State of California
DEPARTMENT OF CALIFORNIA HIGHWAY PATROL
GRANT AGREEMENT - Page 1

Award Number
30989

1. GRANT TITLE
FY26/28 CTFGP Toxicology Crime Laboratories – Office of the Chief Medical Examiner, City and County of San Francisco

2. NAME OF ORGANIZATION/AGENCY
Office of the Chief Medical Examiner, City and County of San Francisco

3. ORGANIZATION/AGENCY SECTION TO ADMINISTER GRANT
Office of the City Administrator / Office of the Chief Medical Examiner

4. PROJECT PERFORMANCE PERIOD
From: 07/01/2026 To: 06/30/2028

5. PURCHASE ORDER NUMBER

6. GRANT OPPORTUNITY INFORMATION DESCRIPTION
Toxicology: Crime Laboratory grants shall be in direct support of grant-funded Project activities that aide in the enforcement of laws related to driving under the influence of alcohol and other drugs (DUI/DUID), including cannabis and cannabis products.

7. FUNDS ALLOCATED UNDER THIS GRANT AGREEMENT SHALL NOT EXCEED $846,952.62

8. TERMS AND CONDITIONS
The Grantee agrees to complete the Project, as described in the Project Description. The Grantee's Grant Application, and the California Code of Regulations, Title 13, Division 2, Chapter 13, Sections 1890.00-1890.27, are hereby incorporated into this Grant Agreement by reference.

The parties hereto agree to comply with the Terms and Conditions of the following attachments:

- Schedule A – Project Description, Problem Statement, Goals and Objectives, and Method of Procedure
- Schedule B – Detailed Budget Estimate
- Schedule B-1 – Budget Narrative

We, the officials named below, hereby swear, under penalty of perjury under the laws of the State of California, that we are duly authorized to legally bind the Grant recipient to the above-described Grant Terms and Conditions.

IN WITNESS WHEREOF, this Grant Agreement is executed by the parties hereto.

9. APPROVAL SIGNATURES

A. AUTHORIZED OFFICIAL OF ORGANIZATION/AGENCY
Name: Jennifer Johnston
Title: Deputy City Administrator
Phone: (415) 554-4572

Address: 1 Dr Carlton B Goodlett Place
Office of the City Administrator
San Francisco, CA 94102

E-Mail: jennifer.johnston@sfgov.org

_____ _____
(Signature) *(Date)*

B. AUTHORIZED OFFICIAL OF CHP
Name: Elliotte Johnson Phone: (916) 843-4360
Title: Captain Fax: (916) 322-3169

Address: 601 North 7th Street
Sacramento, CA 95811

E-Mail: ElJohnson@chp.ca.gov

_____ _____
(Signature) *(Date)*

C. ACCOUNTING OFFICER OF CHP
Name: M. V. Fojas Phone: (916) 843-3531
Title: Commander Fax: (916) 322-3159

Address: 601 North 7th Street
Sacramento, CA 95811

E-Mail: Michelle.Fojas@chp.ca.gov

_____ _____
(Signature) *(Date)*

10. AUTHORIZED FINANCIAL CONTACT TO RECEIVE REIMBURSEMENT PAYMENTS

Name: Katharine Petrucione
Title: Chief Financial Officer, Deputy City Administrator
Phone: (415) 554-4572

Address: 1 Dr Carlton B Goodlett Place
Office of the City Administrator
San Francisco, California 94102

TERMS AND CONDITIONS

Grantee shall comply with the California Code of Regulations, Title 13, Division 2, Chapter 13 Section 1890, et seq. and all other Terms and Conditions noted in this Grant Agreement. Failure by the Grantee to comply may result in the termination of this Grant Agreement by the California Highway Patrol (hereafter referred to as State). The State will have no obligation to reimburse the Grantee for any additional costs once the Grant Agreement has been terminated.

A. EXECUTION

1. The State (the California Highway Patrol) hereby awards, to the Grantee, the sum of money stated on page one of this Grant Agreement. This funding is awarded to the Grantee to carry out the Project set forth in the Project Description and the terms and conditions set forth in this Grant Agreement.

2. The funding for this Grant Agreement is allocated pursuant to California Revenue and Taxation Code Section 34019(f)(3)(B). The Grantee agrees that the State's obligation to pay any sum under this Grant Agreement is contingent upon availability of funds disbursed from the California Cannabis Tax Fund to the State. If there is insufficient funding, the State shall have the option to either: 1) terminate this Grant Agreement; whereby, no party shall have any further obligations or liabilities under this Grant Agreement, or 2) negotiate a Grant Agreement Amendment to reduce the grant award and scope of work to be provided under this Grant Agreement.

3. The Grantee is not to commence or proceed with any work in advance of receiving notice that the Grant Agreement is approved. Any work performed by the Grantee in advance of the date of approval by the State shall be deemed volunteer work and will not be reimbursed by the State.

4. The Grantee agrees to provide any additional funding, beyond what the State has agreed to provide, pursuant to this Grant Agreement, and necessary to complete or carry out the Project, as described in this Grant Agreement. Any modification or alteration of this Grant Agreement, as set forth in the Grant Application submitted by the Grantee and on file with the State, must be submitted in writing thirty (30) calendar days in advance to the State for approval.

5. The Grantee agrees to complete the Project within the timeframe indicated in the Project Performance Period, which is on page one of this Grant Agreement.

B. PROJECT ADMINISTRATION

1. The Grantee shall submit all reimbursements, progress, performance, and/or other required reports concerning the status of work performed in furtherance of this Grant Agreement on a quarterly basis, or as requested by the State.

2. The Grantee shall provide the State with a final report showing all Project expenditures, which includes all State and any other Project funding expended, within sixty (60) calendar days after completion of this Grant Agreement.

3. The Grantee shall ensure all equipment which is purchased, maintained, operated, and/or developed is available for inspection by the State.

4. Equipment purchased through this Grant Agreement shall be used for the education, prevention, and enforcement of impaired driving laws, unless the Grantee is funding a portion of the purchased price not dedicated to impaired driving and that portion is not part of the Project costs. Equipment purchased under this Grant Agreement must only be used for approved Project-related purposes, unless otherwise approved by the State in writing.

5. Prior to disposition of equipment acquired under this Grant Agreement, the Grantee shall notify the State via e-mail, and by telephone, by calling the California Highway Patrol, Impaired Driving Section, Cannabis Grants Unit at (916) 843-4360.

TERMS AND CONDITIONS

C. PROJECT TERMINATION

1. Grantee or the State may terminate this Grant Agreement at any time prior to the commencement of the Project. Once the Project has commenced, this Grant Agreement may only be terminated if the party withdrawing provides thirty (30) calendar days written notice of their intent to withdraw.

    a. If by reason of force majeure the performance hereunder is delayed or prevented, then the term end date may be extended by mutual consent for the same amount of time of such delay or prevention. The term “force majeure” shall mean any fire, flood, earthquake, or public disaster, strike, labor dispute or unrest, embargo, riot, war, insurrection or civil unrest, any act of God, any act of legally constituted authority, or any other cause beyond the Grantee’s control which would excuse the Grantee’s performance as a matter of law.

    b. Grantee agrees to provide written notice of an event of force majeure under this Grant Agreement within ten (10) calendar days of the commencement of such event, and within ten (10) calendar days after the termination of such event, unless the force majeure prohibits Grantee from reasonably giving notice within this period. Grantee will give such notice at the earliest possible time following the event of force majeure.

2. Any violations of law committed by the Grantee, misrepresentations of Project information by the Grantee to the State, submission of falsified documents by the Grantee to the State, or failure to provide records by the Grantee to the State when requested for audit or site visit purposes may be cause for termination. If the Project is terminated for the reasons described in this paragraph, the State will have no obligation to reimburse the Grantee for any additional costs once the Grant Agreement has been terminated.

3. The State may terminate this Grant Agreement and be relieved of any payments should the Grantee fail to perform the requirements of this Grant Agreement at the time and in the manner herein provided. Furthermore, the Grantee, upon termination, shall return grant funds not expended by the Grantee as of the date of termination.

4. If this Grant Agreement is terminated, the State may choose to exclude the Grantee from future Grant Opportunities.

D. FINANCIAL RECORDS

1. The Grantee agrees the State, or their designated representative, shall have the right to review and to copy all records and supporting documentation pertaining to the performance of this Grant Agreement. Grantee agrees to maintain such records for possible audit for a minimum of five (5) years after final payment, unless a longer period of records retention is stipulated or required by law. Grantee agrees to allow the auditor(s) access to such records during normal business hours and to allow interviews of any employees who might reasonably have information related to such records. Furthermore, the Grantee agrees to include a similar right for the State to audit all records and interview staff in any subcontract related to performance of this Grant Agreement.

E. HOLD HARMLESS

1. The Grantee agrees to indemnify, defend, and save harmless the State, its officials, agents and employees from any and all claims and losses accruing or resulting to any and all Grantee’s staff, contractors, subcontractors, suppliers, and other person, firm or corporation furnishing or supplying work services, materials, or supplies in connection with the performance of this Grant Agreement, and from any and all claims and losses accruing or resulting to any person, agency, firm, corporation who may be injured or damaged by the Grantee in performance of this Grant Agreement.

TERMS AND CONDITIONS

F. NONDISCRIMINATION

1. The Grantee agrees to comply with State and federal laws outlawing discrimination, including, but not limited to, those prohibiting discrimination because of sex, race, color, ancestry, religion, creed, national origin, physical disability (including HIV and AIDS), mental disability, medical condition (including cancer or genetic characteristics), sexual orientation, political affiliation, position in a labor dispute, age, marital status, and denial of statutorily-required employment-related leave. (GC 12990 [a-f] and CCR, Title 2, Section 8103.)

G. AMERICANS WITH DISABILITIES ACT

1. The Grantee assures the State it complies with the Americans with Disabilities Act (ADA) of 1990, which prohibits discrimination on the basis of disability, as well as all applicable regulations and guidelines issued pursuant to the ADA. (42 U.S.C. 12101 et seq.)

H. DRUG-FREE WORKPLACE

1. The Grantee shall comply with the requirements of the Drug-Free Workplace Act of 1990 and will provide a drug-free workplace by taking the following actions:

    a. Publish a statement notifying employees that unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance is prohibited and specifying actions to be taken against employees for violations.

    b. Establish a Drug-Free Awareness Program to inform employees about:

        i. The dangers of drug abuse in the workplace.

        ii. The person's or Organization/Agency's policy of maintaining a drug-free workplace.

        iii. Any available counseling, rehabilitation, and employee assistance programs.

        iv. Penalties that may be imposed upon employees for drug abuse violations.

    c. Every employee who works on the Project will:

        i. Receive a copy of the company's drug-free workplace policy statement.

        ii. Agree to abide by the terms of the company's statement as a condition of employment on the Grant Agreement.

2. Failure to comply with these requirements may result in suspension of payments under this Grant Agreement, or termination of this Grant Agreement, or both, and Grantee may be ineligible for award of any future Grant Agreements if the department determines that any of the following has occurred:

    a. The Grantee has made false certification or violated the certification by failing to carry out the requirements, as noted above. (GC 8350 et seq.)

I. LAW ENFORCEMENT AGENCIES

1. All law enforcement Organization/Agency Grantees shall comply with California law regarding racial profiling. Specifically, law enforcement Organization/Agency Grantees shall not engage in the act of racial profiling, as defined in California Penal Code Section 13519.4.

TERMS AND CONDITIONS

J. LABOR CODE/WORKERS' COMPENSATION

1. The Grantee is advised and made aware of the provisions which require every employer to be insured against liability for Worker's Compensation or to undertake self-insurance in accordance with the provisions, and Grantee affirms to comply with such provisions before commencing the performance of the work of this Grant Agreement, (refer to Labor Code Section 3700).

K. GRANT APPLICATION INCORPORATION

1. The Grantee agrees the Grant Application and any subsequent changes or additions approved or required by the State is hereby incorporated into this Grant Agreement.

L. STATE LOBBYING

1. The Grantee is advised that none of the funds provided under this Grant Agreement may be used for any activity specifically designed to urge or influence a state or local legislator to favor or oppose the adoption of any specific legislative proposal pending before any state or local legislative body. Such activities include both direct and indirect (e.g., “grassroots”) lobbying activities, with one exception. This does not preclude a state official, whose salary is supported by this Grant Agreement, from engaging in direct communications with the state or local legislative officials, in accordance with customary state and/or local practice.

M. REPRESENTATION AND WARRANTIES

1. The Grantee represents and warrants that:

    a. It is validly existing and in good standing under the laws of the State of California, has, or will have the requisite power, authority, licenses, permits, and the like necessary to carry on its business as it is now being conducted and as contemplated in this Grant Agreement, and will, at all times, lawfully conduct its business in compliance with all applicable federal, state, and local laws, regulations, and rules.

    b. It is not a party to any Grant Agreement, written or oral, creating obligations that would prevent it from entering into this Grant Agreement or satisfying the terms herein.

    c. If the Grantee is a Nonprofit Organization/Agency, it will maintain its “Active” status with the California Secretary of State, maintain its “Current” status with the California Attorney General’s Registry of Charitable Trusts, and maintain its federal and State of California tax-exempt status. If the Grantee subcontracts with a Nonprofit as part of this Grant Agreement, the Grantee shall ensure the Nonprofit will maintain its “Active” status with the California Secretary of State, maintain its “Current” status with the California Attorney General’s Registry of Charitable Trusts, and maintain its federal and State of California tax-exempt status.

    d. All of the information in its Grant Application and all materials submitted are true and accurate.

N. AIR OR WATER POLLUTION VIOLATION

1. Under the state laws, the Grantee shall not be: (1) in violation of any order or resolution not subject to review promulgated by the State Air Resources Board or an air pollution control district; (2) subject to cease and desist order not subject to review issued pursuant to Section 13301 of the Water Code for violation of waste discharge requirements or discharge prohibitions; or (3) finally determined to be in violation of provisions of federal law relating to air or water pollution.

TERMS AND CONDITIONS

O. GRANTEE NAME CHANGE

1. Grantee agrees to immediately inform the State, in writing, of any changes to the name of the person within the Organization/Agency with delegated signing authority.

2. An Amendment is required to change the Grantee's name, as listed on this Grant Agreement. Upon receipt of legal documentation of the name change, the State will process the Amendment. Payment of invoices presented with a new name cannot be paid prior to approval of said Amendment.

P. RESOLUTION

1. A county, city, district, or other local public body shall provide the State with a copy of a resolution, order, motion, or ordinance of the local governing body, which by law, has authority to enter into a Grant Agreement, authorizing execution of the Grant Agreement.

Q. PAYEE DATA RECORD FORM STD. 204

1. This form shall be completed by all non-governmental Grantees.

R. FINANCIAL INFORMATION SYSTEM FOR CALIFORNIA GOVERNMENT AGENCY TAXPAYER ID FORM

1. This form shall be completed by all Grantees.

S. CONFLICT OF INTEREST

1. This section serves to make the Grantee aware of specific provisions related to current or former state employees. If Grantee has any questions regarding the status of any person rendering services or involved with the Grant Agreement, the Grantee shall contact the State (California Highway Patrol, Impaired Driving Section, Cannabis Grants Unit) immediately for clarification.

2. Current State Employees:

    a. No officer or employee shall engage in any employment, activity, or enterprise, from which the officer or employee receives compensation or has a financial interest, and which is sponsored or funded by any state agency, unless the employment, activity, or enterprise is required, as a condition of regular state employment.

    b. No officer or employee shall contract on their own behalf, as an independent Grantee, with any state agency to provide goods or services.

3. Former State Employees:

    a. For the two-year period from the date they left state employment, no former state officer or employee may enter into a contract in which they engaged in any of the negotiations, transactions, planning, arrangements, or any part of the decision-making process relevant to this Grant Agreement while employed in any capacity by any state agency.

    b. For the 12-month period from the date they left state employment, no former state officer or employee may enter into a contract with any state agency if they were employed by that state agency in a policy-making position in the same general subject area as the proposed Grant Agreement within the 12-month period prior to their leaving state service.

4. The authorized representative of the Grantee Organization/Agency, named within this Grant Agreement, warrants their Organization/Agency and its employees have no personal or financial interest and no present or past employment or activity, which would be incompatible with

participating in any activity related to this Grant Agreement. For the duration of this Grant Agreement, the Organization/Agency and its employees will not accept any gift, benefit, gratuity or consideration, or begin a personal or financial interest in a party who is associated with this Grant Agreement.

5. The Grantee Organization/Agency and its employees shall not disclose any financial, statistical, personal, technical, media-related, and/or other information or data derived from this Grant Agreement, made available for use by the State, for the purposes of providing services to the State, in conjunction with this Grant Agreement, except as otherwise required by law or explicitly permitted by the State in writing. The Grantee shall immediately advise the State of any person(s) who has access to confidential Project information and intends to disclose that information in violation of this Grant Agreement.

6. The Grantee will not enter into any Grant Agreement or discussions with third parties concerning materials described in paragraph five (5) prior to receiving written confirmation from the State that such third party has a Grant Agreement with the State, similar in nature to this one.

7. The Grantee warrants that only those employees who are authorized and required to use the materials described in paragraph 5 will have access to them.

8. If the Grantee violates any provisions in the above paragraphs, such action by the Grantee shall render this Grant Agreement void.

T. EQUIPMENT-USE TERMS

1. The Grantee agrees any equipment purchased under this Grant Agreement shall be used for impaired driving efforts.

2. Law Enforcement Projects:

   a. Oral Fluid Drug Screening Devices and Cannabis/Marijuana Breath Testing Equipment - The Grantee agrees to ensure all personnel using road-side drug testing equipment, including oral fluid drug testing devices and/or cannabis/marijuana breath testing devices, purchased with grant funds from this Grant Agreement, are trained to recognize alcohol and drug impairment. At a minimum, personnel using these devices should receive Standardized Field Sobriety Testing training. These personnel are also encouraged to attend Advanced Roadside Impaired Driving Enforcement and Drug Recognition Evaluator training. Prior to using these devices, the Grantee agrees to obtain permission from their local prosecutor's office, establish a policy ensuring appropriate use, and require the staff using these devices to receive appropriate training, which may include training from the manufacturer. This will help ensure the equipment is used appropriately. The Grantee shall advise the State (California Highway Patrol, Impaired Driving Section, Cannabis Grants Unit) of any legal challenges or other items of significance that may affect the use or legal acceptance of these devices. Additionally, the State may request additional information about the performance of these devices, including information about their use, accuracy, and feedback from personnel using the devices.

   b. Law Enforcement Vehicles – The Grantee agrees any law enforcement vehicles purchased with Grant funds, from this Grant Agreement, will be primarily used for the enforcement of driving under the influence laws and/or providing public education, related to the dangers of driving under the influence. Additionally, any vehicle purchased using funds from this Grant Agreement shall comply with all California Vehicle Code and California Code of Regulation requirements. The State may require the Grantee to mark these vehicles with a decal and/or emblem, indicating the vehicle is used for driving under the influence enforcement.

Schedule A

Office of the Chief Medical Examiner, City and County of San Francisco

The Grantor determined awards and adjustments based on the Project's merit, operational scale, compliance with the Request for Application (RFA), and program regulations. Certain activities or budget items proposed in Schedule A may have been deemed ineligible for funding. The final, binding list of authorized activities and expenses is set forth in Schedule B - Detailed Budget Estimate.

Project Description

The project will enhance driving under the influence of drugs (DUID) testing and reporting capabilities of the San Francisco Office of the Chief Medical Examiner (SFOCME) through software development and improvements to analytical methodology using machine learning. The laboratory information management system (LIMS) implemented during the 2024-2026 grant cycle built the foundation for the SFOCME to develop efficient methods for communicating DUID data through the state's Fatality Analysis Reporting System (FARS). The LIMS continues to be instrumental in routine procedures, and incorporating quality procedures into its procedures will leverage the collective data in the database to move from manual approaches. Following the 2024-2026 grant cycle, the Liquid Chromatography Quadrupole Time of Flight Mass Spectrometry (LC-QTOF-MS) was implemented and performs targeted analysis routinely. However, it performs untargeted acquisition of any xenobiotic (including new and novel drugs) and is capable of an entirely untargeted processing workflow. With over 45,000 data points per sample, only a small fraction of it is being utilized for the library matching process in routine identification. Through integrating machine learning (ML) methods to analyze this data, we can gain insight into novel psychoactive substances (NPS) as quickly as they arise. There are several proposed aspects to this project:

1. A streamlined workflow within LIMS for DUID data for regular reporting to the state's FARS
2. Expand the quality improvement abilities of the LIMS to maintain accreditation.
3. An untargeted screening method for LC-QTOF-MS data capable of identifying NPS and other compounds through ML

Problem Statement

The Forensic Laboratory Division of the SFOCME remains committed to providing comprehensive forensic toxicology services to the City and County of San Francisco. The analysis of DUID casework continues to represent a critical component of our workload and an ongoing public safety priority. In 2025, the laboratory received 722 DUID cases, reflecting a 12% increase from the 647 cases received in 2024 (SFOCME DUID Report 2025)—without the addition of staff to account for case increase. By strategically addressing the following challenges related to DUID reporting and analysis, we seek to sustain and enhance our ability to deliver timely, accurate, and comprehensive results to the community and all stakeholders.

Challenges with Data Reporting:

Traffic fatalities are an intersection of DUI/DUID and death investigation and are reported to the nationwide census FARS via a format standardized by state. The data-collection effort of the department to FARS has been challenging for the existing case management setup for the laboratory and Medical Examiner. Beginning in 2025, SFOCME deployed the LIMS to replace the previous hard-copy records system. The existing setup relies on manual data extraction, manipulation and preparation, not to mention irregularities on frequency and completeness of submissions. LIMS needs further configuration to enable regular, streamlined reporting for FARS. Public safety and legislative stakeholders require this data to make informed policy decisions for the increased road safety and mitigation of fatalities due to impaired driving.

Challenges with Maintaining Accreditation:

In 2023, the laboratory achieved accreditation to the international standard, ISO/IEC 17025, through the ANSI National Accreditation Board (ANAB) while continuing to maintain accreditation by the American Board of Forensic Toxicology (ABFT). Meanwhile, the emphasis and exposure of forensic laboratory work products in court proceedings are significant. In 2022 and 2023, 297 of 319 (>90%) litigation packets prepared by the SFOCME were for DUID cases. Maintenance of accreditation is critical for the ongoing provision of forensic toxicology testing services to the community and the ongoing substantiation and success of such work.

Schedule A

The facilitation of quality activities to meet the rigor of these accreditation schemes (e.g., increasing scope of internal audits, deepening the reach of management reviews, ensuring ongoing proficiency of external service providers) demands access to data and metadata from the various facets of laboratory operation. LIMS requires development to make such data accessible and usable in quality improvement activities, a critical part of accreditation.

Challenges with Reference Library-Based Testing:

Our validated QTOF method for routine DUID casework operates using a targeted analytical approach, requiring the availability of reference materials for compound identification (Sarkisian et al., 2025). Although the method encompasses a broad analytical scope, this requirement inherently limits its full potential. The QTOF platform is capable of untargeted data acquisition, capturing comprehensive small molecule information within a sample. However, in the absence of corresponding reference materials and spectral libraries, these data cannot be confidently translated into definitive structural identifications (Rodda et al., 2025).

The detection of NPS can present a particular and evolving challenge for routine DUID casework. Manufacturers operating in gray-market laboratories actively modify their production methods and precursor products to evade detection, respond to supply variability, or adapt to regulatory changes (Krotulski et al., 2025). As a result, maintaining a comprehensive, current, and validated library of emerging NPS compounds is both scientifically complex and financially burdensome.

While prior studies have demonstrated the feasibility of applying machine learning algorithms to analyze the spectral data of NPS (Wang et al., 2023, Pelletier et al., 2025), these approaches have not been translated into methods suitable for routine DUID casework. For practical implementation in a high-throughput forensic setting, analytical strategies must demonstrate not only scientific accuracy, but also operational scalability, robustness, and compatibility with routine laboratory workflows.

Challenges with Untargeted Methods:

Implementation of a truly untargeted analytical approach presents several technical and operational challenges. The initial obstacle lies in transforming raw QTOF data into identifiable molecular features, which require deconvolution algorithms specifically optimized for the acquisition parameters of the method. Once thousands of small-molecule features are generated, they must be systematically and accurately classified as either NPS or non-NPS in an automated manner to ensure feasibility for routine DUID screening.

Following automated classification, a standardized review process must be established, enabling forensic toxicologists to efficiently interpret and verify results. This necessitates the development of structured reporting tools and a dedicated report viewer designed for routine casework applications. While there have been programs and software tools developed for these purposes, they have not been tailored for forensic applicability or for routine screening purposes (Swan et al., 2025).

Accordingly, any proposed untargeted workflow must integrate seamlessly into the daily operational framework of the OCME while maintaining the high level of analytical accuracy, reproducibility, and defensibility required to support forensic decision-making in DUID casework.

References

City and County of San Francisco, San Francisco Office of the Chief Medical Examiner. Driving Under the Influence of Drugs and/or Alcohol (DUID) Data Report - 2025. Office of the City Administrator. January 21, 2026.

Sarkisian M, Rodda LN. A validated screening and confirmation method for 946 drugs and metabolites using LC-QTOF-MS with SWATH acquisition. J Anal Toxicol. 2025 Jul 1;49(6):407-416. doi: 10.1093/jat/bkaf037. PMID: 40324907.

Schedule A

Luke N Rodda, Kayla N Ellefsen, Marie Mardal, Peter Stockham, Andrea, E Steuer, Dani Mata, Alex J Krotulski, Maria Sarkisian, From promise to practice: why HRMS has yet to fully revolutionize forensic toxicology, Journal of Analytical Toxicology, Volume 49, Issue 7, September 2025, Pages 514–515, https://doi.org/10.1093/jat/bkaf036

Alex J Krotulski, Dani C Mata, Christina R Smith, Kaitlyn B Palmquist-Orlando, Celia Modell, Svante Vikingsson, Michael T Truver, Advances in analytical methodologies for detecting novel psychoactive substances: a review, Journal of Analytical Toxicology, Volume 49, Issue 3, April 2025, Pages 152–169, https://doi.org/10.1093/jat/bkae098

Wang F, Pasin D, Skinnider MA, Liigand J, Kleis JN, Brown D, Oler E, Sajed T, Gautam V, Harrison S, Greiner R, Foster LJ, Dalsgaard PW, Wishart DS. Deep Learning-Enabled MS/MS Spectrum Prediction Facilitates Automated Identification Of Novel Psychoactive Substances. Anal Chem. 2023 Dec 19;95(50):18326-18334. doi: 10.1021/acs.analchem.3c02413. Epub 2023 Dec 4. PMID: 38048435; PMCID: PMC10733899.

Pelletier R, Nahle D, Sarr M, Bourdais A, Morel I, Le Daré B, Gicquel T. Identifying metabolites of new psychoactive substances using in silico prediction tools. Arch Toxicol. 2025 Jul;99(7):2953-2973. doi: 10.1007/s00204-025-04049-5. Epub 2025 May 13. PMID: 40358677; PMCID: PMC12198081.

Samantha Swan, Maria Sarkisian, Daniel Pasin, Luke N Rodda, Applications of machine learning for the general unknown screening of HRMS data within forensic toxicology, Journal of Analytical Toxicology, 2025, https://doi.org/10.1093/jat/bkaf109

Performance Measures/Scope of Work (Proposed Solution)

The analysis and accessible reporting of DUID casework continues to be a priority for the SFOCME. The proposed solutions through the performance measures outlined aim to improve and enhance the existing workflows for routine DUID casework through achievable goals. This will directly address the complex analytical and operational challenges inherent to DUID casework, while preserving the high standards of quality, timeliness, and scientific accuracy that define routine testing of DUID casework at the SFOCME. By leveraging the LIMS to enhance and streamline the existing workflow for DUID casework, we aim to continue to improve our currently achieved accreditations through the work of specialists in quality management and data science.

Proposed Solution for Data Reporting:

The development of a streamlined workflow and pipeline within the LIMS allows relevant DUID data to be reported regularly to the state's FARS. Further configuration of LIMS will identify required fields for reporting; the existing database will be modified to optimize data capture with minimal impact on laboratory operations. Additional fields may be created, and changes may be required to existing fields to ensure complete data submissions. A regular, calendared reporting schedule will also be developed to ensure consistent submissions. Other data reporting may be harmonized or synchronized throughout this process. This proposal aims to continue to resource the laboratory with the Forensic Quality Manager to coordinate this project with the LIMS.

Performance Measures for Data Reporting:

1. Development of workflow streamlined to routine laboratory operations using LIMS to regularly report to FARS by December 2026

2. Process documentation, implementation and deployment of systematic reporting to FARS by June 2027

3. Identify additional reporting schemes and requirements by September 2027

4. Develop and implement additional reporting schemes by June 2028

Schedule A

Proposed Solution for Maintaining Accreditation:

The laboratory's capacity for continuous quality improvement is limited by the accessibility of data collected throughout routine laboratory operations. Among the programs that exist for this purpose, participation in proficiency testing enables the laboratory to objectively monitor and assess its performance – the current paper-based and manual transcriptions involved need transformation in workflow and database infrastructure to minimize redundant data entry and make existing data retrievable for evaluation. Identification of additional data types acquired during analysis often queried for cause analysis and incorporation of such fields will minimize the barrier presented by data accessibility. Proactive alerts and routine queries can also serve to notify data reviewers and managers as a form of early detection or prevention of quality issues.

Performance Measures for Maintaining Accreditation:

1. Development and implementation of proficiency test workflows in LIMS by September 2026

2. Improve newly implemented proficiency test workflows to include internal evaluation and internal circulation by December 2026

3. Identify data types and date fields, update database structure required to facilitate quality improvement activities within LIMS by March 2027

4. Implementation of modules to facilitate quality improvement activities within LIMS by September 2026

Proposed Solution for Reference Library Based Testing:

The development of an untargeted screening method capable of expanding the scope of testing to suggest novel structures could allow the OCME to respond to the dynamic grey market as quickly as it changes (NPS Discovery: Year in Review 2025). The pre-processing stage for small molecules has been developed and the training of a multi-layer deep learning method classifier capable of discerning NPS and non-NPS is undergoing evaluation. It will be integrated with the DarkNPS elucidation strategy that can suggest structures for NPS with unparalleled accuracy (Skinnider et al., 2023). These structures will undergo toxicologist screening for confirmed detections and be input into the LIMS for tracking and suggesting compounds for routine DUID screening. This method has the potential to identify novel substances as fast as they arise, with only the information gained in the routine QTOF acquisition. It leverages the full potential of the untargeted acquisition and would be tailored to the OCME methodology. This real-time evaluation also gives valuable insight into the NPS market for DUID casework. This proposal seeks to equip the laboratory with a dedicated Method Development Specialist possessing expertise in machine learning and data science to advance the continued development and implementation of this method.

Performance Measures for Reference Library Based Testing:

1. Development of an untargeted method capable of generating structure through the training of multi-layer deep learning models for NPS that is applicable and scalable to casework for routine processing of DUID cases by April 2027

2. Implementation of this method in an automated pipeline connecting to the LIMS with programmatic result submission

3. Minimize the need for toxicologist's active time to ~2 hours per week maximum towards this effort

4. Expand the scope of this testing to metabolites and other small molecules of forensic interest for DUID cases by December 2027

Schedule A

Proposed Solution for the Adoption of Untargeted Methods:

Through integration of the untargeted screening method to the LIMS, the results of the untargeted screening method can be leveraged to their fullest potential. This required creating a report and reporting strategy, which has been developed to be a fully automated process to limit the demand for toxicologists' active time needed for processing DUID casework results. A screening tool was developed entirely through the LIMS to cue the reports so that a toxicologist can evaluate them systemically. Through the screening process, toxicologists can quickly evaluate the machine learning generated structures. By maintaining a record of all confirmed experimental detections in DUID casework, we can gain insight into any new novel drugs as they arise. We can also use the detections from routine casework to hypothesize new metabolites or precursors, gaining increased insight into DUID casework. By connecting the machine learning process with our routine and validated methods, we can suggest compounds for addition into routine screening methods so that future DUID cases will include these as part of their scope of testing. This proposal seeks to develop and implement an integrated untargeted screening method suitable for routine casework, with the objective of establishing a sustainable, long-term analytical solution that enhances and strengthens the laboratory's routine testing capabilities.

Performance Measures for the Adoption of Untargeted Methods:

1. Case and batch report generation, screening, and review of generated structures entirely through LIMS in a streamlined workflow by December 2026

2. Analysis performed in LIMS for relational searches between generated structures and routinely confirmed detections to suggest new metabolite or precursor relationships by December 2027

3. Suggestion of new compounds for routine casework library testing additions, expanding the scope of QTON processing to reflect the generated structures

References

Krotulski, AJ; Papsun, DM; Walton, SE; DeBord, JS; Stang, BN; Denn, MT; Logan, BK (2026), NPS Discovery: Year in Review 2025, Center for Forensic Science Research and Education, United States.

NPS Discovery: Year in Review 2025, Center for Forensic Science Research and Education, United States.Skinnider, M.A., Wang, F., Pasin, D. et al. A deep generative model enables automated structure elucidation of novel psychoactive substances. Nat Mach Intell 3, 973–984 (2021). https://doi.org/10.1038/s42256-021-00407-x

Project Performance Evaluation

Project effectiveness will be evaluated through a combination of quantitative performance metrics, qualitative assessments, and a defined communication and dissemination strategy to ensure transparency, sustainability, and community impact. Evaluation strategies are designed to assess analytical performance, operational integration, accreditation compliance, and the project's contribution to improving the detection and understanding of emerging substances in DUID casework.

The project's positive impact on the community will be demonstrated through enhanced detection of NPS, expansion of reportable testing scope, and proactive identification of emerging drug trends affecting public safety.

Performance Measures for Data Reporting:

Quantitative Performance Measures

Project effectiveness will be assessed using the following data-driven metrics:

- Number of cases submitted to FARS in the calendar year before and after implementation of new reporting workflow.

Schedule A

- Number of person-hours required to submit to FARS in the calendar year before and after implementation.

- Number of NPS detected and classified using the untargeted LC-QTOF-MS workflow.

- Rate of successful spectral classification of NPS using machine learning-based preprocessing compared to historical untargeted screening methods.

- Number of predicted structures generated and evaluated through elucidative workflows.

- Number of newly identified metabolites confirmed or provisionally characterized from routine DUID casework.

- Reduction in time to detection and characterization of emerging substances compared to traditional library-based approaches.

- Number of library and scope additions recommended and implemented into routine targeted LC-QTOF-MS methodologies based on untargeted findings.

- Increase in scope of reportable analytes for DUID casework attributable to project outputs.

- Trend analysis will be performed to evaluate changes in detection frequency, substance diversity, and emerging drug classes over time.

  Qualitative Performance Measures

  Qualitative measures will include:

- Feedback on accessibility and usability from internal users that execute queries to investigate issues impacting quality and that perform quality improvement activities

- Internal analyst feedback regarding usability, interpretability, and workflow integration of the untargeted screening and reporting tools.

- Case-based evaluations demonstrating how untargeted findings contributed to improved toxicological interpretation.

- Assessment of the project's ability to identify previously unrecognized substances or metabolites relevant to impairment.

Data Capture and Reporting

All project-related data will be systematically captured through LIMS integration, including spectral features, predicted structures, confirmation outcomes, and reporting decisions. Data summaries and performance metrics will be generated quarterly and reviewed as part of the internal quality and management processes.

Performance Measures for Maintaining Accreditation:

The project will be developed and evaluated in accordance with national and international standards ASB 098, ASB 113, and ISO/IEC 17025:2017, and applicable CHP grant requirements to ensure continued accreditation compliance.

Performance measures will include:

- Complete transition from paper-based system to LIMS system for evaluation of proficiency testing program.

- Rendered obsolete current checklists to facilitate proficiency testing receipt, submission and evaluation.

Schedule A

- Continued quality assurance monitoring of issues, including investigation, cause analysis, process improvements and associated documentation.
- Documented validation and verification activities for all analytical workflows, including preprocessing, classification, and elucidation components.
- Defined acceptance criteria for machine learning outputs, including confidence thresholds, corroborative evidence requirements, and reporting limitations.
- Traceability and auditability of all data processing steps through LIMS, including version control of models, libraries and decision criteria.
- Ongoing quality assurance monitoring including false positive and false negative trend analysis, and retrospective review of untargeted findings incorporated into routine DUID testing.
- Training competency and documentation for analysts using the untargeted workflow.
- Internal technical and administrative reviews demonstrating that untargeted results used for intelligence or scope expansion meet fit-for-purpose requirements.

This project will not replace validated targeted methods but will function as a scientifically controlled adjunct to routine testing, consistent with accreditation expectations.

Project Performance for Reference Library Based Testing / Project Performance for the Adoption of Untargeted Methods:

Reference Library Based Testing Performance

Project success will be measured by the extent to which untargeted findings inform and strengthen traditional reference library-based testing, including:

- Identification of candidate compounds and metabolites for targeted library inclusion.
- Evaluation of detection frequency and case relevance prior to formal method expansion.
- Demonstrated improvement in routine detection rates for newly added compounds.
- Reduction in reliance on external intelligence sources for emerging drug identification.

Adoption of Untargeted Methods

Performance measures for the adoption of untargeted methodologies include:

- Successful integration of untargeted screening into routine DUID workflows without disruption to case throughput and turnaround times.
- Demonstrated analyst proficiency and confidence in interpreting untargeted outputs.
- Use of untargeted findings to generate actionable intelligence regarding the evolving market of illicit substances.
- Evidence that untargeted screening improves early detection of emerging substances before they become widespread.

The project will be evaluated not only on analytical outputs, but also on its sustainability, scalability, and ability to support long-term forensic intelligence efforts.

Schedule A

Communication Plan: Internal and External Stakeholders

Project results will be communicated through a structured dissemination strategy:

Internal Stakeholders

- Individual result reports and identified component reports to consolidate information for considering future library additions for routine LC-QTOF testing.
- Regular updates to laboratory management and quality teams.
- Training sessions and documentation for analysts and technical reviewers.

External Stakeholders

- Compounds identified as part of the untargeted screening method that are added to routine LC-QTOF testing will then be reported to external stakeholder agencies through routine testing and reporting.
- Presentations at forensic science and toxicology conferences.
- Peer-reviewed publications describing validated workflows and findings.
- Collaboration and information sharing with regional and national forensic laboratories to support broader adoption.

This communication strategy ensures that project outcomes extend beyond the laboratory, contributing to improved impaired driving investigations, public safety awareness, and advancement of forensic toxicology practices statewide.

Program Sustainability

The goal of the outlined projects is the creation of long-term methods for data reporting, quality control, and dataset analysis. Past the initial development and validation of these methods they will require minimal maintenance and are without recurring costs.

Several methods including code documentation, environmental management, and version control systems through Git have been enacted to ensure the reproducibility of the workflows created. Through responsible development and a focus on developing the LIMS to directly reflect the needs of the SFOCME, the projects are on the timeframe to be incorporated as part of sustained routine operations not reliant on state funding. The data reporting and accreditation capabilities are being developed for the existing laboratory information management system (LIMS) and once implemented, it will require limited upkeep, an existing part of routine laboratory operations and budget planning. The process documentation of new workflows supports the ongoing execution of reporting to FARS and other schemes.

The untargeted method is being developed with the goal of being fully automated programmatically. Through a reproducible coding strategy, it will remain unaffected by software updates. By integrating this method into the LIMS, a permanent fixture of OCME routine casework, it can be maintained and continued to be used for NPS screening. The models are retrainable, allowing for the deep-learning methods to be adapted over time without any significant re-development.

Administrative Support

The Forensic Laboratory Division (FLD) of the Office of the Chief Medical Examiner (OCME) is required to perform all forensic toxicological examinations for the City and County of San Francisco, including all driving under the influence of alcohol and drugs for law enforcement agencies, namely, the San Francisco Police Department and the California Highway Patrol.

Physical resouces includes a comprehensive laboratory with adequate resources in instrumentation, equipment, consumables and IT.

Schedule A

Personnel resources to execute this project include those with expertise in research, quality assurance, accreditation, and testimony/interpretational skills, routine testing of DUID, legal counsel, human resources, accounting, and management; specifically:

- The FLD is led by a Forensic Toxicologist Supervisor and Forensic Laboratory Manager (FTS) who performs day-to-day management of laboratory operations; and a Chief Forensic Toxicologist and Forensic Laboratory Director (CFT) who oversees all operations and development of new method and testing schemes, and final approval of all procedures.

- The CFT provides forensic toxicology expertise to the state DUID taskforce hosted by CHP, focusing on sharing knowledge on the advancement of efficient and effective testing methods. Dr. Rodda's profile https://pathology.ucsf.edu/about/faculty/luke-n-rodda-phd

- The CFT is certified to inspect ISO 17025 and ABFT accreditations for peer laboratories and are invited to do so on a regular basis.

- The FLD employs Forensic Laboratory Analysts and Forensic Toxicologists to maintain current workloads.

- The FLD employees an office support staff member that assists in administrative case handling, including fees, communications, report typing and dissemination.

- The OCME is administered by the Executive Director who supports the Office, including the FLD.

- The OCME is further supported by the Office of the City Administrator, who oversees the entire OCME, namely providing financial regulation and expertise.

- The City Attorney's Office provides a Deputy City Attorney specifically for the OCME who offers legal counsel.

Under the direction of the CFT and Laboratory Director, the project will be executed by two personnel. A Forensic Quality Manager (City job code 2457) with experience in laboratory management, national and international accreditation standards, quality assurance program development and maintenance, software development using Python and Flask, database management with SQL, and a Laboratory Information Management System Specialist (City job code 2456) with experience in analytical method development and validation, routine toxicology testing, a knowledge of up-to-date analytical literature and methodologies, and advanced data science and biologic informatics skills. This staff member has the skillsets to develop, train, and implement deep learning methods through multi-layer neural networks. They have the database skillset and background in biological research to utilize the data stored in LIMS in a distinct way, leveraging casework to create aggregate datasets for training models that specifically match OCME laboratory acquisition procedures. They are comfortable programming within the LIMS database, developing tools directly through the LIMS interface for a high degree of customizability and long-term maintainability. This integration requires a thorough understanding of OCME operating protocols, data science and biological statistics, and machine learning to create new methods applicable to casework and that are routinely implementable. This staff member requires a full understanding of ASB/ANSI Standard 036, "Standard Practices for Method Validation in Forensic Toxicology". The Forensic Quality Manager and the Forensic Toxicologist will be in communication with the CFT daily to ensure effective execution of the project in a time-sensitive manner. Personnel costs are required to fund these staff members as this significant endeavor will be undertaken concurrently with the existing routine caseload falling within the jurisdiction of the Forensic Laboratory Division.

Schedule B

Detailed Budget Estimate

Award Number	Organization/Agency	Total Amount
30989	Office of the Chief Medical Examiner, City and County of San Francisco	$846,952.62

Cost Category	Line Item Name	Total Cost to Grant
Personnel	2456 Laboratory Information Management System Specialist	$386,624.00
	2457 Forensic Quality Manager	$432,328.62
Category Sub-Total		**$818,952.62**
Other Direct Costs	Software: Ideagen Quality Management	$28,000.00
Category Sub-Total		**$28,000.00**

Grant Total	**$846,952.62**

Schedule B-1
Budget Narrative

Office of the Chief Medical Examiner, City and County of San Francisco

Personnel

2456 Laboratory Information Management System Specialist

$386,624.00

The Laboratory Information Management System Specialist works 40 hours/week (2080 per year), as responsible for executing the LIMS ML Project, with a knowledge of up-to-date analytical literature and methodologies, and advanced data science and biologic informatics skills. This staff member has the skillsets to develop, train, and implement deep learning methods through multi-layer neural networks. They have the database skillset and background in biological research to utilize the data stored in LIMS in a distinct way, leveraging casework to create aggregate datasets for training models that specifically match OCME laboratory acquisition procedures. They are comfortable programming within the LIMS database, developing tools directly through the LIMS interface for a high degree of customizability and long-term maintainability. This integration requires a thorough understanding of OCME operating protocols, data science and biological statistics, and machine learning to create new methods applicable to casework and that are routinely implementable. The total salary and benefits is $386,624 in total.

2457 Forensic Quality Manager

$432,328.62

The Forensic Quality Manager (FQM) will be responsible for executing the Quality Project, providing quality assurance and quality control oversight of the LIMS software, and coordinating the development and implementation of LIMS for quality management activities. The annual salary and benefits are described below. 100% of this individual's work will be applicable to the projects and project related duties. A qualified individual has already been identified for this role and is available, at 30 hours a week (1560 per year), to commence immediately upon contract execution. This position is required for two years. The total salary and benefits is $432,328.62

Other Direct Costs

Software: Ideagen Quality Management

$28,000.00

Other direct costs include licensing of one software for quality management and document control - Quality Management by Ideagen. The software licensing for two years (7/1/2026-6/30/2028) is $28,000. This software is 100% applicable to the Accreditation Project. However, DUIs are three-quarters of the reason why this software is needed. Therefore, the direct cost is 75%, $21,000k. The remaining costs will be paid by the OCME.