasingly being incorporated into edible products such as gummies, presenting new challenges in forensic analysis due to the instability of psilocybin and psilocin, as well as the complexity of edible matrices. This study evaluated the effects of storage condition and time on psilocybin and psilocin in gummy samples using LC-MS/MS, with optimized extraction methods used to maximize recovery. Psilocybin remained relatively stable under most storage conditions, while psilocin demonstrated significant degradation at room temperature (light and dark) and elevated temperatures. Qualitative evidence of psilocybin-to-psilocin conversion was observed under all storage conditions, with conversion most prominent at elevated temperatures and least frequent under frozen storage. Within the scope of this study, frozen storage best preserved sample integrity, demonstrating that the chemical composition of mushroom gummies may change during storage, with important implications for forensic interpretation, regulatory compliance, and consumer safety.

Tracking the Shift: NIST's RaDAR Program and the Evolving Drug Landscape

Meghan G. Appley, Sarah A. Shuda, Edward Sisco - National Institute of Standards and Technology

The drug landscape across the United States is constantly evolving in both component presence and concentration. The Rapid Drug Analysis and Research (RaDAR) program at the National Institute of Standards and Technology (NIST) is a specialized drug-checking initiative that provides near-real-time, comprehensive information on the chemical makeup of illicit drugs. This presentation highlights recent trends detected within the drug supply alongside critical programmatic updates regarding RaDAR's operational expansion. Additionally, we will share insights from ongoing research aimed at improving analytical workflows across public health and safety agencies. Through these efforts, RaDAR continues to provide timely, high-quality data to inform harm reduction strategies and forensic science standards.

Identification of Cannabidiol (CBD) and THC in Designer Cannabis Products using 2D “Dirty” NMR

Rachel Green and Ling Huang, PhD - Hofstra University

The continual development of designer CBD products in the United States poses a major issue for crime laboratories, as analysis techniques must evolve to contend with a growing market and new sample matrices. Currently, Gas Chromatography-Mass Spectrometry (GC-MS) is widely used for screening cannabinoids, but it requires cumbersome sample preparation and is destructive. This study presents a non-destructive, streamlined approach for screening cannabidiol (CBD) in designer cannabis products through “Dirty” two-dimensional Nuclear Magnetic Resonance (2D NMR) Spectroscopy. The name refers to the minimal sample preparation involved in this method, extracting cannabinoids from designer drug products without time-consuming traditional liquid-liquid extraction.

This method employs Homonuclear Correlation Spectroscopy (COSY) to identify CBD across a variety of sample matrices, including CBD plant material, gummies, and oils. Beyond qualitative analysis, this



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method has shown potential for semi-quantitative analysis through calibration studies and determination of a COSY limit of detection.

The results from this study show that “Dirty” 2D NMR is a viable method for screening CBD in designer matrices. The COSY spectra from the three test matrices were compared to those of a CBD standard. The resultant data demonstrates that this method could possibly be used to identify CBD in designer cannabis products, as possible signals from CBD were found in all spectra.

These drugs are so last year, what’s trending now?

Holly Fox, Justin Hoang, Emily Frey - Cumberland County DA's Office Forensic Laboratory

Cumberland County is the second fastest-growing county in Pennsylvania and has easy access to major cities such as Baltimore and Philadelphia. The Cumberland County DA's Office Forensic Laboratory is located approximately 30 miles west of Harrisburg, PA, the state capital. The Seized Drugs section analyzes items submitted by local and state departments, as well as items submitted by the Pennsylvania Department of Corrections. This presentation will discuss the trends of controlled substances and other compounds observed in case submissions, including the changes of cutting agents/adulterants observed in street drugs, and the compounds observed in items found in the state prisons of Pennsylvania.

Investigation of a Portable Combination Raman and Surface-Enhanced Raman Spectroscopy (SERS) Instrument for the Analysis of Forensic Drug Samples

Katya A. Beltran and Sarah A. Shuda - The National Institute of Standards and Technology

Raman spectroscopy is a powerful technique for identifying components in drug samples, but it has limitations when compounds are present in mixtures or at low concentrations (below $\approx 5\%$ by weight). Surface-enhanced Raman spectroscopy (SERS) amplifies the Raman signal, allowing for the detection of trace analytes at parts-per-million concentrations. A study was conducted to investigate a portable combined Raman and SERS instrument. Combining the techniques allowed lower limits of detection to be achieved ($1 \mu\text{g/mL}$ for some tested compounds) and identification of multiple components present in mixtures. Analysis of real-world samples demonstrated that Raman coupled with SERS is overall a suitable, efficient, and sensitive technique for forensic drug checking applications.

Supporting Forensic Drug Identification with a Comprehensive In-House Standard Database

Katherine Harkins and Alyssa Reyes - Baltimore Police Department

This presentation focuses on the development of an in-house drug standard reference database to streamline the policy and procedures of the Drug Analysis Unit (DAU) of the Baltimore Police Department. A variety of Novel Psychoactive Substances (NPS), including synthetic opioids and cannabinoids, were purchased from Cayman Chemical and analyzed via an Agilent Gas Chromatograph-Mass Spectrometer (GC-MSD series 7890B/5977A), using validated methods. The column used was a HP Ultra 1 (12 meters long, 0.2 mm bore with 0.33-micron film coating), and



instrument parameters such as: oven/ inlet temperature, run time, and split ratio were adjusted accordingly. The expected results will include information on chromatography, retention time, relative retention time, mass spectra fragmentation patterns, and isomer differentiation. The primary goal of this project is to update our policies to account for new emerging designer drugs and analogs that pose a significant challenge to drug chemists.

Greener Color Test for Designer Cannabis Product Detection

Christopher Collins; Kolby Vautour; Nanette M. Wachter, PhD.; Robert B. Cody PhD.; Ling Huang PhD.
- Hofstra University

The presumptive color test, known as the Lemay-Vautour (LV) test is similar to the Duquenois-Levine test, but is simpler and safer for forensic scientists and law enforcement. The LV test does not require hazardous reagents such as chloroform and acetaldehyde. The development of deep red or maroon color is indicative of a positive result while the sample will remain a pale yellow for a negative result. Since visible color is subjective from person to person, the LV test utilizes UV-Vis spectroscopy to obtain an objective representation of the color. A positive result will reveal a large peak at 587 nanometers.

Evaluating Portable Spectrometry for Field-Based Detection and Identification of Synthetic Opioids

Lauryn Cammarata, B.S.¹; Pauline E. Leary, Ph.D.²; Seth Fisher³; Eric Wallis³; Brooke W. Kammrath, Ph.D.¹ - ¹University of New Haven, ²Noble, ³1st Detect Corporation

The increasing prevalence of illicitly manufactured drugs, including fentanyl, its analogues, and other novel psychoactive substances (NPS), has created an urgent need for rapid and reliable field-based detection methods due to their high potency and occurrence in complex street mixtures. Portable mass spectrometry (MS) offers a promising approach for on-site detection; however, factors such as mass analyzer type, ionization method, operating conditions, and matrix effects can influence spectral quality and identification accuracy. This study evaluated approximately 300 synthetic opioids and NPS compounds across three commercially available portable MS platforms, including toroidal ion-trap GC-MS, quadrupole GC-MS, and linear ion trap MS systems. Instrument performance was assessed based on detection and identification capabilities, spectral fidelity, and library matching performance using NIST, Cayman Chemical, and vendor-specific spectral libraries. The results provide insight into the capabilities and limitations of portable MS platforms for reliable field identification of emerging synthetic opioids and related substances.



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Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) Update

Tiffany Ribadeneyra, M.S., ABC-CC¹, Jennifer Bonetti, Ph.D, ABC-DA², Jaclyn Iera, Ph.D³ - ¹Nassau County Office of the Medical Examiner, ²Virginia Department of Forensic Science, ³U.S. Drug Enforcement Administration

The Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) was formed in 1997 in a joint effort between the U.S. Drug Enforcement Administration (DEA) Office of Forensic Sciences and the Office of National Drug Control Policy (ONDCP). Historically, SWGDRUG recommended minimum standards for the forensic examination of seized drugs and sought their international acceptance. Considering the formation of the Organization of Scientific Area Committees (OSAC), SWGDRUG continues to work as part of the international community to improve the quality of the forensic examination of seized drugs. In addition, the extensively utilized resources provided on the SWGDRUG website will continue to be updated and available including free spectra libraries and monographs.

This presentation will provide attendees with an update on SWGDRUG activities during the year 2025 and currently in 2026 including future initiatives including the newly published Stop Testing Procedure, NIST Sampling App and EPA Open Spectra App.

Adulterant Trends in the Illicit Drug Supply Across the Northeast and Mid-Atlantic Regions

Alexis Quinter - *The Center for Forensic Science Research and Education*

This presentation will examine the prevalence of adulterants found within the illicit drug supply, which will be impactful for forensic laboratory testing. Various types of drugs will be evaluated, with an emphasis on the increasingly complex opioid supply. Commonly encountered adulterants will be examined based on their presence, concentration, and trends over time and geographical regions will be presented. The presentation will describe the analytical approaches used to identify and characterize adulterants in illicit drug samples, including the importance of quantitative drug chemistry data. Participants will be instructed on the trend analysis of the qualitative and quantitative results used to evaluate the changes in prevalence and potency of adulterants. Understanding these emerging trends can help forensic laboratories, medical professionals, and other public health and safety stakeholders better recognize changes in the composition and concentration of the illicit drug supply, supporting informed decision-making and risk mitigation efforts.



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Using Direct Analysis in Real Time Triple Quadrupole Mass Spectrometry (DART-TQ-MS) to Generate and Compare Compositional Profiles of Authentic Fentanyl Samples

Joel E.R. Moss, Joshua S. DeBord, Nicholas Khorozov, Alexis Quinter, Heather L. Harris - Center for Forensic Science Research and Education

The detection and identification of fentanyl and fentanyl-related substances in seized drug evidence is crucial in law enforcement investigations. Since its development, the use of DART ion sources has been explored in forensic applications, including the rapid analysis of seized drug materials. In this study, a direct analysis in real time triple quadrupole mass spectrometry (DART-TQ-MS) method was developed for the rapid analysis of 15 authentic fentanyl samples to evaluate the feasibility of using chemical profiles to distinguish samples manufactured through similar processes and assess their potential for common source determination. The results of the DART-MS/MS method supported accurate detection and identification of fentanyl-related substances when compared to previously obtained results from gas chromatography-mass spectrometry and liquid chromatography-quadrupole time of flight-mass spectrometry. Although the generated chemical profiles did not support defensible common source determinations, the results demonstrated potential for distinguishing between samples manufactured using similar but different processes.

Analysis of Physical Drug Evidence in Suspected Overdose Cases

Ashley Dillard - Allegheny County Office of the Medical Examiner

Overdoses are a public health concern of epidemic proportion with devastating consequences for individuals, families, and communities. Physical drug evidence is critical to the understanding of the public health crisis, but also necessary for potential criminal investigations. With the ever-changing drug supply, the analysis of drug evidence collected at these types of scenes can provide valuable insight into drug trends within a community. At the Allegheny County Office of the Medical Examiner, drug evidence from suspected fatal overdose scenes was analyzed, using GC-MS/FID, for all cases involving primarily stamp bag submissions, in 2025-2026. This data shows trends in substances confirmed within those bags as well as the stamp bag markings, which can act as a branding or marketing mechanism for suppliers. Through this analysis, we are able to collaborate with the Toxicology department and outside organizations, such as the health department and various law enforcement agencies, that can utilize this information. Identification of substances present at suspected overdose scenes can help assess critical gaps in detection of emerging drug threats, particularly those not yet observed in the seized drug supply. This information can also facilitate timely notification of appropriate public health authorities, supporting a more rapid and effective response.



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Going Grey During Your Forensic Career: A Senior Scientist's Take On LC-MS/MS Troubleshooting for a Drug Chemistry Application.

Richard T. Ramsey - Allegheny County Office of the Medical Examiner

One day you wake up and go to the laboratory and the realization hits you. You are the most senior member of your department. When did this happen??? Most of your daily statements begin with “back in my day” or “when I ran a TLC plate” we analyzed it that way. Looking in the mirror has only confirmed this realization, you are indeed going grey in Forensics!! This talk will cover rekindling the passion in not only the younger coworker generational jargon, but more importantly, the quest to keep learning new technology and in this situation, troubleshooting the LC-MS/MS.

The LC-MS/MS is quickly gaining ground on replacing the GC/MS as the go-to instrument for drug analysis. Even though the letters and parts are similar, the hands-on utilization and especially troubleshooting are very different. This is where one must pivot from what you have always learned and done to an excitingly different frontier. Is the passion still there to try? What if I fail or worse yet, never attempt? I will be covering a couple entry level issues that have occurred during the validation of my laboratory's LC-MS/MS and maybe a story or two along the way.

Evaluation of Direct Analysis in Real Time-Triple Quadrupole-Mass Spectrometry (DART-TQ-MS) for Rapid Multi-Class Drug Screening

Nicholas Khorozov, M.S, Joshua DeBord, PhD, Alex Krotulski, PhD, Barry Logan, PhD - Center for Forensic Science Research and Education

The use of ambient ionization techniques for rapid drug chemistry screening is of growing interest in forensic labs. Direct Analysis in Real Time (DART), paired with tandem quadrupole mass spectrometry can allow for the rapid analysis of a wide variety of drugs of abuse with minimal sample preparation. Our laboratory has developed a comprehensive workflow for the analysis street-level samples for a nitazene analogs, benzodiazepines, and nineteen other common substances found in drug samples. Results were compared to previous analyses by GC/MS and LC-QTOF, utilizing threshold criteria involving relative internal standard area comparison, ion ratio deviation, and absolute principal ion area. False positive identification of drug substances by DART were low, demonstrating the potential for rapid, multi-class drug screening using ambient ionization methods.

Detecting the Next Emerging Drug: The Role of Full-Scan GC/MS in Forensic Drug Surveillance

Alexandra Kuchinos, MSFS, Mia Borrelli, MSFS, Amanda L.A. Mohr, MSFS, Barry K. Logan, PhD - Center for Forensic Science Research and Education

The illicit drug supply continues to evolve with the frequent introduction of novel psychoactive substances (NPS), creating challenges for laboratories tasked with monitoring emerging drug trends. While targeted analytical methods, such as gas chromatography/mass spectrometry (GCMS) with selected ion monitoring (SIM), are well suited for the detection of known compounds, laboratories



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supporting public health and drug monitoring efforts require analytical approaches capable of identifying unexpected substances outside an established target list. At the Center for Forensic Science Research and Education (CFSRE), full-scan GC-MS is routinely used to comprehensively characterize street drug samples submitted through public health drug checking and surveillance initiatives. This approach has facilitated the detection of numerous NPS, including emerging drugs such as cathinones, designer benzodiazepines, and novel synthetic opioids such as nitazenes and orphine compounds, which often elute late in the chromatographic run and may fall outside the scope of shorter, targeted analytical methods used in routine casework. The early identification of emerging compounds through full-scan GC/MS supports timely public health alerts, informs forensic laboratories of evolving drug trends, and strengthens drug surveillance efforts.