

2020

Forensic Science Laboratory Annual Report

SEDGWICK COUNTY, KANSAS

REGIONAL FORENSIC SCIENCE CENTER
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TABLE OF CONTENTS

TABLE OF CONTENTS 1

MISSION 2

LABORATORY LEADERSHIP 2

LABORATORY ORGANIZATION 2

INTRODUCTION 3

SIGNIFICANT ACHIEVEMENTS 4

 FORENSIC SCIENCE LABORATORIES SERVICE OVERVIEW 6

 Case Submissions 6

 Backlog 8

 Expert Testimony 9

 Agencies Served 9

 Sedgwick County vs. Out-of-County Cases 10

 Cases Completed 10

 Case Submission Turn-Around-Time 11

CRIMINALISTICS 11

DRUG ID 13

 Open Container / Beverage Alcohol 15

FIRE DEBRIS 15

FIREARMS 16

BIOLOGY/DNA 17

 CODIS 18

 Unknown and Known Exhibits Examined 19

TOXICOLOGY 20

 Drug-Related Deaths 21

 Alcohol Analysis 24

 Alcohol Positive Drivers – Under the Age of 21 24

 Drugs and Driving 25

 Driver Drug Usage 26

 Drug-Facilitated Sexual Assaults 27

MISSION

The Forensic Science Center strives to provide the highest quality medicolegal and advanced forensic laboratory services to Sedgwick County. Death Investigation and Forensic Autopsy services are conducted in a compassionate and objective manner to achieve accurate certification of cause and manner of death. The Forensic Laboratory services provide unbiased and accurate analytical testing to support the resolution of criminal cases. As an independent agency operating under the Division of Public Safety, the Forensic Science Center collaborates with public health and criminal justice stakeholders to reduce crime and prevent deaths.

LABORATORY LEADERSHIP

All laboratory managers are case-working and proficiency tested scientists.

Director

Shelly Steadman, Ph.D.

Criminalistics Lab Manager

Lana Goodson

Toxicology Lab Manager

Kimberly Youso, M.S., D-ABFT-FT

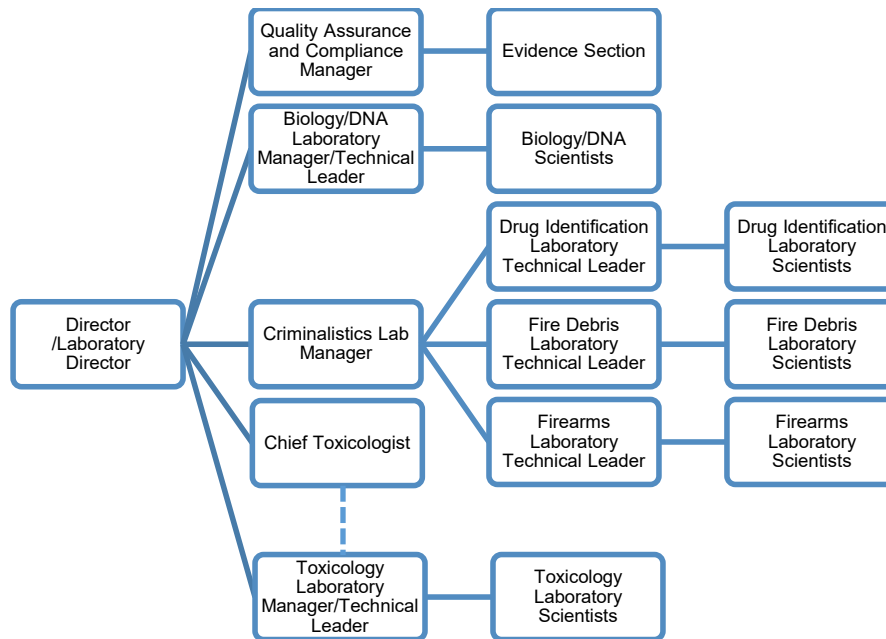
Forensic Biology/DNA Manager

Sarah Geering, M.S.

Quality Assurance Manager

Robert Hansen, M.S.F.S.

LABORATORY ORGANIZATION



INTRODUCTION

The Regional Forensic Science Center (RFSC) officially opened on December 21st, 1995. The Center houses the Office of the District Coroner and the Forensic Science Laboratories. The Forensic Science Laboratories are comprised of three major sections: Criminalistics (Drug Identification, Firearms / Tool Marks, and Fire Debris), Biology/DNA, and Toxicology (Ante-mortem and Post-mortem).

The Forensic Science Laboratory is staffed with highly-trained and experienced forensic scientists, many of whom have advanced scientific degrees (MS, MSFS, Ph.D.). The technical staff has well over 200 years of combined professional experience. For 2020, the laboratory staff consisted of 19 scientist and 3 support personnel.

In April of 1996, the Forensic Science Laboratory began accepting cases for firearms examinations. Three months later, the Biology Laboratory provided forensic examinations for the identification of biological fluids. The Toxicology Laboratory began producing comprehensive examinations in Post-mortem Toxicology in support of the Sedgwick County District Coroner (District Coroner) in September of 1996. This was followed by the Forensic Science Laboratories providing forensic drug identification for local and regional law enforcement agencies. In November of 1996, fire debris analysis was added to the Criminalistics Section. In January of 1997, the Biology/DNA Laboratory became the first short tandem repeat-deoxynucleic acid (STR-DNA) testing laboratory in the State of Kansas.

In 2003, the Forensic Science Laboratory first became accredited by the American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB) under the ASCLD/LAB-*Legacy* program.

In February 2014, the Forensic Laboratory was granted ASCLD/LAB-*International* accreditation for Forensic Testing Laboratories in the categories of Controlled Substances, Quantitative Analysis, Ante-mortem Toxicology, Post-mortem Toxicology, DNA-Nuclear, Body Fluid Identification, Fire Debris, Firearms, and Serial Number Restoration. The ASCLD/LAB-*International* accreditation program evaluates the laboratory's management system, and technical procedures and practices against criteria set forth in *ISO/IEC 17025:2005*, and the testing laboratory requirements of the *ASCLD/LAB-International* Supplemental Requirements.

In the 2018, the Forensic Science Laboratory completed an ANAB *ISO/IEC 17025:2017*, AR3125 full assessment. The laboratory was the first in the state and among the first in the nation to undergo assessment for these new international accreditation standards. This enhanced accreditation program is based upon the latest set of requirements against which a forensic testing laboratory can be evaluated.

In 2020, the Forensic Science Laboratory completed an ANAB *ISO/IEC 17025:2017*, AR3125 surveillance assessment. Also, the Biology/DNA Laboratory completed an external FBI QAS Audit for forensic testing laboratories.

Striving for and meeting these accreditation requirements demonstrates the Forensic Laboratory's commitment to excellence in the services we provide to our submitting agencies.

SIGNIFICANT ACHIEVEMENTS

- **Publications:**
 - Rohrig, T.P., Osawa, K.A., Baird, T.R., and Youso, K.B.- *Driving Impairment Cases Involving Etizolam and Flubromazolam*, Journal of Analytical Toxicology, 2020.
 - Rohrig, T.P., Nash, E., Osawa, K.A., Shan, X., Scarneo, C., Youso, K.B., Miller, R., and Tiscione, N.B., - *Fentanyl and Driving Impairment*, Journal of Analytical Toxicology, 2020.
 - Baron, M.G., Rohrig, T.P., Gonzalez-Rodriguez, J., - *Forensic Science in the UK Part III. Regulation of Forensic Science in England and Wales - The Role of the Forensic Science Regulator*, Forensic Science Review 32(1): 2-6, 2020

- **Laboratory Staff enhanced their technical and professional expertise by attending the following workshops and/or training sessions on-site, at conferences, or via webinar:**
 - 2019 JAT Article 4: Recommendations for Toxicological Investigations of Drug-Impaired Driving and Motor Vehicle Fatalities
 - 2020 Annual Review of DNA Data Accepted at NDIS
 - 2020 JAT Article 1: Dibutylone (bk-DMBDB): Intoxicants, Quantitative Confirmations and Metabolism in Authentic Biological Specimens
 - 2020 JAT Article 2: Procedure for the Selection and Validation of a Calibration - Model I - Description and Application
 - 2020 JAT Article 3: Procedure for the Selection and Validation of a Calibration - Model II - Theoretical Basis
 - 2020 JAT Article 4: Relationship Between Postmortem Urine and Blood Concentrations of GHB Furnishes Useful Information to Help Interpret Drug Intoxication Deaths
 - 2020 Online Symposium: Current Trends in Forensic Toxicology; Court Testimony
 - 2020 Online Symposium: Current Trends in Forensic Toxicology; Challenges of Cannabis and Cannabinoids
 - 2020 Online Symposium: Current Trends in Forensic Toxicology; Court Testimony
 - 2020 Online Symposium: Current Trends in Forensic Toxicology; Innovations in Analysis
 - 2020 Online Symposium: Current Trends in Forensic Toxicology; Inter-Individual Variations and Toxicology Interpretation
 - 2020 Online Symposium: Current Trends in Forensic Toxicology; Inter-Individual Variations and Toxicology Interpretation
 - 2020 Online Symposium: Current Trends in Forensic Toxicology; Postmortem Changes
 - 26th Annual National CODIS Conference
 - 6th Annual Workshop on STRMix Implementation and Casework Approach
 - AED Usage
 - ANAB ISO/IEC 17025:2017 and AR3125 Assessor Training
 - Arguing the Case for DNA Evidence Based on Probabilistic Genotyping
 - ASCLD Train the Director Series - Toxicology: Instrumentation, Methodology and Workflows
 - ASCLD Train the Directors Series - Marijuana Analysis in a New Frontier: Two State Laboratory Approaches
 - Biology Oral Presentations
 - Bloodborne Pathogens
 - Compressed Gas Cylinders
 - DNA Hit of the Year - Announcement of the 4th DNA Hit of the Year

- Drug Exposures in the Forensic Laboratory: What We Know, What We Can Learn
 - Ethics in Forensic Science
 - Expert Testimony Training for the Prosecutor and Scientist 1 Module
 - Expert Testimony Training for the Prosecutor and Scientist 2 Module
 - Fire Extinguisher
 - Forensic DNA Phenotyping
 - Forensic Drug Chemistry
 - Harassment Training
 - Hazard Communication
 - How can we maximize the impact of forensic DNA? - Panel Discussion
 - How To Be A Good Expert Witness
 - Intact Low Explosives Analysis with an Emphasis on Microscopical Methods
 - ISHI 2020 On Demand - Dr. Chelsey Juarez Explains How Isotopic Analysis Works
 - ISHI 2020 On Demand - Neanderthal Genes in Modern Humans
 - ISHI 2020 Virtual General Session
 - Marijuana or Hemp: From Farm Bill to Forensic Analysis
 - Mass Spectrometry for Fentanyl Analog Screening, Confirmation and Metabolite Discovery in Forensic Casework
 - NARCAN Usage
 - PPE
 - Quality Assurance Standards (QAS) Auditor Training
 - Sedgwick County Exposure Control Plan ICO Training
 - Sig Sauer 1911 Armorer Certification
 - SOFTember Scientific Sessions 1
 - SOFTember Scientific Sessions 2
 - SOFTember Scientific Sessions 3
 - SOFTember Scientific Sessions 4
 - SOFTember Scientific Sessions 5
 - SOFTember Scientific Sessions 6
 - SOFTember Scientific Sessions 7
 - SOFTember Scientific Sessions 8
 - SOFTember Scientific Sessions 9
 - The Sequel - Marijuana or Hemp: From Farm Bill to Forensic Analysis
- **Grant Funding:**
 - 21-NFSIA (2020 Coverdell) - \$85,293
 - 2020 Capacity Enhancement and Backlog Reduction (CEBR) Program - \$212,000
 - 2020 Justice Assistance Grant (JAG) – \$16,625
 - 2020 KDHE Overdose Data to Action Program - \$197,921.70

FORENSIC SCIENCE LABORATORIES SERVICE OVERVIEW

Case Submissions

The Forensic Science Laboratory continues to experience a significant demand for its expert services. **Figure 1** illustrates the number of forensic laboratory cases first submitted for examination over the past 5 years, the average of which is 3365.

The Center has worked with our law enforcement contributors as well as attorneys to be mindful in the cases that are submitted to the laboratories for analysis. This is to better utilize our resources so that we can report case information that is critical to an investigation and/or prosecution in a more timely manner. As a result there has been a slight decrease in the number of cases submitted. However, with the increase in sexual assault cases and emerging designer drugs, the cases submitted have been increasingly complicated, often with more exhibits associated.

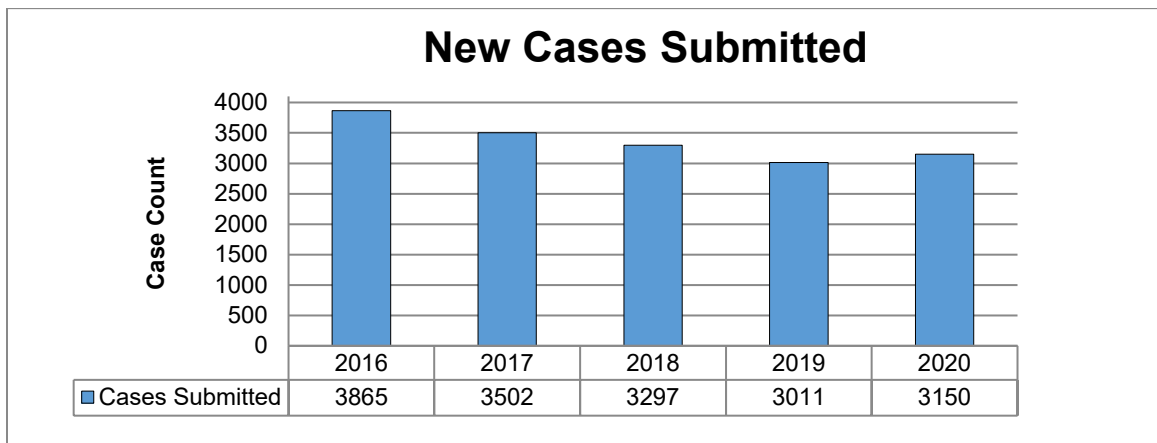


Figure 1 Number of initial forensic laboratory cases submitted for examination (law enforcement and District Coroner post-mortem evidence submissions) from 2016 through 2020.

As illustrated in **Figure 2**, the number of exhibits examined by the Forensic Laboratory increased in 2017 by approximately 13% and remained relatively at the same output level until in 2020 when the laboratory exhibits examined increased approximately 22%, equates to a 35% increase from 5 years ago.

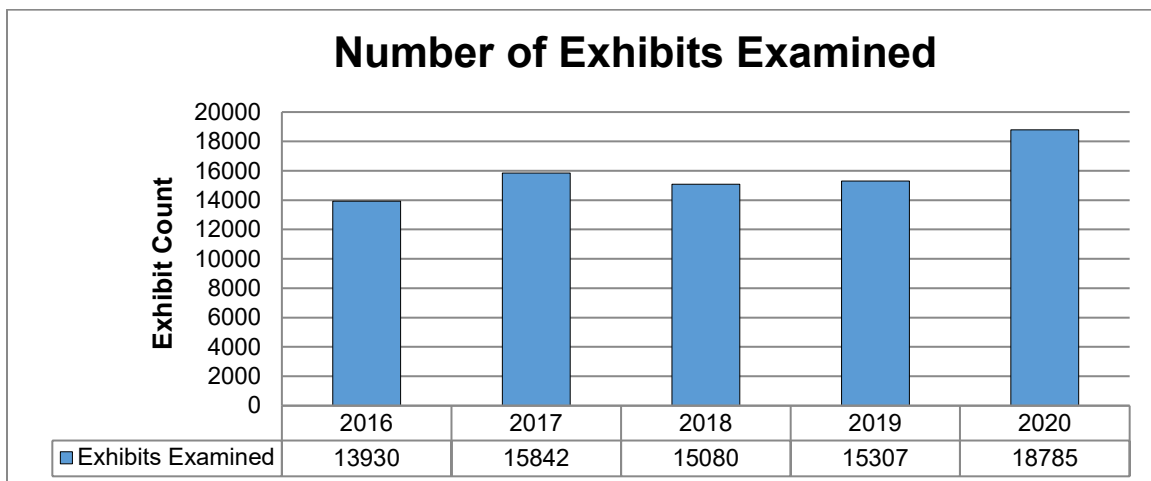


Figure 2 The number of forensic exhibits examined between 2016 and 2020.

Law enforcement agencies submit criminal cases to the Forensic Laboratory for analysis. **Figure 3** illustrates the number of cases submitted to the Forensic Laboratory for the first time in each year per laboratory section.

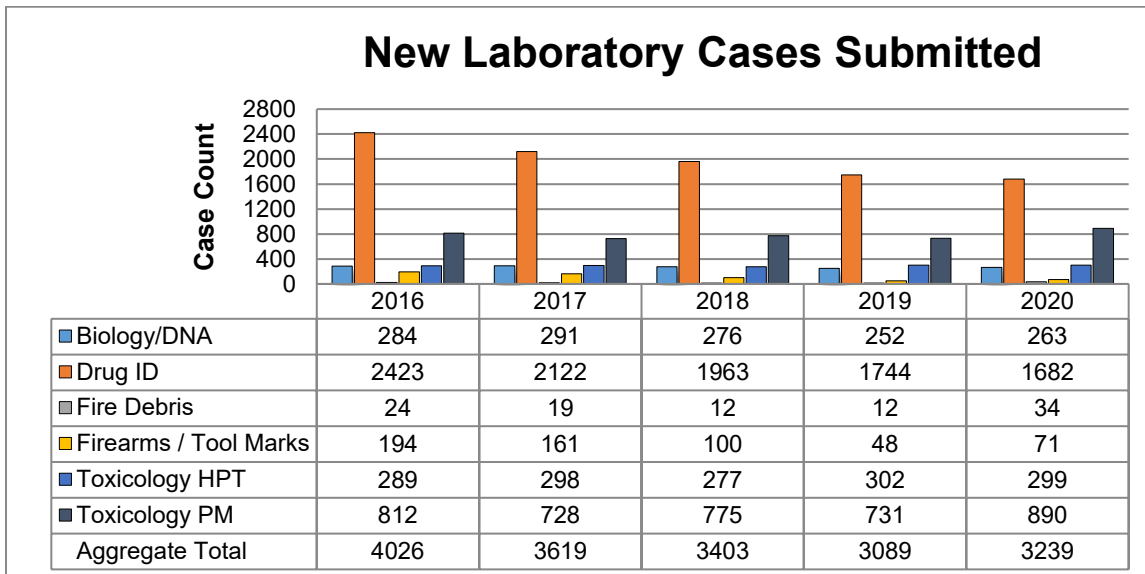


Figure 3 Number of cases submitted for the first time each year per laboratory section.

A listing of the agencies that submitted evidence to the laboratory division for forensic analysis and the number of new cases that were submitted by each in 2020 is provided in **Figure 4**. The District Coroner’s Office submits evidence for analysis in support of the regional autopsy service. Out of county agencies that submit evidence for analysis are subject to a fee schedule set forth by the Sedgwick County Board of County Commissioners.

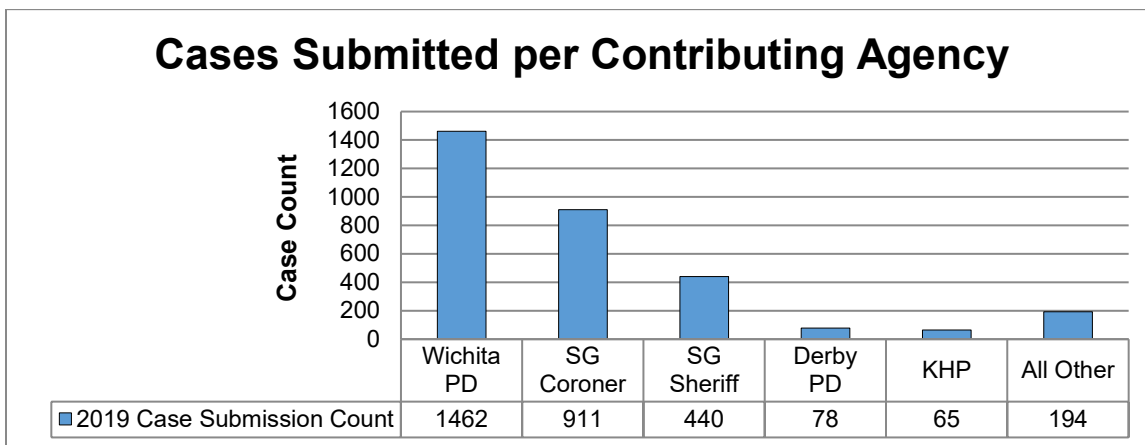


Figure 4: Count of new case submissions received from each contributing law enforcement agency. Abbreviation Key (PD = Police Department, SG = Sedgwick County, KHP = Kansas Highway Patrol).

Cases are submitted for forensic examination under five analytical disciplines, Biology / DNA, Drug ID, Firearms, Fire Debris, and Toxicology (Post-mortem and Ante-mortem). Toxicology receives ante-mortem evidence from law enforcement through the evidence section and post-mortem specimens directly from the District Coroner.

In addition to the 3150 new cases submitted (**see Figure 1**), there were case submissions from an additional 168 on-going cases that were originally submitted in previous years for an aggregate total of 3318 individual cases received in 2020.

The number of case submissions associated with each laboratory is illustrated in **Table 1**. The aggregate submission count (3610) includes all submissions from contributing agencies, which includes submissions from the aggregated 3239 new cases (the sum of all new cases submitted to each laboratory) generated in year 2020 (**see Figure 3**) and

submissions from cases generated in previous years in support of on-going investigations by law enforcement.

The Criminalistics Section continues to receive the majority of evidence submitted; however, the Toxicology Laboratory experienced an increase of approximately 18% from 2019.

In addition to the 3150 submissions from contributing agencies, the evidence section also received 244 internal submissions, which were generated as a result of examination derivatives, all of which were returned to the respective contributing agency.

Laboratory	2020 Aggregate Case Submissions Count
Biology / DNA	407
Drug ID	1,750
Firearms / Tool Marks	98
Fire Debris	36
Toxicology Ante-mortem	313
Toxicology Post-mortem	1006
Sum of Submission Count	3610

Table 1 Number of case submissions per laboratory.

The relative percentage of cases submitted to each analytical unit is illustrated in **Figure 5**. The Drug Identification Laboratory continues to receive the majority of evidence submitted, followed by submission to the Toxicology Laboratory, which had for the first time received over 1000 submissions. Also, the submissions to the Fire Debris Laboratory doubled from 2019.

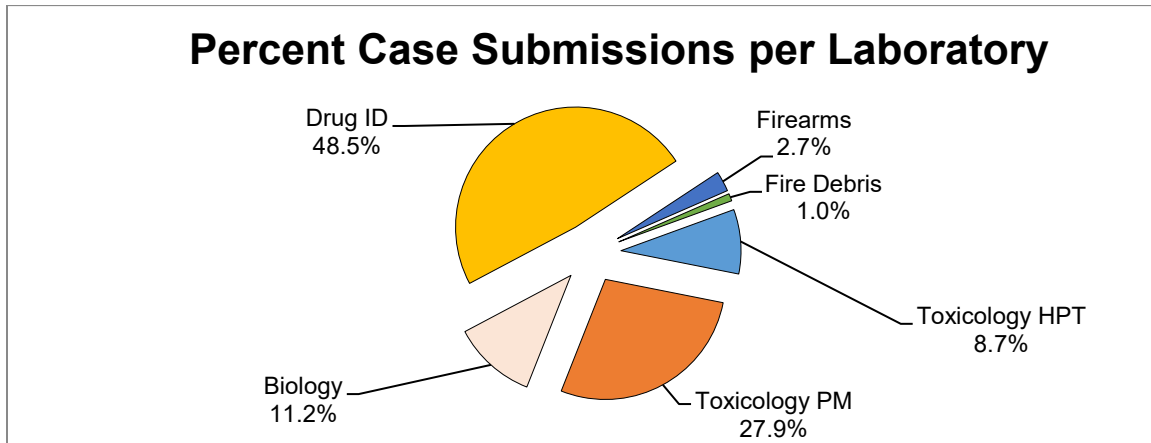


Figure 5 Percentage of case submissions per laboratory. The Criminalistics Section continues to receive the majority of evidence submitted.

Backlog

Nationally, the target turn-around time for case completion is 30 days from submission. The Forensic Laboratory has set an internal goal of 60 days, which is acceptable to the vast majority of our contributors according to our annual contributor surveys. As of December 31, 2020 the Forensic Laboratories had a 60 day backlog of 350 cases and a 30 day backlog of 443 cases (see **Figure 6**). This represents a decrease in the backlog compared to the previous four years.

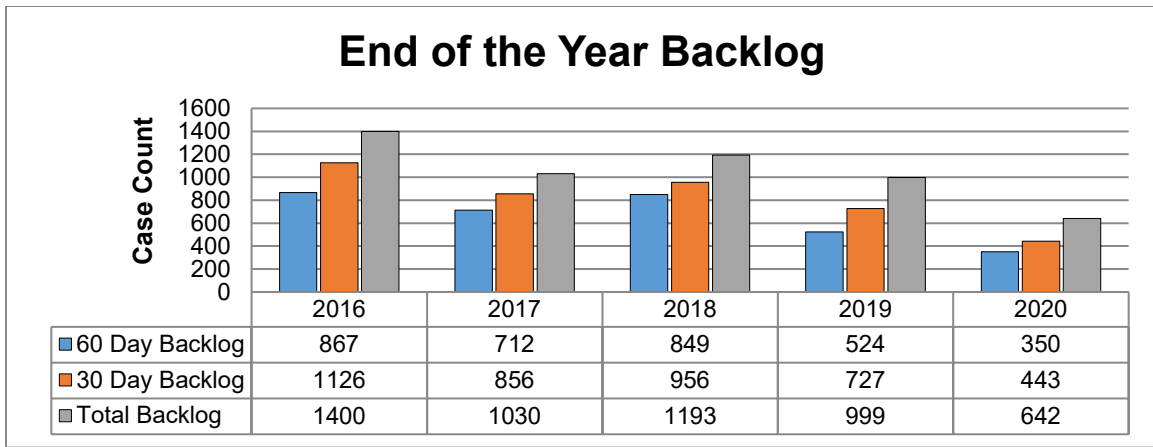


Figure 6 The number of the total, the 30 day, and the 60 day backlogged cases on December 31 of each of the last five years.

Expert Testimony

The professional staff is frequently called upon to present expert testimony in court. The amount of time spent by staff preparing for testimony, waiting to testify at courthouses, and on the stand providing testimony is significant.

In 2020, the Forensic Science Laboratories received 481 subpoenas for court appearances. This resulted in laboratory staff providing expert testimony in 24 criminal cases.

Agencies Served

The Forensic Science Laboratory provides expert testing services and consultation for a variety of law enforcement agencies within and outside of Sedgwick County. In 2020, the Forensic Science Laboratories provided expert testing services and consultations to 46 law enforcement agencies, fire departments, and district coroners. In **Figure 7**, the shaded counties indicate jurisdictions within the state for which forensic laboratory services were provided.

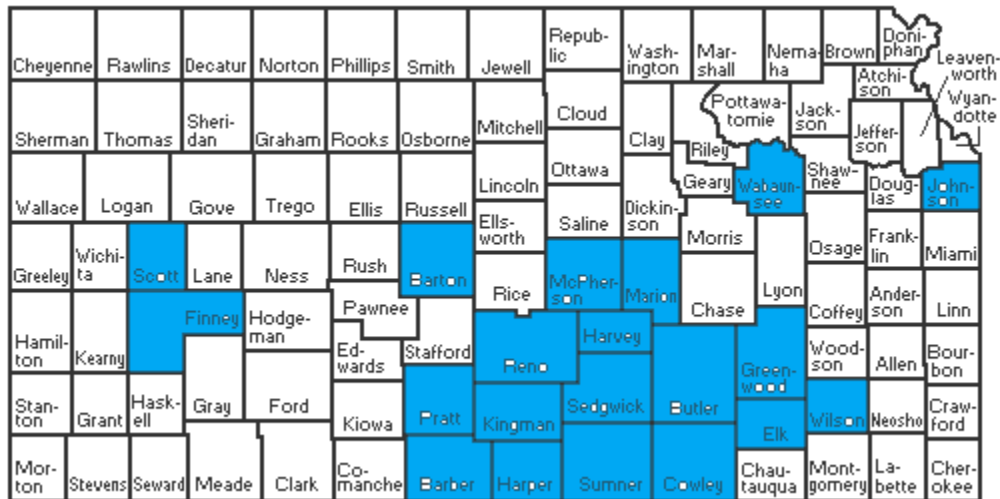


Figure 7 Counties that had forensic laboratory services provided to them by the Sedgwick County Regional Forensic Science Center in 2020 (shaded).

Sedgwick County vs. Out-of-County Cases

The Regional Forensic Science Center serves as the principle forensic (crime) laboratory for all Sedgwick County law enforcement agencies and provides forensic services to many other counties and municipalities within the state of Kansas (**see Table 2**); however, the vast majority of forensic laboratory services were provided for Sedgwick County law enforcement agencies. A significant portion of the out-of-county casework was in support of the District Coroner's out-of-county autopsies.

Alcohol Tobacco and Firearms (ATF)	Goddard Police Department	Mulvane Police Department
Andale Police Department	Goddard USD 265 Police Department	Olathe Police Department
Barber County Coroner	Greenwood County Coroner	Park City Police Department
Barton County Coroner	Harper County Coroner	Pratt County Coroner
Bel Aire Police Department	Haven Police Department	Reno County Coroner
Bentley Police Department	Haysville Police Department	Scott County Coroner
Butler County Coroner	Harvey County Coroner	Sedgwick County Coroner
Cheney Police Department	Hutchinson Correctional Facility	Sedgwick County Fire Department
Clearwater Police Department	ICE	Sedgwick County Sheriff
Cowley County Coroner	Kansas Department of Corrections	Sumner County Coroner
Derby Police Department	Kansas Highway Patrol	US Postal Inspections
Drug Enforcement Agency (DEA)	Kechi Police Department	Valley Center Police Department
El Dorado Correctional Facility	Kingman County Coroner	Wellington Fire Department
El Dorado Police Department	Larned Correctional Facility	Wichita Fire Department
Elk County Coroner	Maize Police Department	Wichita Police Department
Finney County Coroner	Marion County Coroner	Wichita State University Police Department
Garden Plain Police Department	McPherson County Coroner	Wilson County Coroner
	Mount Hope Police Department	Winfield Correctional Facility

Table 2: List of law enforcement agencies, fire departments, and county coroners for which the forensic laboratories provided services in 2020.

Cases Completed

Cases completed every year may include cases that are submitted for the first time that year or may be cases that were originally submitted in previous years, but have additional examination(s) requested. **Figure 8** illustrates the number of cases completed by the laboratories in the given year.

The Forensic Laboratory has faced staffing challenges throughout 2018, 2019, and 2020. This was especially true for the Firearms and Toxicology Laboratories, which helps explain the noticeable drop in the number of cases completed for these years. However, in 2020 there was an increase in the total cases completed when compared to 2018 and 2019.

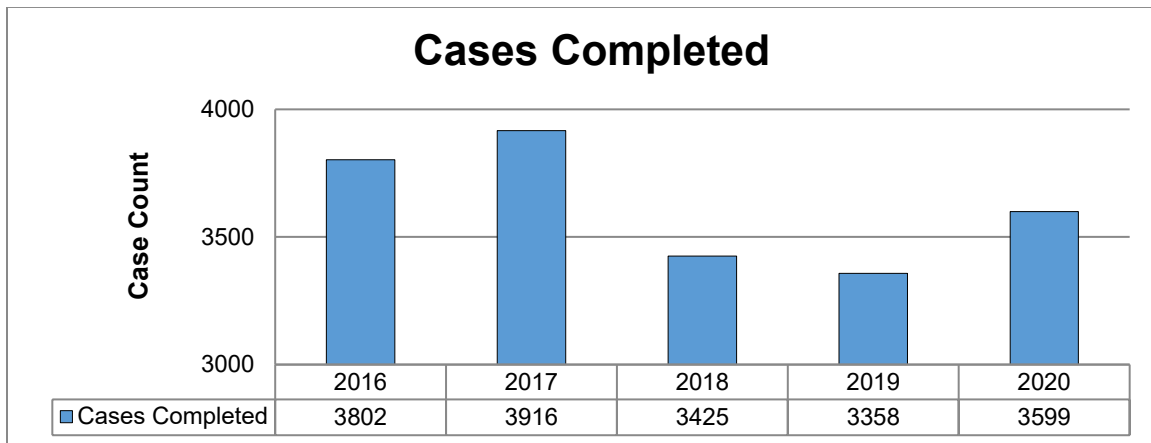


Figure 8 Number of cases completed per year.

Case Submission Turn-Around-Time

One metric of the Forensic Laboratory casework output is the amount of time it takes for a case to be completed following submission. As illustrated in **Figure 9**, 62% of cases submitted to the Laboratory Division in 2020 were completed within 60 days of submission, which is double that of 2019.

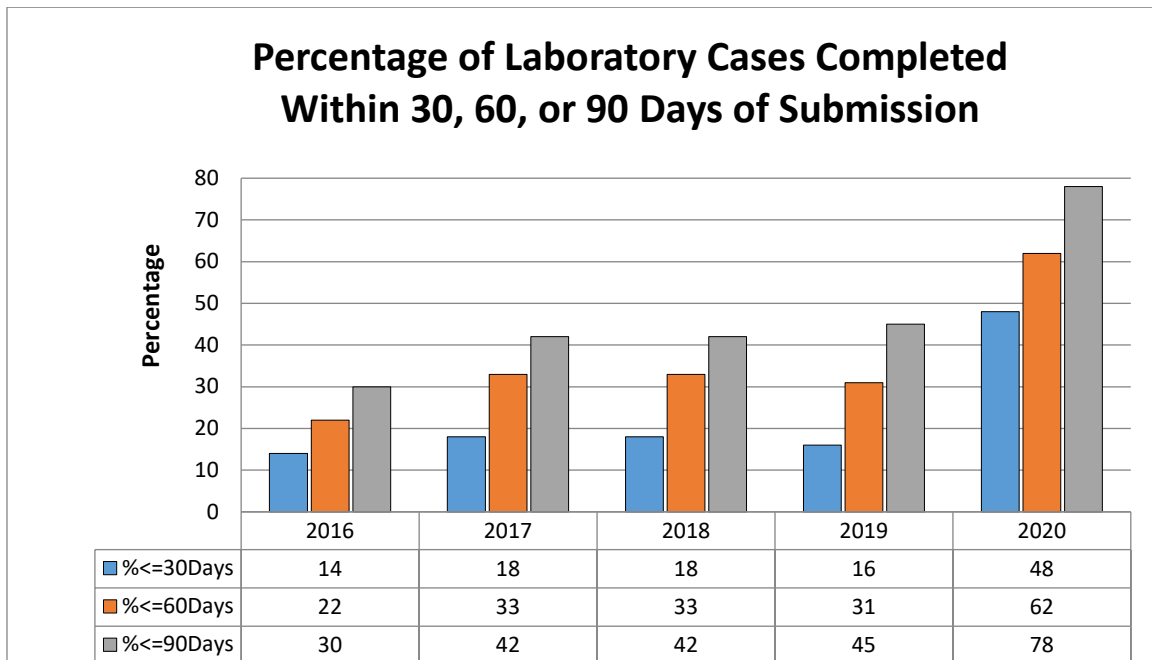


Figure 9 Percentage of laboratory cases completed within 30, 60, or 90 days of submission.

CRIMINALISTICS

The Criminalistics Section receives the majority of the cases submitted to the Forensic Laboratories. The Criminalistics Section provides forensic examinations in Drug Identification, Open Container Analysis, Firearms, Serial Number Restoration and Fire Debris. **Figure 10** illustrates the trend in forensic case volume submitted to the Criminalistics Section.

The first full calendar year that the District Attorney's Office implemented the policy to triage cases that are needed for prosecution was in 2019. This change in policy caused a decrease in case submissions. The reduction in case submission has improved turn-around-time and makes more efficient use of laboratory resources; however, the reduction in case submissions was off-set by the increased number of exhibits examined in 2020 (11,180) compared to 2016 (6,197), 2017 (7,857), 2018 (7,054), and 2019 (8,199) (**see Figure 11**).

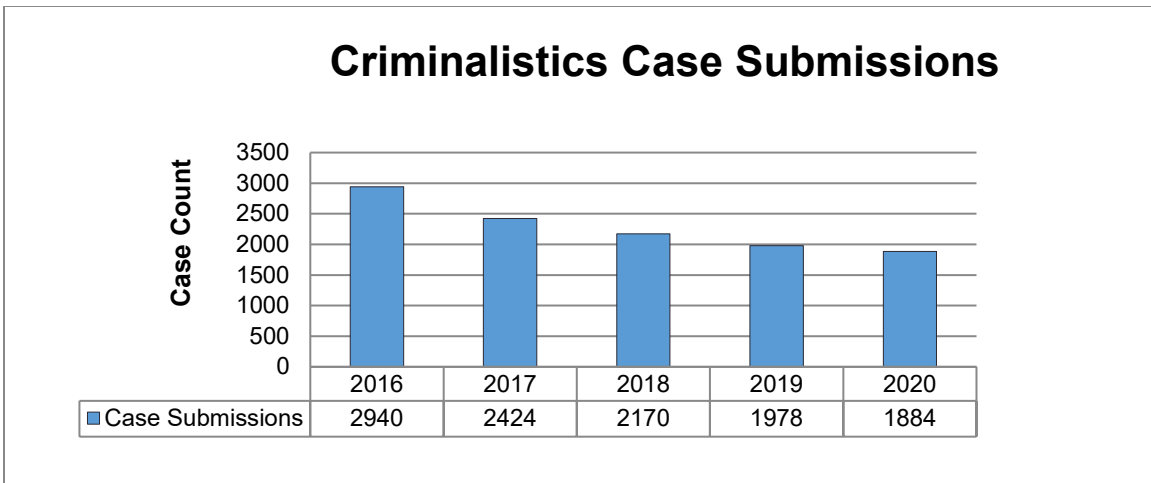


Figure 10 Number of case submissions to the Criminalistics Section (Drug ID, Firearms/Tool Marks, and Fire Debris) over five year period from 2016 through 2020. These include all new cases submitted to the Center for the first time and submissions from cases with subsequent submissions.

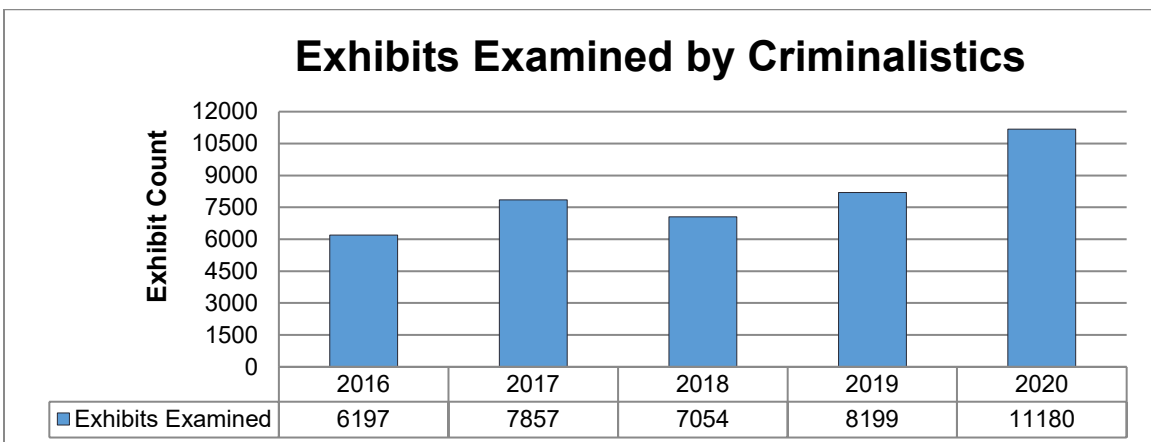


Figure 11 The number of exhibits examined from 2016 through 2020 by the Criminalistics Section (Drug ID, Firearms, and Fire Debris).

The volume and percentage of cases submitted to each laboratory of the criminalistics section is illustrated in **Figure 12**.

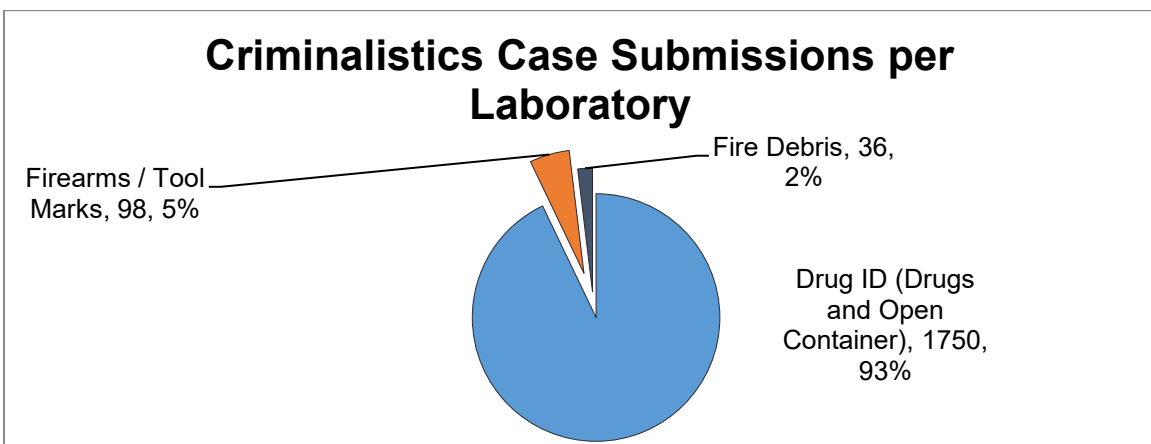


Figure 12 Volume and percentage of cases submitted to each Criminalistics Laboratory Unit.

DRUG ID

Examination requests for the identification of illicit drugs accounted for approximately 96% of the cases submitted to Criminalistics, as depicted in **Figure 12** above. Additionally, open container cases without any associated drugs accounted for 2% of the total submitted Drug ID cases. Casework requests for both illicit drug and open container examination accounted for another 2% of the total Drug ID submissions.

The agency that submits the greatest volume of evidence to Drug ID is the Wichita Police Department (WPD). This is apparent in **Figure 13**, as nearly 64% of cases received are from WPD. Agencies other than WPD and the Sedgwick County Sheriff's Office (SGSO) are responsible for approximately 14% of the total cases submitted.

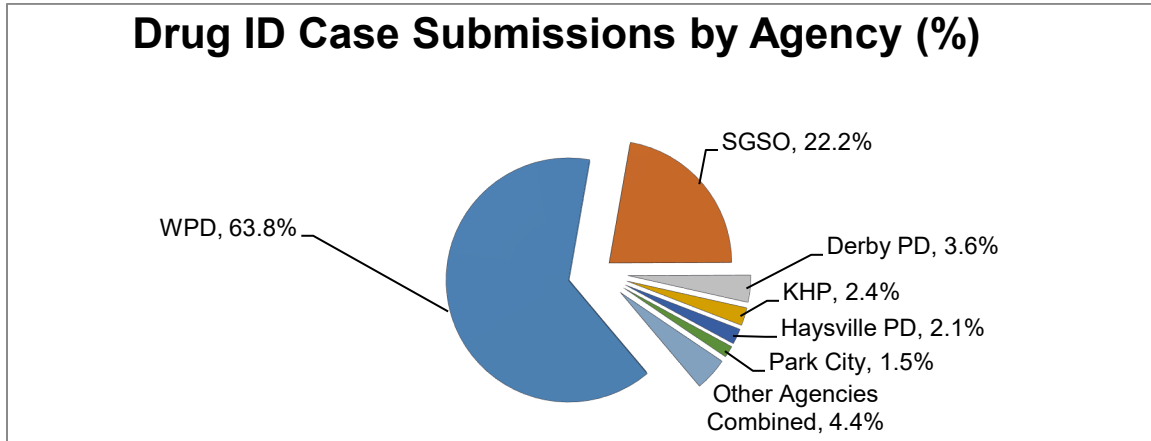


Figure 13 Percentages of Drug ID cases submitted per contributing agency.

The number of submissions, the number of cases submitted, and the number of new cases submitted to the Drug ID Laboratory over the last five years is illustrated in **Figure 14**.

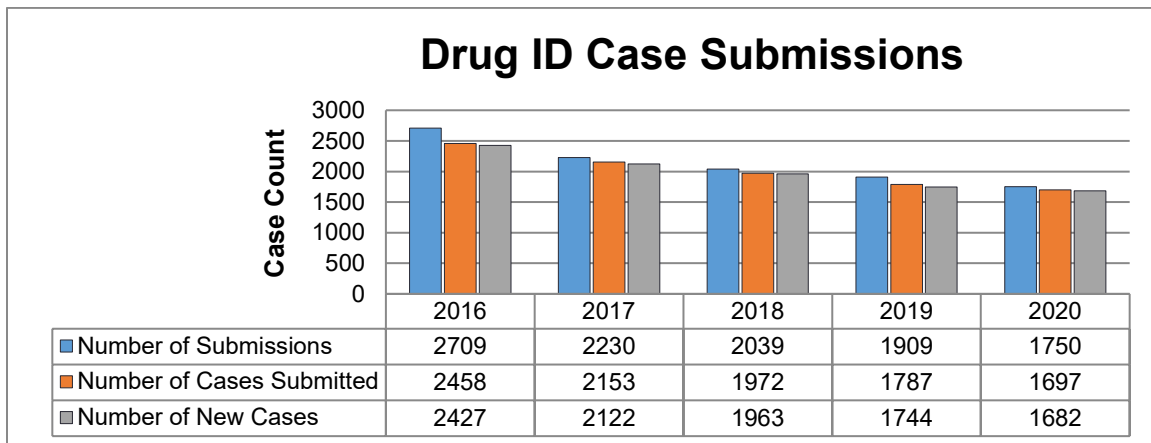


Figure 14 The number of case submissions to the Drug ID Laboratory over a five year period.

In 2020, the Drug Identification Laboratory examined thousands of exhibits for the presence of controlled substances. Consistent with years past, the majority of drug exhibits were identified as marijuana w/ tetrahydrocannabinol (THC), THC, cocaine, and methamphetamine. The Forensic Laboratory supported federal drug prosecution by performing methamphetamine quantitations, with an average purity of 75%, and cocaine base / salt form determinations.

The twelve (12) most commonly detected drugs are illustrated in **Figure 15**. Methamphetamine is the most commonly detected drug, followed closely by marijuana (MJ) with THC as the second most commonly detected drug. THC without the presence of marijuana plant material is the third most commonly detected drug. THC is the psychoactive component of cannabis and can be extracted out of the marijuana plant for use. It is often found in forensic samples as a residue or added to any other drug or material prior to being used by an individual. To be reported as MJ w/ THC the scientist must confirm the presence of marijuana by microscopically observing the specific characteristics of the plant.

Four opioids (heroin, hydrocodone, oxycodone, fentanyl) are included in the ten most commonly detected drugs.

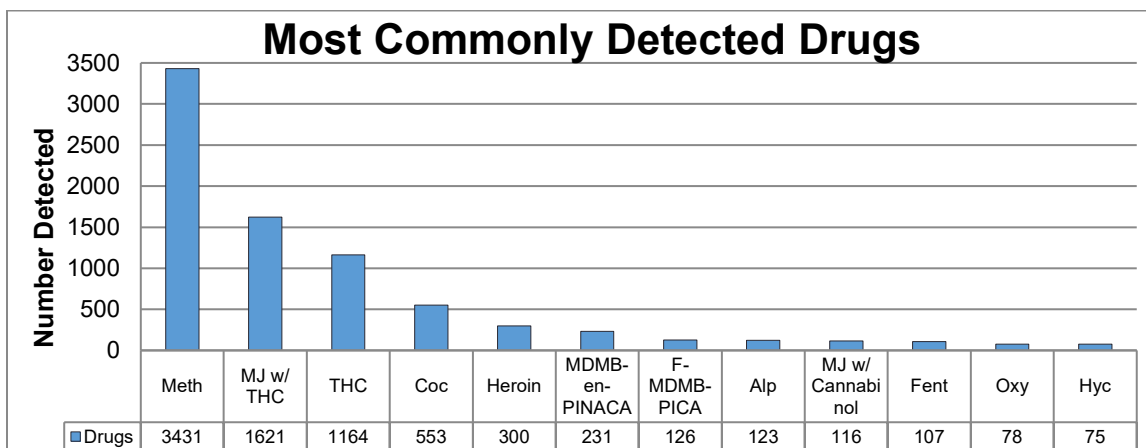


Figure 15 The twelve (12) most commonly detected drugs from 2020 examinations. Drug Abbreviation Key (Meth = methamphetamine, MJ = marijuana, THC = tetrahydrocannabinol, Coc = cocaine, Alp = alprazolam, Fent = fentanyl, Oxy = oxycodone, Hyc = hydrocodone).

Synthetic cannabinoids, which are commonly known as K-2 or spice, have been detected in many of Drug ID casework samples in 2020. In some exhibits synthetic cannabinoids are detected alone and in other exhibits they are detected mixed with other drugs. **Figure 16** illustrates the most prevalent.

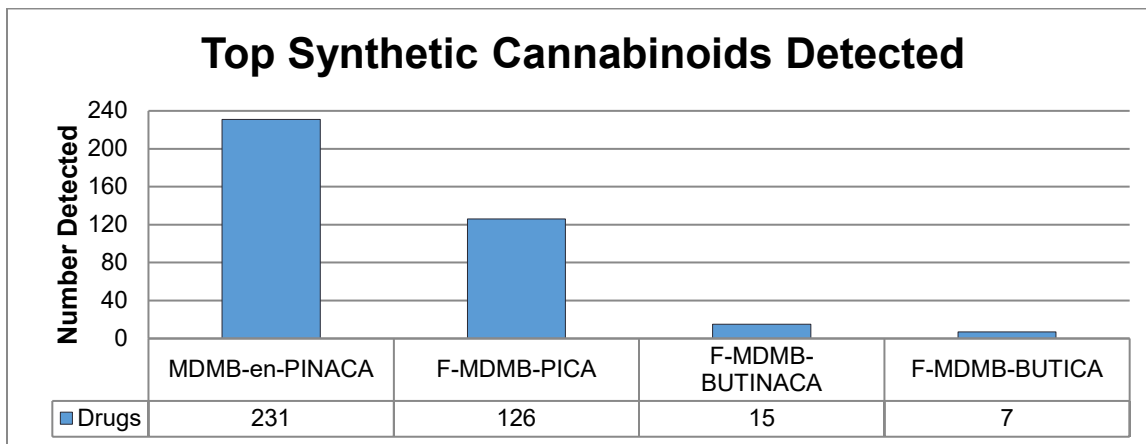


Figure 16 The four (4) most common synthetic cannabinoids detected from 2020 examinations. Drug Abbreviation Key: MDMB-en-PINACA = (N-(1-methoxy-3,3-dimethyl-1-oxo-2-butyl)-1-(x-pentenyl)indazole-3-carboxamide [MDMB-en-PINACA; classified as an Indazole-3-carboxamide], F-MDMB-PICA = 1-(x-fluoropentyl)-N-(1-methoxy-3,3-dimethyl-1-oxo-2-butyl)indole-3-carboxamide [F-MDMB-PICA; classified as an Indole-3-carboxamide], F-MDMB-BUTINACA = 1-(x-fluorobutyl)-N-(1-methoxy-3,3-dimethyl-1-oxo-2-butyl)indazole-3-carboxamide [F-MDMB-BUTINACA; classified as an Indazole-3-carboxamide], F-MDMB-BUTICA = 1-(x-fluorobutyl)-N-(1-methoxy-3,3-dimethyl-1-oxo-2-butyl)indole-3-carboxamide [F-MDMB-BUTICA; classified as an Indole-3-carboxamide].

Open Container / Beverage Alcohol

Open Container / Beverage Alcohol analysis is conducted in support of criminal cases with other associated crimes such as drug charges, weapons violations, and aggravated assaults. This analysis is also conducted to support the state and local DUI laws, prohibition of minors to possess alcohol, and other liquor law violations. **Figure 17** illustrates the number of open container cases submitted between 2016 and 2020.

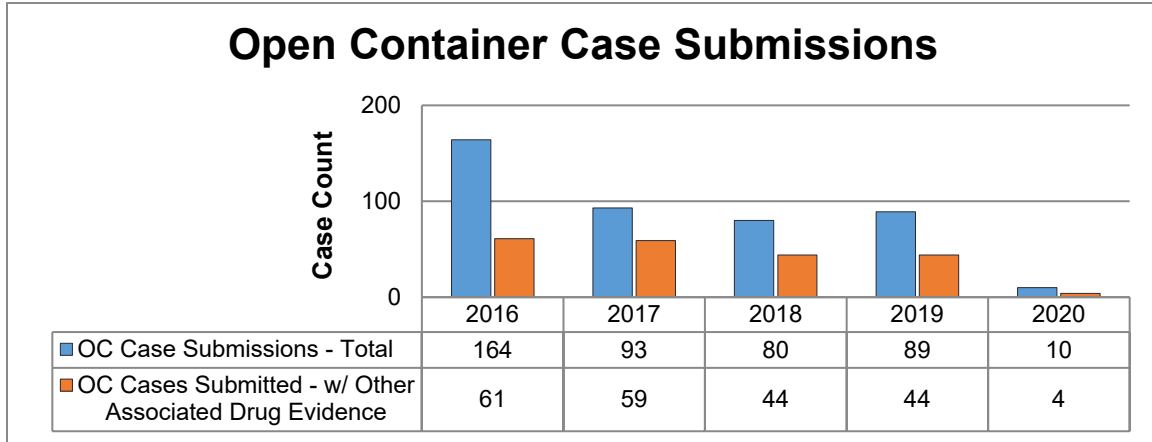


Figure 17 Number of open container cases submitted.

FIRE DEBRIS

The Fire Debris Laboratory examines fire debris evidence in support of fire investigations. The information provided to the investigator aids in determining if a fire was accidentally or intentionally set for purposes ranging from insurance fraud to homicide.

In 2020, the Fire Debris Laboratory received evidence from 34 cases with a total of 36 submissions. The trend of case submissions over the last five years is illustrated in **Figure 18**.

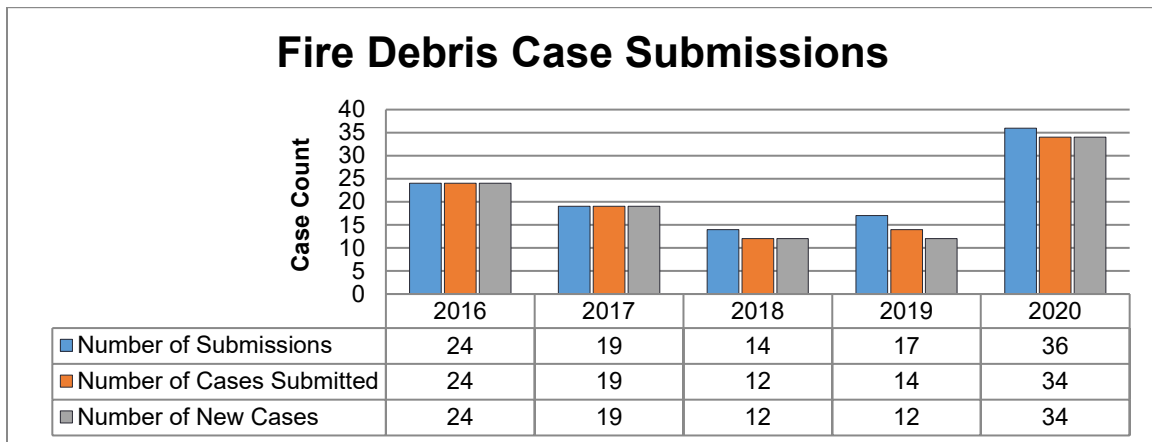


Figure 18 Number of fire debris cases submitted over a five year period.

FIREARMS

Firearm examination is conducted in support of state and federal law enforcement. The Firearms Laboratory conducts many types of forensic examinations. The majority of examinations involve operability (function) tests on the submitted firearms. Other exams performed by the Firearms Laboratory include bullet comparisons, cartridge case comparisons, and serial number restorations. In 2020, the Firearms Laboratory received evidence from 78 cases with a total of 98 submissions. The trend of case submissions over the last five years is illustrated in **Figure 19**. During 2019, the Center lost both qualified examiners, resulting in a decrease in submissions. However, the Center was able to hire two examiners and will soon be fully qualified to perform all Firearms casework types.

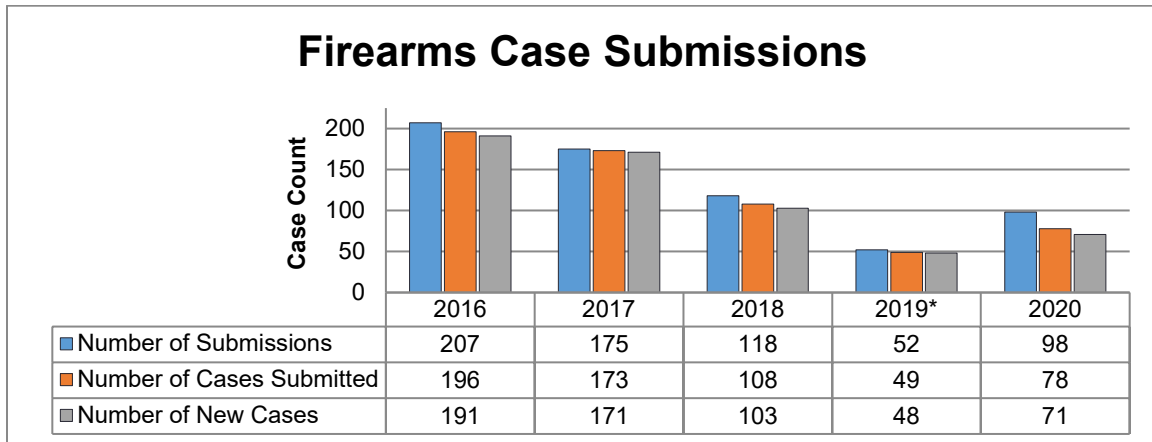


Figure 19 Firearm case submissions from 2016 through 2020. *In 2019, the Firearms Laboratory lost both qualified scientists. This required the laboratory to suspend receiving evidence for approximately 6 months. The laboratory commenced accepting evidence again in January 2020.

Examination types (test fire, bullet comparison, cartridge case comparison, serial number restoration) that were performed during each of the last five years are illustrated in **Figure 20**.

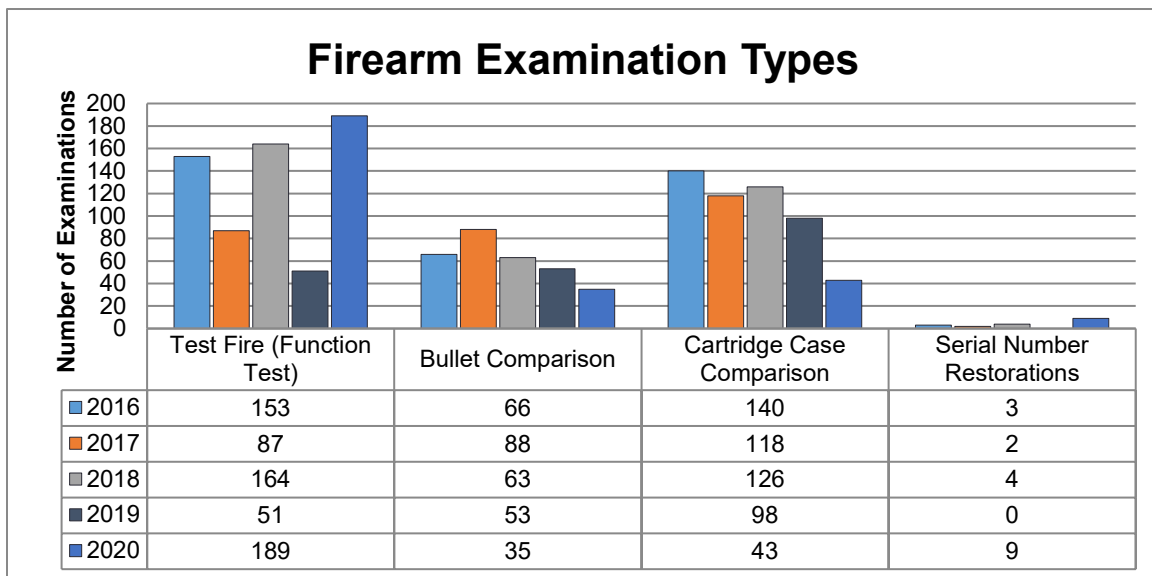


Figure 20 Case examination requests in the Firearms Laboratory; classified as test fires, bullet comparisons, cartridge case comparisons, and serial number restorations.

BIOLOGY/DNA

The Biology/DNA Laboratory examines evidence from a variety of cases including sex crimes (rape, indecent liberties, incest, etc.), homicides, property crimes, assaults, and forensic identifications (unidentified bodies).

The laboratory screens evidence for the presence of biological material (blood, semen, saliva, and feces). For DNA analysis, the laboratory generates short tandem repeat (STR) profiles from the scene exhibits, those profiles can then be compared to reference standards collected from individuals believed to be associated to the scene (victims, suspects, or other known individuals). Ultimately, results are interpreted and a conclusion is drawn as to whether the reference standard profiles are consistent with or excluded from the crime scene profiles. The nature of forensic samples collected at crime scenes vary greatly. Under optimal circumstances (fresh blood stains), high quality single source profiles may result. Alternatively, the samples may have been left by multiple individuals or exposed to environmental elements, which can lead to low quantity/degraded samples. All of these factors affect the laboratory's ability to obtain a comparable profile. If a profile is suitable for comparison, statistical analysis may be performed by analysts so that power of discrimination can be clearly presented to a jury when an association is made between a reference sample and a scene exhibit.

In 2020, the Biology/DNA Laboratory received evidence from 312 cases with a total of 406 submissions. The trends of case submissions over the past five years are illustrated in **Figure 21**.

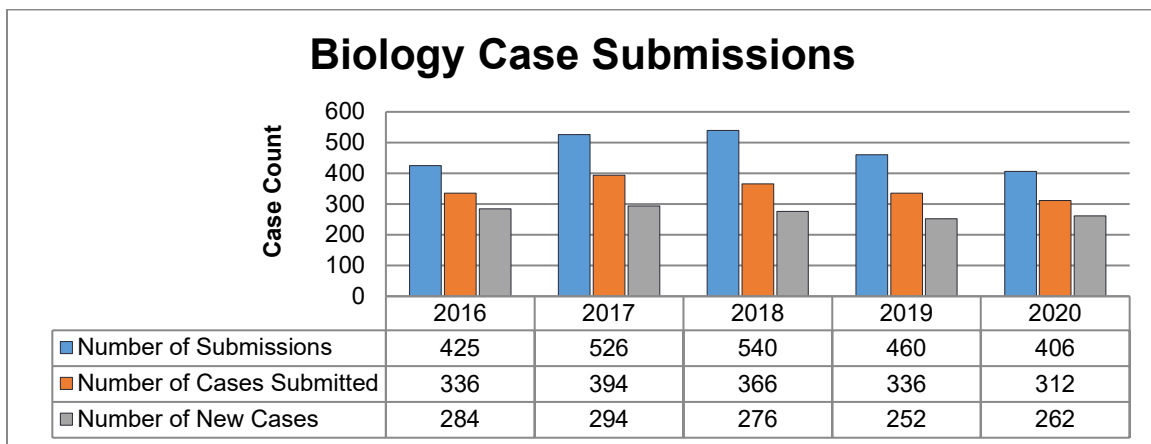


Figure 21 Number of cases submitted to the Biology/DNA Laboratory over a five year period.

Figure 22 illustrates the various case types commonly submitted for biological testing. For the first time ever, over half (~57%) of the new cases involved sexual assault. Property crimes continue to have a high likelihood of resulting in a profile suitable for CODIS entry. Given that these crimes have a high recidivism rate they have an exceptional solvability factor when crime scene profiles are searched against the database. Nearly 4% of the case types are categorized as other. This category may include cases involving attempted murder, vandalism, narcotics, stalking, etc. The laboratory identified human remains for 10 non-homicide cases submitted by the District Coroner through forensic DNA analysis.

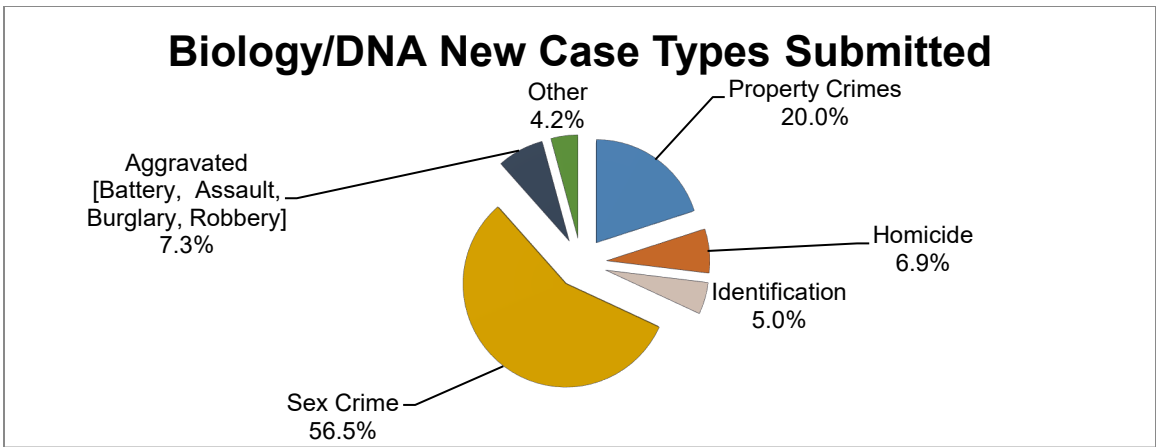


Figure 22 Classification of cases submitted for Biology/DNA analysis.

The number of sex crime cases submitted to the Biology/DNA Laboratory over the last five years is illustrated in **Figure 23**. In 2020, the Biology/DNA Laboratory received evidence from 166 sex crime cases with a total of 193 submissions, marking a record high for new case submissions in any single year, and continues the trend of an increase in sex crime case submissions.

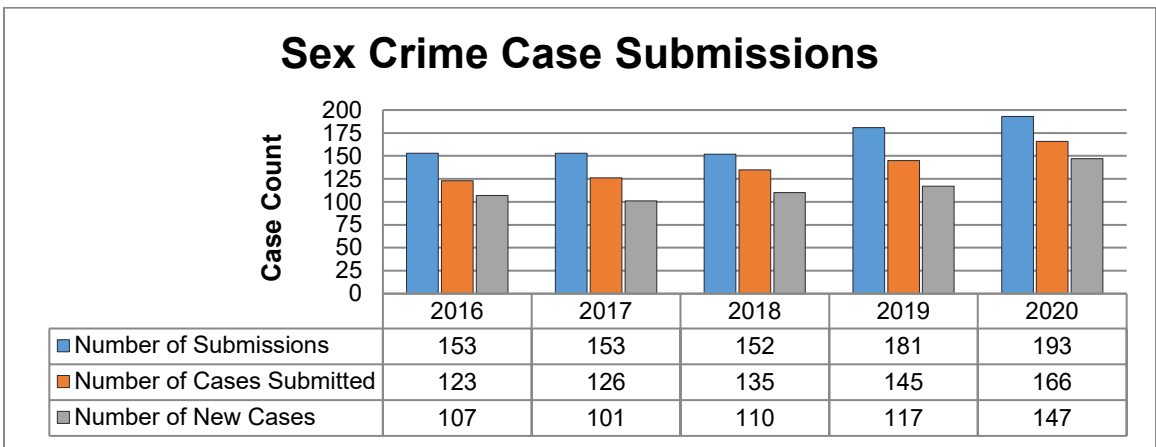


Figure 23 The number of sex crime case submissions to the Biology/DNA Laboratory over the last five years.

CODIS

The Combined DNA Index System (CODIS) is database software used to compare DNA profiles within and between crime scene laboratories throughout the nation. In 2007 Kansas became an all arrestee state, meaning that law enforcement collects DNA samples for any person arrested for qualifying offenses. The DNA profile generated from the arrestee/offender is entered into the state database (SDIS) in Topeka, KS and is available to be searched against the unknown profiles the laboratory enters into our local database (LDIS). In late 2009, the DNA Laboratory adopted new procedures for the release of investigative lead information to include formal written and reviewed notifications for database associations.

Over the years, the increased number of associations identified through CODIS resulted in an increase in reports generated, as well as an increase in the number of known samples processed to confirm and prosecute these additional CODIS hits. The number of CODIS entries, associated hits generated, and oversight of this database, entails a large amount of scientist time. Samples compared as a function of database management are not reflected in the number of cases submitted or accounted for as a separate “case type” in the figures describing case submissions.

Trends in CODIS activity are illustrated in **Figure 24** and **Figure 25**. In the last 5 years, the average number of case profiles entered into CODIS is 138, the average number of hits per year is 93, and the average number of investigations aided per year is 82.

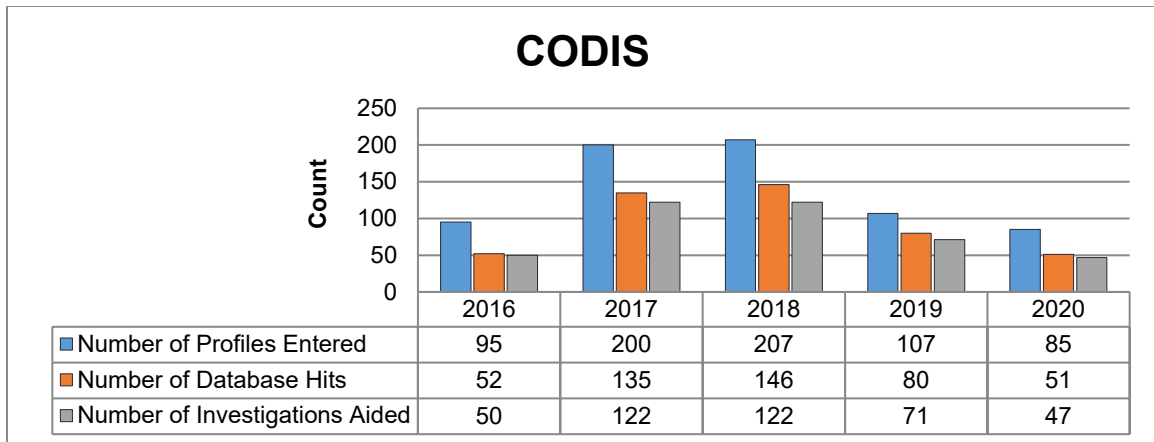


Figure 24 Five (5) year depiction of the number of DNA profiles entered into CODIS as well as the number of database hits and number of investigations aided.

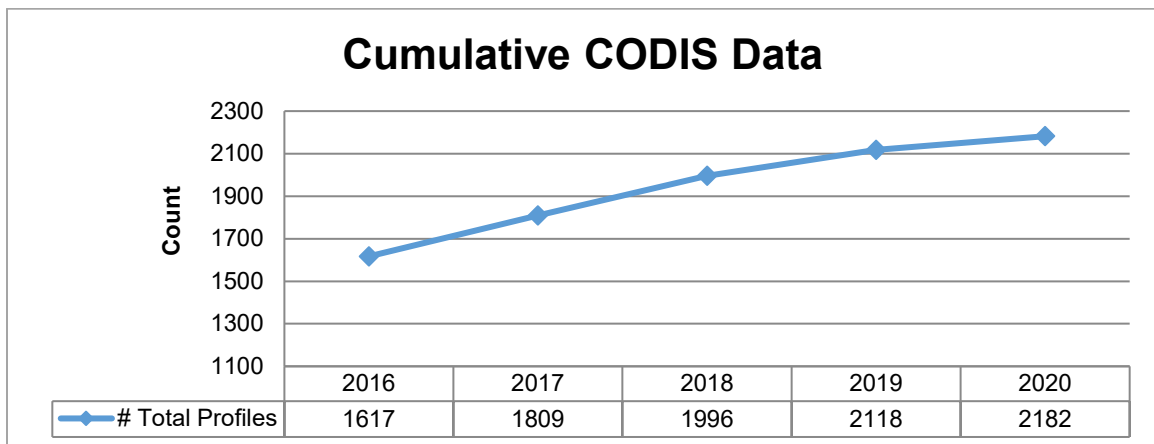


Figure 25 The graph and chart depicts total number of profiles residing in the database (LDIS) at the end of each year.

Unknown and Known Exhibits Examined

The Biology/DNA Laboratory exams unknown samples (Qs) from crime scene exhibits and known samples (Ks) collected from known individuals. The number of exhibits submitted in any given case can vary greatly. Some investigations may involve multiple scenes and individuals, while others require the testing of a single sample. Therefore, to reflect the workload of the section, it is often useful to also capture data involving the number of exhibits the section has tested or processed and the number of DNA profiles that required scientist interpretation and comparison.

Figure 26 below illustrates the number of unknown and known exhibits examined by the laboratory over the past five years. **Figure 27** below illustrates the number of DNA profiles generated by PCR from the unknown and known exhibits over the same period.

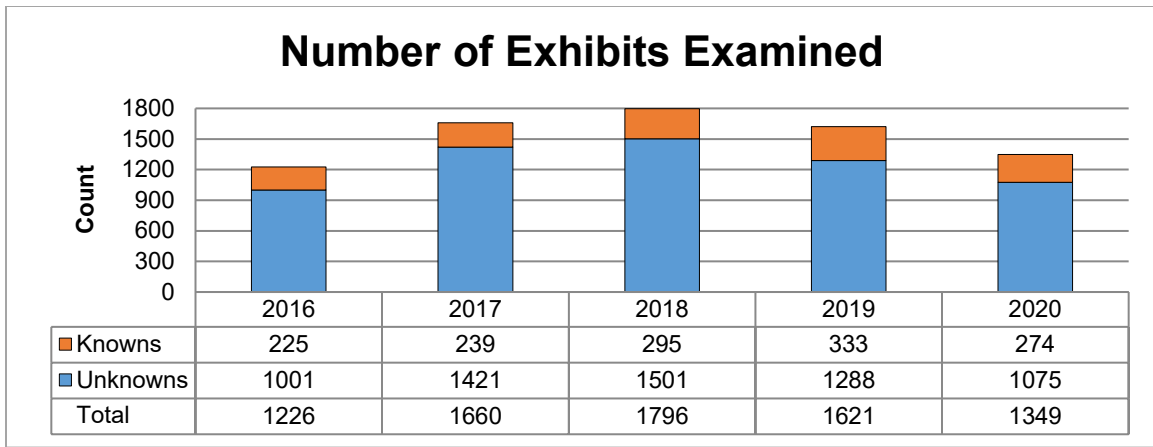


Figure 26 The number of unknown and known exhibits examined by the Biology/DNA Laboratory in each of the past five years.

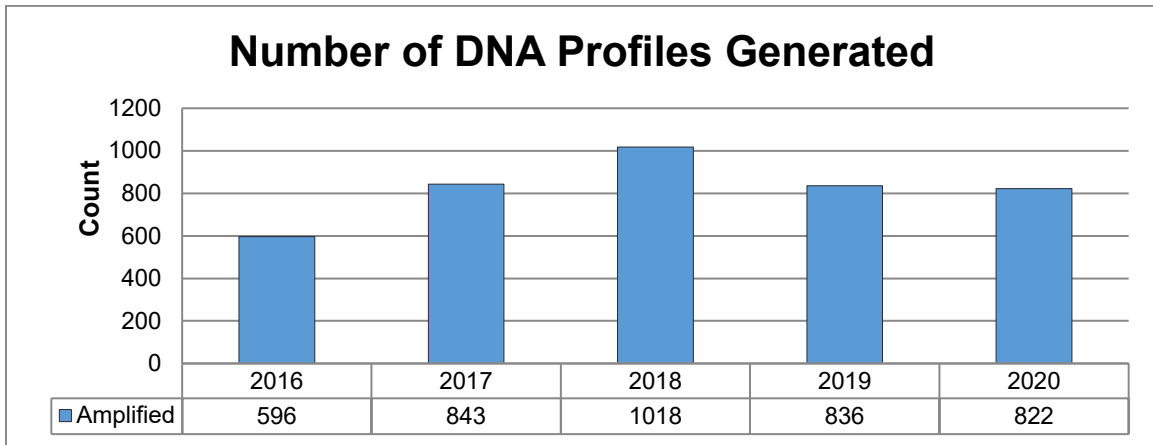


Figure 27 The number of profile generated from PCR amplification by the Biology/DNA Laboratory in each of the past five years.

TOXICOLOGY

The Toxicology Laboratory provides comprehensive examinations of post-mortem (autopsy) samples to assist in the determination of cause and manner of death. Specimens collected during the investigation of driving under the influence of drugs and/or alcohol cases and drug-facilitated sexual assault cases are also examined by the Toxicology Laboratory. The Toxicology Laboratory also provides drug testing on children removed from clandestine methamphetamine laboratories.

The laboratory continues to expand the number of drugs and poisons it can detect and quantitate.

A significant portion of samples submitted are from post-mortem (PM) cases, the number of which is dependent upon the number of autopsies performed at the Center by the Pathology Division. The remaining portion of the cases are ante-mortem cases submitted for analysis by law enforcement agencies. These include DUI (driving under the influence), DUID (driving under the influence of drugs), DFSA (drug facilitated sexual assault) and other ante-mortem cases submitted by law enforcement agencies. Illustrated in **Figure 28** is the total number of case submissions to the Toxicology Laboratory over a 5 year period.

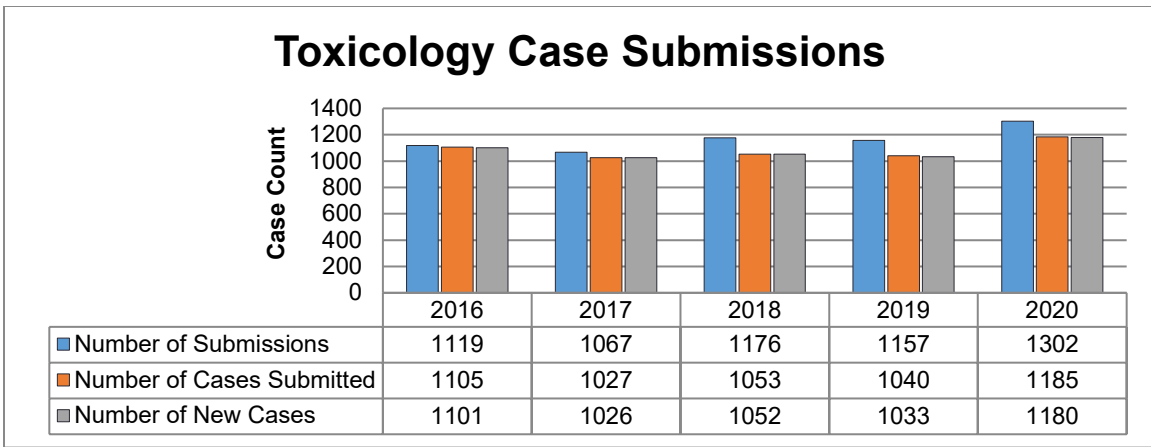


Figure 28 The number of case submissions, the number of cases submitted, and the number of new cases submitted to the Toxicology Laboratory for analysis over a five year period.

The percentage of toxicology cases submitted by case type is illustrated in **Figure 29**. Post-mortem (PM) toxicological examinations in support of the District Coroner account for approximately 75% of the forensic case work performed by the laboratory.

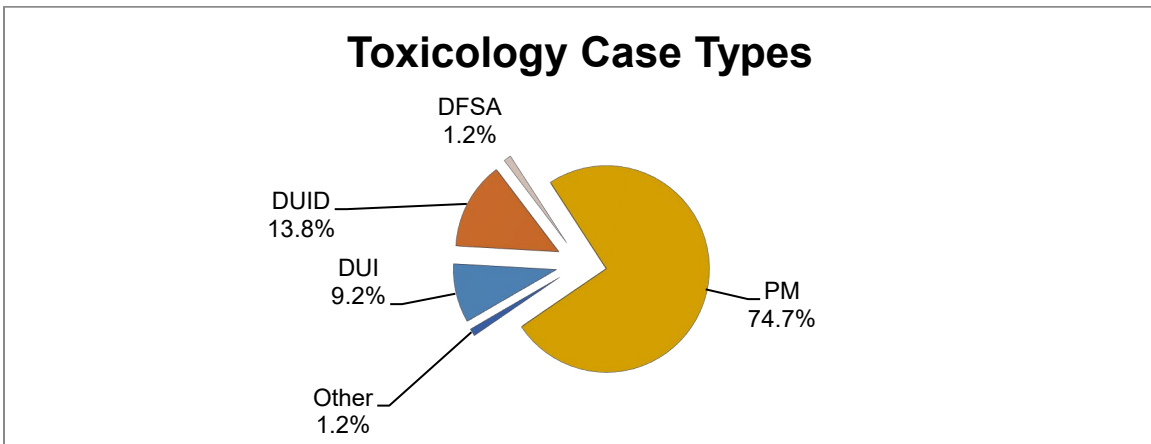


Figure 29 Submission of toxicology cases, sorted by case type. DUI (driving under the influence of alcohol), DUID (driving under the influence of drugs), PM (post-mortem), DFSA (drug facilitated sexual assault), and Other (Aggravated Battery, Aggravated Assault, Drug, Homicide, and Undetermined).

Drug-Related Deaths

Opioid related deaths remained prevalent in 2020 with a total of 143. The range of opioid related deaths over the past five years is 133 to 159 with an average of 144 deaths. **Figure 30** provides the count of opioid related deaths broken down into four categories (fentanyl, heroin, oxycodone, and other opioids).

Opioid Related Deaths

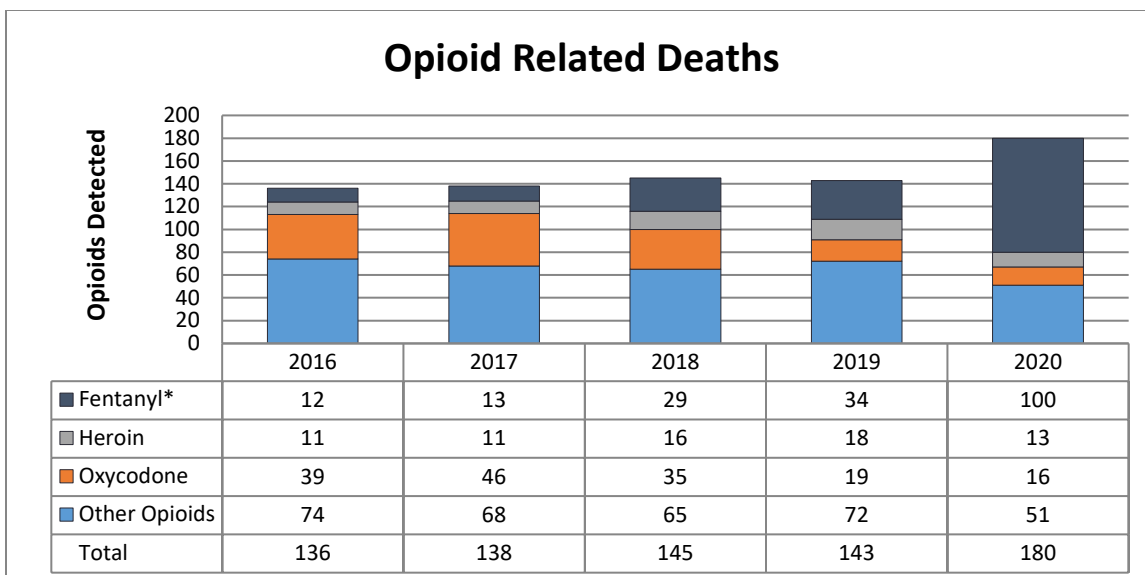


Figure 30 Opioid related death count detected in Post-mortem Toxicology cases over the last five years. *Fentanyl count includes fentanyl and fentanyl analogs.

In **Table 3** is a list of the number of cases that each opioid was detected in Post-mortem Toxicology specimens per submission year. In 2020, the number of cases in which fentanyl was detected increased by 212% from the previous high in 2019.

Opioids Detected in Post-mortem Specimens	2016	2017	2018	2019	2020
4-Fluoro-isobutyryl fentanyl	0	0	1	0	0
6-Acetylmorphine (Heroin)	11	12	16	17	22
4-OH Mitragynine	0	0	1	0	0
Buprenorphine	1	0	0	1	0
Codeine	7	5	10	7	6
Despropionylfentanyl	1	0	0	0	0
Fentanyl	11	13	28	32	100
Furanyl-fentanyl	1	0	0	0	0
Hydrocodone	31	36	35	27	25
Hydromorphone	10	4	5	4	8
Loperamide	3	0	0	0	0
Methadone	15	21	18	21	11
Mitragynine	1	0	2	1	4
Morphine*	40	26	35	40	38
Norfentanyl	0	0	1	3	78
Oxycodone	44	47	39	19	24
Oxymorphone	18	9	8	3	2
Propofol	3	0	1	2	0
Tramadol	13	9	11	10	9
U-47700	1	0	0	0	0

Table 3: Opioids detected in death cases over the last 5 years. *Some positive morphine cases may be due to a delayed heroin related death.

Aside from alcohol, methamphetamine was the most commonly detected drug in post-mortem cases. As illustrated in **Figure 31**, methamphetamine related deaths increased in 2018, and again in 2020.

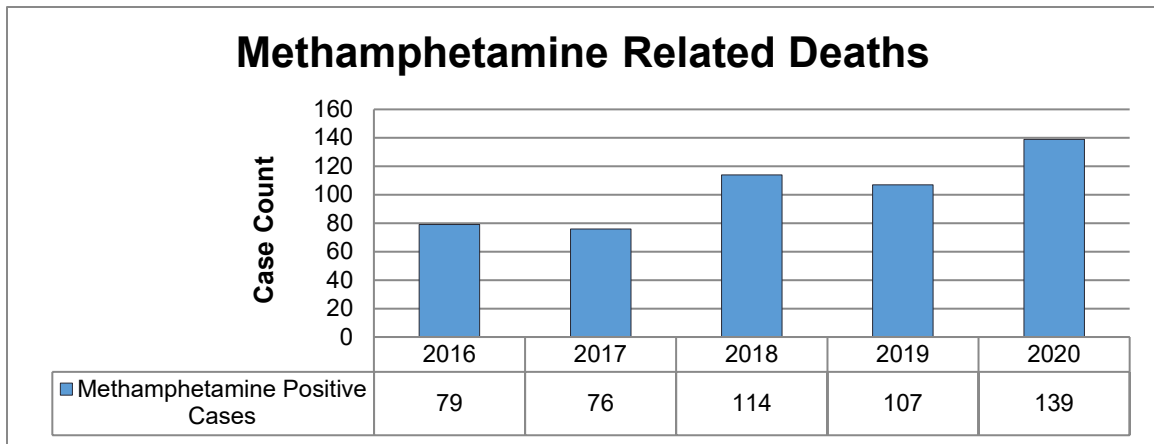


Figure 31: Methamphetamine related deaths detected in Post-mortem Toxicology cases.

Hundreds of different drugs can be detected in Post-mortem Toxicology cases, including a wide range of illicit, prescription, and over the counter drugs. New drugs are constantly emerging on the illicit drug market providing a challenge to the toxicology laboratory. **Table 4** illustrates the number of 2020 Post-mortem Toxicology cases that the most frequently detected drugs and/or metabolites were detected. Excluding Acetone and ethyl alcohol, there were a total of 117 different drugs and/or metabolites detected in 457 cases.

Drugs Detected in Post-mortem Cases	2020 Case Count	2020 Percent of Case Detected
Methamphetamine	139	30.4
Amphetamine	132	28.8
Tetrahydrocannabinol	115	25.1
Fentanyl	98	21.4
Norfentanyl	78	17.0
Benzoylcegonine	49	10.7
Morphine*	37	8.0
Carboxytetrahydrocannabinol	35	7.6
Alprazolam	32	7.0
Gabapentin	32	7.0
7-Aminoclonazepam	25	5.4
Hydrocodone	25	5.4
Oxycodone	22	4.8
Cocaine	20	4.3
Toluene	19	4.1
6-Acetylmorphine	17	3.7
Levetiracetam	14	3.0
Lorazepam	14	3.0
Zolpidem	14	3.0
Nordiazepam	13	2.8
Diphenhydramine	12	2.6
Cocaethylene	11	2.4
Methadone	11	2.4

Table 4: The most commonly detected drugs and/or metabolites detected in 2020 Post-mortem Toxicology cases. Also, the percent of positive cases that each was detected. The remaining drugs and/or metabolites were detected in less than 10 cases. *Some positive morphine cases may be due to a delayed heroin related death.

Alcohol Analysis

Alcohol continues to play a significant role in all of the Toxicology Laboratory case types as depicted below in **Figure 32**. Blood alcohol results that were at least twice the legal limit of 0.08 gm% were detected in approximately 35% of DUI cases and 16% of DUID cases.

In approximately 19% of the post-mortem case investigations and approximately 27% of driving under the influence (DUI) cases were found to have alcohol concentrations at or above the legal limit of 0.08 gm%.

For cases submitted in 2020, approximately 50% of the tested samples in DUI and DUID cases were negative for the presence of alcohol and approximately 77% of alcohol positive drivers were at or above “per se” limit of 0.08 gm%.

Approximately 60% of DUID cases were found to be negative for alcohol upon pre-screening, approximately 12% were cases involving blood alcohol levels below the legal limit, and 27% of the cases were at or above the legal limit (0.08 gm% and up).

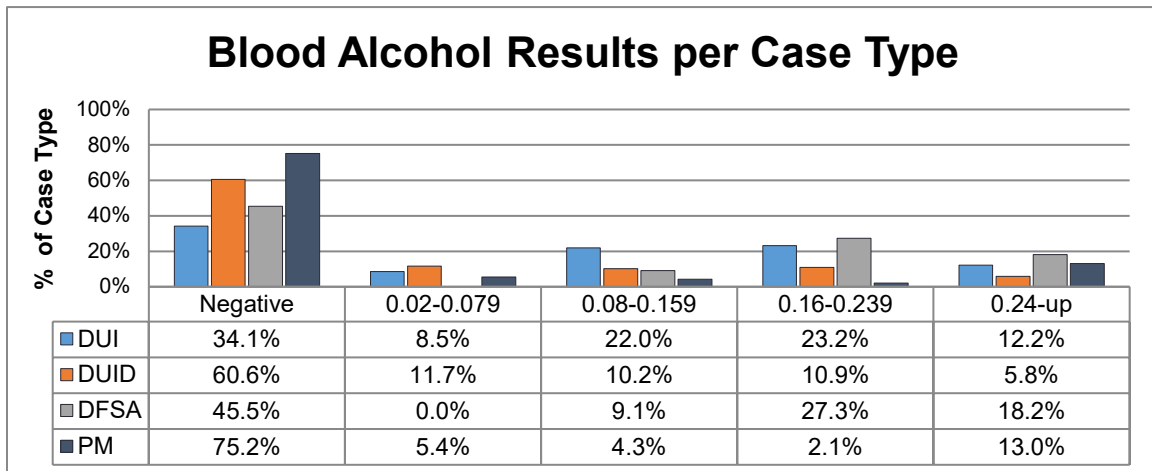


Figure 32: Percentage of alcohol test result ranges for each type of case.

Alcohol Positive Drivers – Under the Age of 21

The legal age for possession of alcohol is 21 years of age. In 2020, approximately 11% of all motor vehicle drivers testing positive for alcohol were under the age of 21. **Figure 33** illustrates the percentages of suspected alcohol impaired drivers by age and the blood alcohol levels for minors vs. legal drinking age. For drivers tested that were at least 21 years old, approximately 39% had alcohol concentrations ≥ 0.08 gm%.

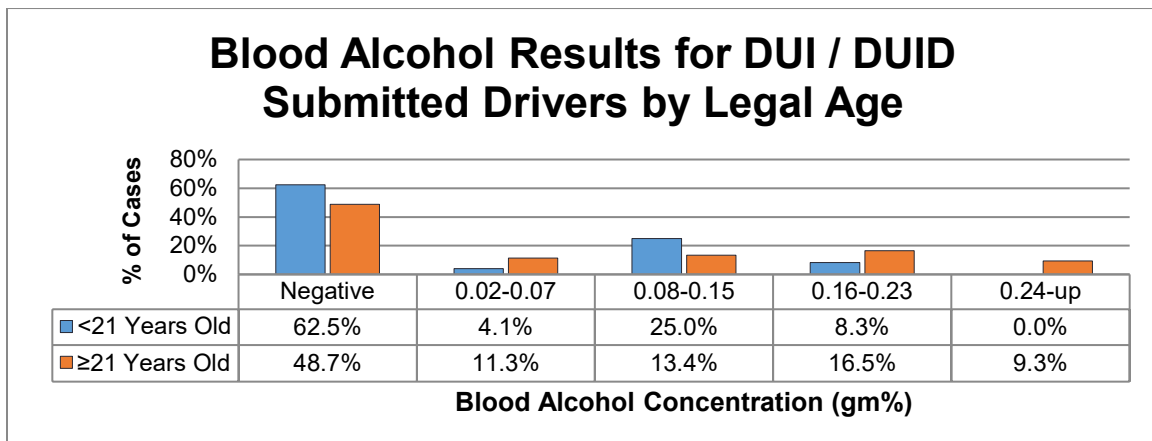


Figure 33 DUI and DUID blood alcohol results sorted by age (minors vs. 21 years and older).

Drugs and Driving

Many driving cases involve drivers that are under the influence of tetrahydrocannabinol (THC). **Figure 34** provides the number of positive THC results from the 174 DUID (Driving Under the Influence of Drugs) cases submitted in 2020. There was measureable THC detected in 58, or approximately 33%, of the 2020 cases. Since the standard operating procedure of the Toxicology Laboratory to not routinely test for drugs in specimens that have a blood alcohol level that is ≥ 0.100 gm%, the percentage of THC positives in driving cases is likely an underestimation.

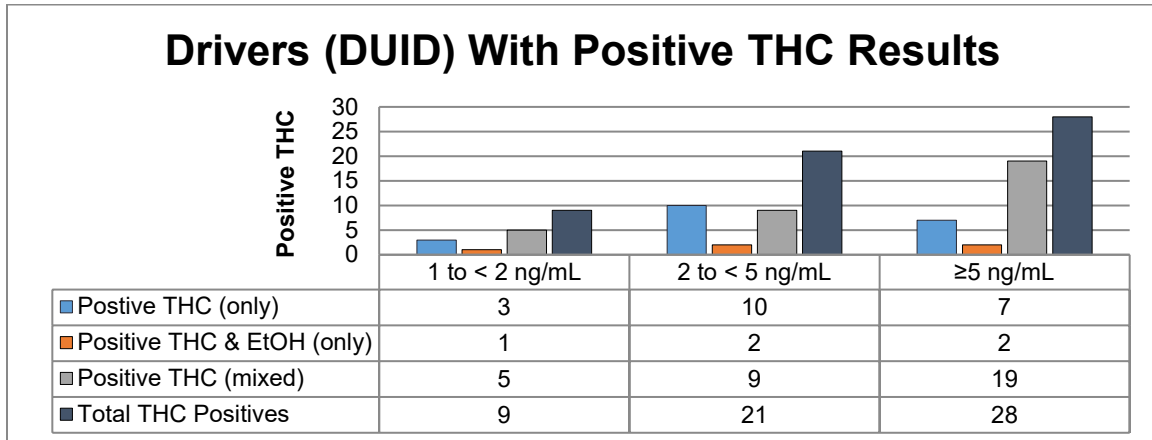


Figure 34 The number of DUID case specimens that tested positive for tetrahydrocannabinol (THC) that were submitted in 2020. The table compares the number of drivers that tested positive for THC only and drivers that tested positive for THC mixed with any other drugs, including alcohol.

As illustrated in **Figure 35**, approximately 60% of DUID cases were found to be negative for alcohol upon pre-screening, approximately 10% were cases involving blood alcohol levels below the legal limit, and approximately 21% of the cases were at or above the legal limit (0.08 gm% and up).

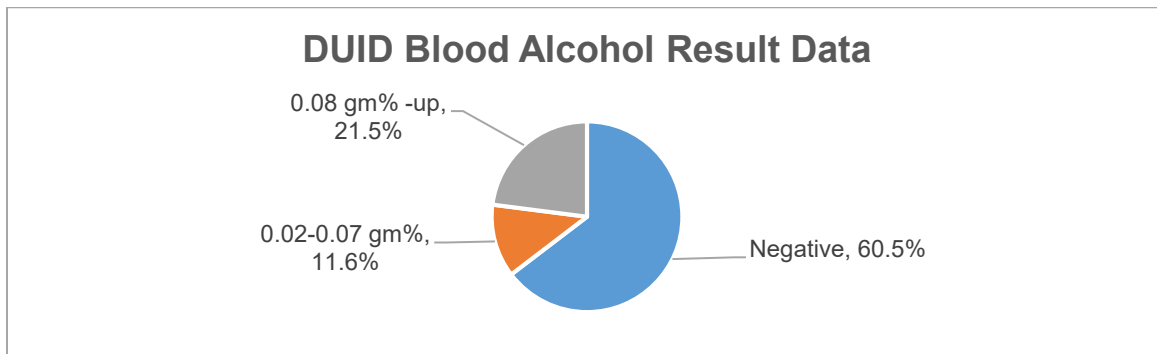


Figure 35 Alcohol testing result ranges for DUID submitted cases.

Drugs play a significant role in driving under the influence cases and can cause different levels of impairment. As depicted in **Figure 36**, the majority (83.9%) of DUID cases tested in 2020 were found to be positive for the presence of drugs.

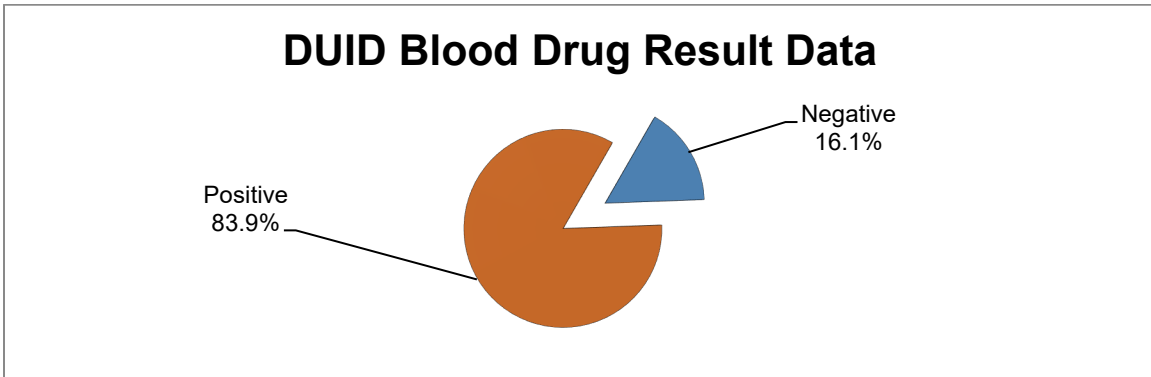


Figure 36 DUID blood drug results.

Driver Drug Usage

The Toxicology Laboratory detected 40 different drugs and/or their metabolites in DUID cases. Illustrated in **Figure 37** are the most commonly detected drugs in 2020 (excluding ethyl alcohol).

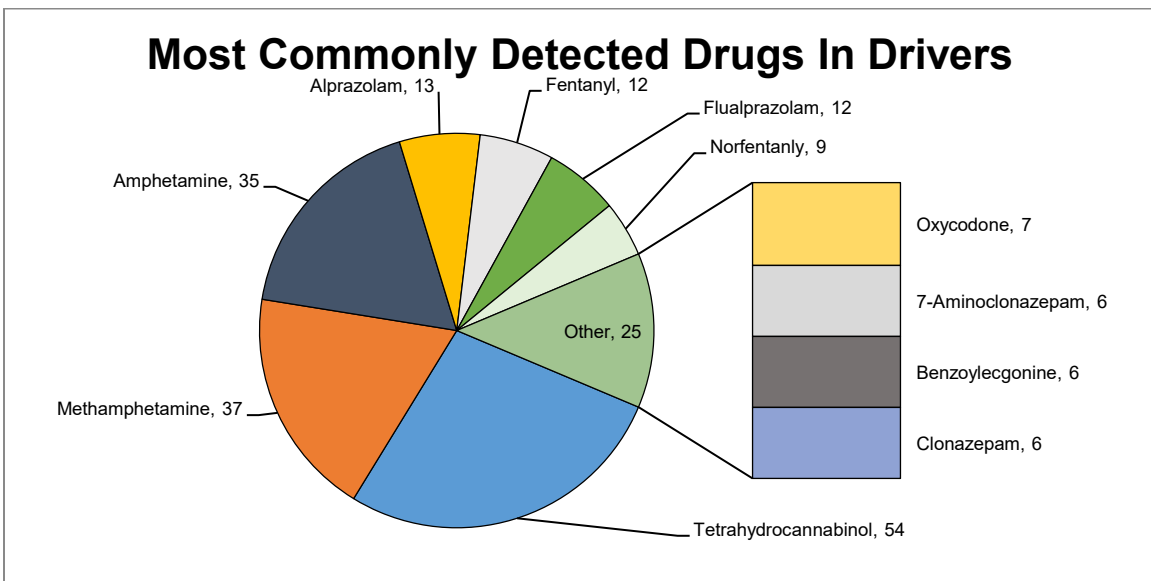


Figure 37 The most commonly detected drugs in driving under the influence of drugs (DUID) toxicology cases (excluding ethyl alcohol) and the number of positive exhibits.

Drug-Facilitated Sexual Assaults

Drug-facilitated sexual assaults (DFSA) is a demanding type of forensic investigation. The cases often involve a perpetrator who will surreptitiously administer a drug to a victim to render them unconscious and sexually assault them. As illustrated in **Table 5**, in 2020 there were 15 DFSA cases submitted for analysis and the Toxicology Laboratory completed 25 DFSA cases. Ethanol was detected in 6 of the completed DFSA cases in 2020.

Year	Cases Submitted	Cases Completed
2016	14	11
2017	15	22
2018	24	17
2019	26	28
2020	15	25

Table 5 DFSA cases submitted and completed each year since 2016.

DFSA case specimens often have several different drugs present. **Figure 38** illustrates the percentage of cases in which each of the listed drugs were detected during analysis of the 25 completed DFSA cases in 2020.

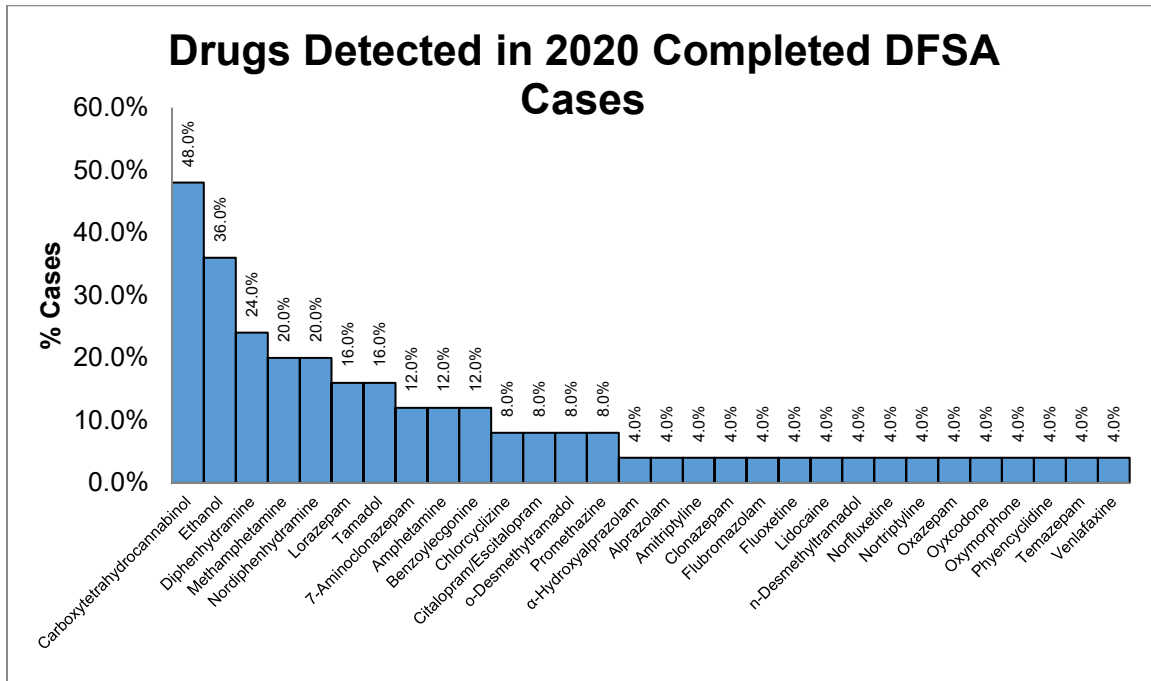


Figure 38 The percentage of DFSA cases that the listed drug was detected during analysis in 2020.