



Optimizing and Advancing DUID Toxicology: Bolstering Quality through Data Systems and Untargeted Screening through Machine Learning

Prepared by Office of the Chief Medical Examiner, City and County of San Francisco
for California Highway Patrol (CHP) Toxicology: Crime Laboratories FY 2026/2028

Submitted by Luke Rodda

Submitted on 02/21/2026 8:58 PM Pacific Standard Time



Optimizing and Advancing DUID Toxicology: Bolstering Quality through Data Systems and Untargeted Screening through Machine Learning

Opportunity Details

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

Opportunity Information

Title

Toxicology: Crime Laboratories FY 2026/2028

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.

Awarding Agency Name

California Highway Patrol

Agency Contact Name

Cannabis Grants Unit (CGU)

Agency Contact Phone

916-843-4360

Agency Contact Email

CGUGrants@chp.ca.gov

Fund Activity Categories

Science and Technology and Other Research and Development

Manager

Cannabis Grants Unit (CGU)

Opportunity Posted Date

1/7/2026

Public Link

<https://www.gotomygrants.com/Public/Opportunities/Details/36b3c95d-35c5-4837-bde9-062a8828d012>

Is Published

Yes

Funding Information

Opportunity Funding

\$11,000,000.00

Funding Sources

State

Funding Source Description

With the passage of Proposition 64 in 2016, The Control, Regulate, and Tax Adult Use Marijuana Act (AUMA), California voters mandated the state to set aside funding for the CHP to provide grants to local governments and Qualified Nonprofit Organizations for the education, prevention, and enforcement of impaired driving laws pursuant to Section 34019 (f)(3)(B) Revenue and Taxation Code (RTC).

Funding Restrictions

State Agencies/Departments, please refer to Section 34019 (f)(3)(B) RTC and California Code of Regulations, Title 13, Division 2, Chapter 13, for additional information.

Award Information



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Award Range

\$2,000,000.00 Ceiling

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

Award Period

07/01/2026 - 06/30/2028

Award Type

Competitive

Indirect Costs Allowed

No

Matching Requirement

No

Submission Information

Submission Window

01/07/2026 8:00 AM - 02/23/2026 5:00 PM

Submission Timeline Type

One Time

Submission Timeline Additional Information

GRANT APPLICATIONS ARE DUE FEBRUARY 23, 2026, BY 5:00 PM PST.

Grant Applicants are advised to ask submittal questions well before the deadline. The Cannabis Grants Unit cannot guarantee an immediate response and the Grant Management System (GMS) will automatically close at 5:00 PM PST. Once a Grant Application is submitted through the GMS, Grant Applicants may not add, edit, or delete any Grant Application information.

Question Submission Information

Question Submission Open Date

01/07/2026 8:00 AM

Question Submission Close Date

02/23/2026 5:00 PM

Question Submission Email Address

CGUGrants@chp.ca.gov

Question Submission Additional Information

GRANT APPLICATIONS ARE DUE FEBRUARY 23, 2026, BY 5:00 PM PST.

CGU Office Hours:
Monday through Friday
8:00 am to 5:00 pm

Attachments

- FY26-28 RFA - Toxicology Crime Laboratory
- FY26-27 Grant Application Evaluation Criteria

Eligibility Information

Eligibility Type

Public



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Additional Eligibility Information

Local Government, which includes California Counties and the City of San Francisco, City and County of San Francisco

Additional Information

Additional Information URL

<https://www.chp.ca.gov/programs-services/programs/cannabis-tax-fund-grant-program>

Award Administration Information

State Award Notices

Awards will be announced in May and June 2026.

Administrative and National Policy Requirements

The California Highway Patrol (CHP) adopted regulations within Title 13 of the California Code of Regulations (CCR), Division 2, by adding Chapter 13, which govern the CHP Cannabis Tax Fund Grant Program.

These regulations outline:

- * Grant Provisions
- * Grant Project Types
- * Specific Grant Application Requirements
- * Grant Evaluation Criteria
- * Necessary Administrative Procedures for the Program.

Regulations can be found at:

<https://www.chp.ca.gov/programs-services/programs/cannabis-tax-fund-grant-program/program-regulations>

Reporting

Quarterly Reporting is required and due within 14 calendar days after the close of each quarter.

FY 2026/2027

Year One, Quarter One (Y1 Q1): July 1 - September 30

Year One, Quarter Two (Y1 Q2): October 1 - December 31

Year One, Quarter Three (Y1 Q3): January 1 - March 31

Year One, Quarter Four (Y1 Q4): April 1 - June 30

FY 2027/2028

Year Two, Quarter One (Y2 Q1): July 1 - September 30

Year Two, Quarter Two (Y2 Q2): October 1 - December 31

Year Two, Quarter Three (Y2 Q3): January 1 - March 31

Year Two, Quarter Four (Y2 Q4): April 1 - June 30

Other Information

Please ensure your Organization/Agency has the capability to electronically sign required documents (ex: Grant Agreement).



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Project Information

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

Application Information

Application Name

Optimizing and Advancing DUID Toxicology: Bolstering Quality through Data Systems and Untargeted Screening through Machine Learning

Award Requested

\$846,952.62

Total Award Budget

\$846,952.62

Primary Contact Information

Name

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Email Address

Luke.Rodda@sfgov.org

Address

Office of Chief Medical Examiner, 1 Newhall Street
San Francisco, CA 94124

Phone Number

(415) 741-6982



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Project Description

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

1. Organization/Agency Representatives

Organization/Agency Section/Unit (subdivision) to administer the Grant Agreement.

Office of the City Administrator / Office of the Chief Medical Examiner

Organization/Agency Representative

Complete the following fields with the appropriate Organization/Agency representatives for the Grant Agreement. The completed fields will auto-populate in the Grant Agreement, so please ensure each individual will be the point of contact throughout the Project Performance Period.

- The Authorized Official is authorized to enter into a Grant Agreement with signing authority
- The Authorized Financial Contact maintains financial records, documentation, and recipient of warrant
- The Administrative Contact is responsible for day-to-day administration

Authorized Official Name (first and last)

Jennifer Johnston

Authorized Official Title

Deputy City Administrator

Authorized Official Address (Street)

1 Dr Carlton B Goodlett Place, Office of the City Administrator

Authorized Official Address (City, State, and ZIP Code)

San Francisco, CA, 94102

Authorized Official Phone Number (with area code)

4155544572

Authorized Official Email Address

jennifer.johnston@sfgov.org

Authorized Financial Contact Name (first and last)

Katharine Petrucione

Authorized Financial Contact Title

Chief Financial Officer, Deputy City Administrator

Authorized Payment Reimbursement Address (Street) MUST MATCH FISCAL FORM

1 Dr Carlton B Goodlett Place, Office of the City Administrator

Authorized Payment Reimbursement Address (City, State, and ZIP Code) MUST MATCH FISCAL FORM

San Francisco, California, 94102

Authorized Financial Contact Phone Number (with area code)

4152740481

Authorized Financial Contact Email Address

katharine.petrucione@sfgov.org

Administrative Contact Name (first and last)

Luke N. Rodda PhD



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Administrative Contact Title

Chief Forensic Toxicologist and Director, Forensic Toxicology, Office of the Chief Medical Examiner, City and County of San Francisco

Administrative Contact Phone Number (with area code)

4156413611

Administrative Contact Email Address

luke.rodde@sfgov.org



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2. Senate/Assembly/Congressional/County Information
Office of the Chief Medical Examiner, City and County of San Francisco

To determine the State Senate District(s), State Assembly District(s), and California Congressional District(s), copy and paste the below URL in your browser and search:

<https://gis.data.ca.gov/maps/CDEGIS::legislative-districts-in-california-2/about>

Select one or more State Senate District(s) where the proposed Project activities will occur. To make multiple selections, hold down the Ctrl key and click each one.

State Senate 11

Select one or more State Assembly District(s) where the proposed Project activities will occur. To make multiple selections, hold down the Ctrl key and click each one.

State Assembly 11, State Assembly 17, State Assembly 19

Select one or more California Congressional District(s) where the proposed Project activities will occur. To make multiple selections, hold down the Ctrl key and click each one.

California Congressional District 12, California Congressional District 14

Select one or more California counties where the proposed Project activities will occur. To make multiple selections, hold down the Ctrl key and click each one.

San Francisco

Number of residents (population) that your Organization/Agency serves.

827526



3. Statistical Data

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Ensure the responses below align with the statistical data provided within the Grant Application. If a question is not applicable, please input "0" or "N/A".

Approximately how many qualified analysts are conducting driving under the influence (DUI)/driving under the influence of drugs (DUID) testing at your laboratory?

	Monthly Average	Yearly Average
Number of Analysts	67	800

Approximately how many DUID cases does your laboratory analyze for only drugs?

	Monthly Average	Yearly Average
Number of Cases	0	0

Approximately how many DUI cases does your laboratory analyze for only alcohol?

	Monthly Average	Yearly Average
Number of Cases	0	0

Approximately how many cases are tested for both alcohol and drugs?

	Monthly Average	Yearly Average
Number of Cases	67	800

What is the estimated turn-around time for case analysis?

	DUI Cases	DUID Cases	DUI/DUID Cases
Number of Days			12

What is the estimated number of backlogged DUI cases?

	Monthly Average	Yearly Average
Number of Cases	5	60

Approximately how many times per year does your laboratory provide DUI/DUID-related court testimony?

	DUI Cases	DUID Cases	DUI/DUID Cases
Times Per Year			25

Does your Organization/Agency track which samples have an associated Drug Recognition Expert (DRE) evaluation?

- ☐ Yes
☒ No

If yes, what is the percentage?

Does your laboratory make an administrative decision to stop testing if a blood alcohol concentration (BAC) result is at or above a specific BAC?

- ☐ Yes
☒ No



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If yes, what is that BAC concentration result?

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List the top 10 drugs present in your laboratory's current DUID case work (number 1-10; 1 = most prevalent). If unknown or not tracked, please provide any known information.

1 - Alcohol; Cannabis; Methamphetamine; Cocaine; Fentanyl; Diphenhydramine; Ketamine; Gabapentin; Alprazolam; Morphine; 10 - Clonazepam. Also see chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://media.api.sf.gov/documents/2025_OCME_DUID_Report.pdf

Current Equipment

What equipment does your laboratory use (make/model/number of each)?

2 x HS-GC-FID . Agilent Technologies Gas Chromatograph (7890B) with Agilent Technologies Headspace Sampler (7697A). Currently performing alcohol analyses. 2 x LC-MS/MS. Sciex Liquid Chromatograph (Nexera X2 LC-30) with Sciex QTRAP tandem mass spectrometer (6500+).

What equipment is currently needed?

N/A

If equipment is needed, will it be able to test for Delta-9-Tetrahydrocannabinol (THC), 11-Hydroxy-THC and Carboxy-THC?

- ☐ Yes
☒ No

If new equipment is purchased, is staff training needed?

- ☐ Yes
☒ No

If yes, detail what training is needed.

N/A

Grant-Funded Equipment

Have previous Cannabis Tax Fund Grant Program Grant Funds been utilized to purchase equipment (an acquisition cost of at least \$5,000)?

- ☒ Yes
☐ No

If yes, list the fiscal year of the Grant Agreement and EACH equipment item.

FY21-23 = 1 x Hamilton Robotic Instrument

EXAMPLE ONLY

FY21-23 = One LCMS, One Nitrogen Generator

FY22-24 = One QTOF



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4. Project Description

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

Provide a brief overview/synopsis (a paragraph) of the proposed Project. PLEASE DO NOT COPY AND PASTE TABLES IN FIELD - TYPE INFORMATION IN FIELD.

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



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5. Problem Statement

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Clearly identify the problem/need (Problem Statement) in your local community, which is the reason for requesting grant funds. If applicable, provide recent and high-level statistical data that directly supports the problem/need in your local community. PLEASE DO NOT COPY AND PASTE TABLES IN FIELD - EITHER TYPE INFORMATION IN FIELD OR ATTACH DOCUMENT.

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.

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



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algorithms specifically optimized for the acquisition parameters of the method. Screening 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.

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/bkaf098>

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>

Statistical Data/Report(s)



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6. Performance Measures/Scope of Work (Proposed Solution)

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Detail EACH Project activity/item below, which will serve as your goals and objectives for the Project. For EACH goal/objective, include estimated timelines (ex: monthly, quarterly), quantitative measurements (ex: reduction of DUI/DUID by %), and resources (Budget Line Items) needed to successfully complete the Project activities with justification detailing how it will enhance/support the Project. NOTE: These goals and objectives must be consistent with the Budget. PLEASE DO NOT COPY AND PASTE TABLES IN FIELD - TYPE INFORMATION IN FIELD.

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

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



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with the DarkNPS elucidation strategy that can suggest structures for NPS with small molecules (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

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>

EXAMPLE ONLY

16 DUI Saturation Patrols (Q1 = 4, Q2 = 4, Q3 = 4, Q4 = 4): Aim to reduce DUI/DUID deaths by 10%, which will improve roadway safety in the community.

2 DUI Checkpoints (Q2 = 1, Q4 = 1): Aim to reduce DUI/DUID by 15%, which will reduce the number of impaired



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drivers in the community.

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4 Message Boards for DUI Checkpoints and Educational Messaging (Q1 = Purchase, Q2 = Receive, Q2-Q4 = Use to complete DUI Checkpoints and education): We will utilize the Message Boards to notify the public of an approaching DUI Checkpoint. In between DUI Checkpoints, we will display educational messaging against driving under the influence.

4 Educational Presentations at local high schools (Q1 = 1, Q2 = 1, Q3 = 1, Q4 = 1): Aim to contact at least 100 students each quarter to increase awareness of driving under the influence. The presentations will educate students on the implications of driving impaired.

NOTE: The number of activities listed for each Performance Measure must match the number of activities listed in the Budget.



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7. Project Performance Evaluation

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

Provide the method of evaluation to show Project effectiveness and positive impact(s) on the community. These strategies shall include captured quantitative/qualitative data and a communication plan to share Project results with both internal and external stakeholders. PLEASE DO NOT COPY AND PASTE TABLES IN FIELD - TYPE INFORMATION IN FIELD.

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.
- 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.



Optimizing and Advancing DUID Toxicology: Bolstering Quality through Data Systems and Untargeted Performance Measures for Maintaining Accreditation: Screening through Machine Learning

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



Optimizing and Advancing DUID Toxicology: Bolstering Quality through Data Systems and Untargeted Screening through Machine Learning
Communication Plan: Internal and External Stakeholders

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



Optimizing and Advancing DUID Toxicology: Bolstering Quality through Data Systems and Untargeted Screening through Machine Learning

8. Program Sustainability

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

Describe the plan for reducing reliance on future grant funding. Include a summary and timeframe to continue efforts when grant funds are either not available or significantly reduced. PLEASE DO NOT COPY AND PASTE TABLES IN FIELD - TYPE INFORMATION IN FIELD.

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.



Optimizing and Advancing DUID Toxicology: Bolstering Quality through Data Systems and Untargeted Screening through Machine Learning

9. Administrative Support

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

Describe the administrative support, including the Organization/Agency's grant experience, personnel, and physical resources needed to successfully complete the Project within the Project Performance Period. PLEASE DO NOT COPY AND PASTE TABLES IN FIELD - TYPE INFORMATION IN FIELD.

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

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 employs 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.



Optimizing and Advancing DUID Toxicology: Bolstering Quality through Data Systems and Untargeted Screening through Machine Learning

10. Other Grant Programs

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

Impaired Driving Grant Activities

Has your Organization/Agency previously received grant funding for impaired driving activities?

☒ Yes

☐ No

If yes, detail the outcome. PLEASE DO NOT COPY AND PASTE TABLES IN FIELD - TYPE INFORMATION IN FIELD.

FY21-23 CHP Cannabis Tax Fund

FY22-24 CHP Cannabis Tax Fund

FY23-25 CHP Cannabis Tax Fund

FY24-26 CHP Cannabis Tax Fund

FY24-26 CHP Cannabis Tax Fund

FY25-27 CHP Cannabis Tax Fund

Has or will your Organization/Agency submit a proposal to another grant program for this Project (ex: funds for the same components as this Project, or similar/related components that will be completed during the same time period as this Project)?

☐ Yes

☒ No

If yes, detail the granting Organization/Agency. In addition, clearly distinguish which tasks would be funded by the CTFGP and which tasks would be funded by another Organization/Agency. PLEASE DO NOT COPY AND PASTE TABLES IN FIELD - TYPE INFORMATION IN FIELD.

Other Funding Sources

Are any personnel dedicated to this Project funded by other sources or grants, including salary support?

☐ Yes

☒ No

If yes, detail which source/grant. PLEASE DO NOT COPY AND PASTE TABLES IN FIELD - TYPE INFORMATION IN FIELD.



Optimizing and Advancing DUID Toxicology: Bolstering Quality through Data Systems and Untargeted Screening through Machine Learning

11. Terms and Conditions

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

By submitting your Grant Application, you agree to the following Terms and Conditions:

I certify, under penalty of perjury, that the information I entered in this Grant Application is true and complete to the best of my knowledge. I further understand that any false, incomplete, or incorrect statements may result in my disqualification from the grant process or dismissal from receiving grants funded by the California Highway Patrol (CHP), Cannabis Tax Fund Grant Program. I authorize the California Highway Patrol, Cannabis Grants Unit (CGU), to investigate referenced documents or other documents submitted to the program to check the accuracy of the information provided.

I agree with the Request for Application, the above Terms and Conditions, and the California Code of Regulations, Title 13, Division 2, Chapter 13, Sections 1890.00 through 1890.27.

☒ I Agree

When using the GMS (EUNA), I authorize the state to take my requested action by an electronic means and authorize the state to accept the combination of my User ID and password in lieu of my written signature.

☒ I Agree

My password is unique to me and is to remain confidential. I will not allow other individuals to use my User ID and password to access the GMS (EUNA).

☒ I Agree

It is my responsibility to maintain the confidentiality of GMS (EUNA) information.

☒ I Agree

Once I submit the Grant Application, I am unable to add, edit, or delete any Grant Application information.

☒ I Agree

Confidentiality Notice: All documents submitted as a part of the Cannabis Tax Fund Grant Program Grant Application are public documents and may be subject to a request pursuant to the California Public Records Act. The CHP, CGU, cannot ensure the confidentiality of any information submitted in or with this Grant Application (Gov. Code, § 6250 et seq.).

☒ I Agree

Generated Income Disclaimer: There will be no program income generated from this grant. Nothing in this Grant Application shall be interpreted as a requirement, formal or informal, that a particular law enforcement officer issue a specified or predetermined number of citations, in pursuance of the goals and objectives. Although special emphasis will be placed upon violations specific to this Grant Application, appropriate enforcement action will be taken for all observed violations.

☒ I Agree

Grant funds shall not replace (supplant) any federal, state and/or local funds that are appropriated or earmarked for the same purpose and are routine and/or existing state and local expenditures. Supplanting is the deliberate reduction in the amount of federal, state, or local funding appropriated to an existing program or activity because grant funds are awarded for the same purpose. It is the responsibility of the Grant Applicant to ensure supplanting does not occur.

☒ I Agree

Financial Information System for California Government Agency Taxpayer ID (FI\$Cal Form)

A FI\$Cal Form is required for reimbursement. If the Grant Applicant does not have a completed FI\$Cal Form at final Grant Application submission time, the Grant Applicant may submit the completed FI\$Cal Form via email to CGU prior to execution of the Grant Agreement. NOTE: The "Remit-To Address" on the FI\$Cal Form MUST match the "Official Address to Receive Reimbursement Payment" you entered in Form #1. Organization/Agency Representative. This address shall be the official address on file with FI\$Cal and the State Controller's Office (SCO) to receive warrants (Reimbursement Request Payments). Forms are located on the Cannabis Tax Fund Grant Program's website at <https://www.chp.ca.gov/programs-services/programs/cannabis-tax-fund-grant-program>.

☒ I Agree

FI\$Cal Form

Fi\$cal_TaxPayor_ID_Form (OCME Signed 2026).pdf

City Council or County Resolution



Optimizing and Advancing DUID Toxicology: Bolstering Quality through Data Systems and Untargeted Screening through Machine Learning

A county, city, district, or other public body shall provide a copy of a resolution, order, motion or ordinance of local governing body, which by law has the authority to enter into an agreement authorizing execution of a Grant Agreement. If the Grant Applicant does not have a signed resolution at final Grant Application submission time, the Grant Applicant may submit a signed resolution via email to CGU prior to execution of the Grant Agreement. NOTE: The resolution MUST explicitly state the Organization/Agency has delegated authority to enter into a Grant Agreement for the requested amount.

☒ I Agree



Optimizing and Advancing DUID Toxicology: Bolstering Quality through Data Systems and Untargeted Screening through Machine Learning

Budget

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

Proposed Budget Summary

Expense Budget

	Grant Funded	Total Budgeted
Personnel		
2456 Laboratory Information Management System Specialist	\$386,624.00	\$386,624.00
2457 Forensic Quality Manager	\$432,328.62	\$432,328.62
Subtotal	\$818,952.62	\$818,952.62
Other Direct Costs		
Software: Ideagen Quality Management	\$28,000.00	\$28,000.00
Subtotal	\$28,000.00	\$28,000.00
Total Proposed Cost	\$846,952.62	\$846,952.62

Revenue Budget

	Grant Funded	Total Budgeted
Grant Funding		
Award Requested	\$846,952.62	\$846,952.62
Subtotal	\$846,952.62	\$846,952.62
Total Proposed Revenue	\$846,952.62	\$846,952.62

Proposed Budget Detail

See attached spreadsheet.

Proposed Budget Narrative

Personnel

Costs may include compensation for wages, such as overtime, and benefits (annual leave and sick leave) for work directly related to, and consistent with, the Project. Personnel hours will be awarded based on the number of CTFGP grant-funded Project activities approved by CGU. To be eligible for reimbursement, personnel services must occur within the Project Performance Period. Itemize separate Budget line items by Project activity. Combine wages and benefits in the same Budget line item for each Project activity. For EACH Budget Line Item, the narrative shall include: * Job title/classification(s) * Description of work/job duties * Salary/rate of pay for each classification (notate regular and/or overtime pay) * Number of hours for each classification EXAMPLE: Forensic Scientist. Overtime to work extra hours on DUID-related tasks such as preparing, analyzing and reviewing DUID casework batches, reducing backlog and improving turnaround times, and method validation. Forensic Scientist OT, \$53 - \$109.50/hour. Approximately 10 hours/month. Total Cost = \$12,720 - \$26,280 NOTE: The number of activities listed for each Budget line item must match the number of activities listed in the Performance Measures.



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2456 Laboratory Information Management System Specialist

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

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

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

Costs may include operational costs. Other Direct Costs shall be directly related and necessary to complete CTFGP grant-funded activities included in the Project. Other Direct Costs should be purchased at the beginning of the Project Performance Period to ensure they are utilized when completing corresponding Project activities. To be eligible for reimbursement, Other Direct Costs must be purchased and received within the Project Performance Period. Itemize separate Budget line items for each Other Direct Costs item. For EACH Budget line item, the narrative shall include: * Name/description of Other Direct Costs * Quantity * Unit cost * Total cost * Correlating CTFGP activity. EXAMPLE: Consumables. Vials = \$146 for DUI/DUID testing on LCQTOF, Pipette = \$1,800 for DUI/DUID testing on LCMSMS, Total Cost = \$1,946 NOTE: The number of activities listed for each Budget line item must match the number of activities listed in the Performance Measures.

Software: Ideagen Quality Management

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.