

2019

# Forensic Science Laboratory Annual Report

SEDGWICK COUNTY, KANSAS

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## 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-Interim**  
*Shelly Steadman, Ph.D.*

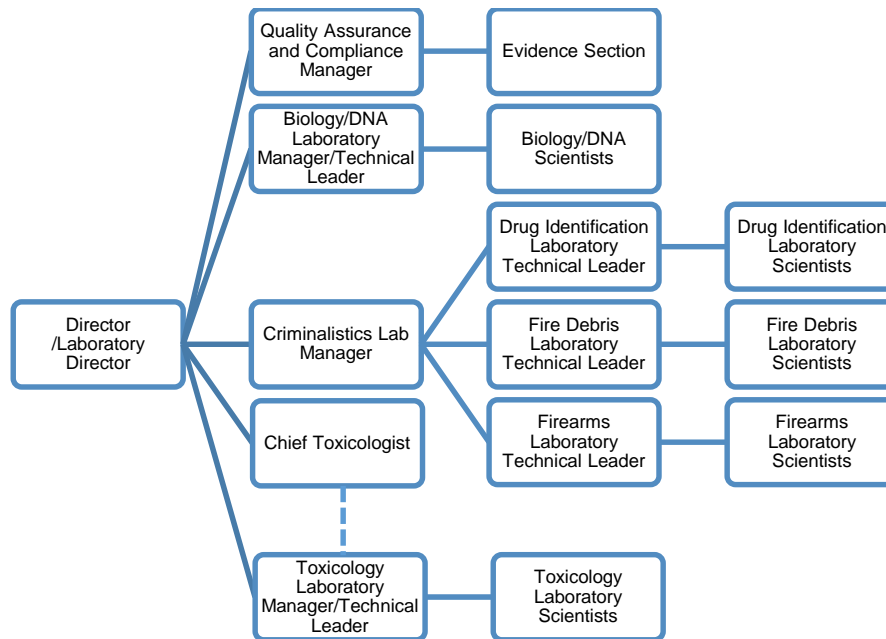
**Criminalistics Lab Manager**  
*Lana Goodson*

**Toxicology Lab Manager**  
*Kimberly Youso, M.S., D-ABFT-FT*

**Forensic Biology/DNA Manager**  
*Shelly Steadman, Ph.D.*

**Quality Assurance Manager**  
*Robert Hansen, M.S.F.S.*

## LABORATORY ORGANIZATION



## **INTRODUCTION**

The Regional Forensic Science Center (RFSC) officially opened on December 21<sup>st</sup>, 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 2019, 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 2019, the Forensic Science Laboratory completed and ANAB *ISO/IEC 17025:2017*, AR3125 surveillance assessment. Also, the Biology/DNA Laboratory completed an internal 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**

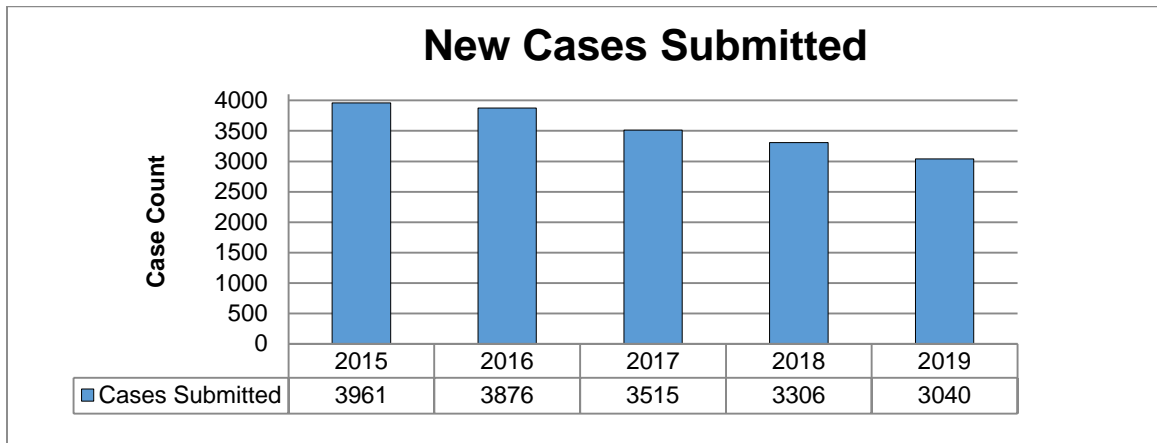
- *Publications:*
  - Rohrig, T.P. Post-mortem Toxicology: Challenges and Interpretive Considerations, 1<sup>st</sup> Ed., Academic Press, 2019.
  
- *Laboratory Staff enhanced their technical and professional expertise by attending the following workshops and/or training sessions on-site, at conferences, or via webinar:*
  - 18<sup>th</sup> Annual AFQAM Training Conference
  - 2019 “HID future trends in forensic DNA technology” seminar series
  - 2019 Annual Review of DNA Data Accepted at NDIS
  - 2019 JAT Article 1: Pilot-Reported Beta-Blockers Identified
  - 2019 JAT Article 2: Suspect Screening Using LC-Q-TOF Is a Useful tool for Detecting Drugs in Biological Samples
  - 2019 JAT Article 3: Bioavailability and Pharmacokinetics of Oral Cocaine in Humans
  - 2019 JAT Article 4: Recommendations for Toxicological Investigations of Drug-Impaired Driving and Motor Vehicle Fatalities
  - 25<sup>th</sup> Annual National CODIS Conference
  - 2<sup>nd</sup> Annual Online Symposium: Current Trends in Forensics & Forensic Toxicology
  - A New Concept: Risks and Opportunities
  - Benzodiazepines for Dummies ...And Smarties, Too! - SOFT
  - Cultivating Responses to Stress to Strengthen the Quality of Work and Life
  - Emerging Forensic Research Series: Firearms and Toolmarks Research
  - Ethics Training
  - Fire Debris Analysis in Not Black Magic
  - How the Digital Transformation in the GC Lab is Improving Efficiency
  - Improving National Laboratory Capability and Capacity to Measure Human Exposure to Synthetic Opioids
  - Kratom Abuse Is On The Rise: The Next Chapter in the Opioid Crisis
  - Mid-America 2019 Forensic DNA Conference
  - NOMAD X-ray Operator
  - Oral Fluid Toxicology: Workplace Testing, Pain Management, and DUID - SOFT
  - Reports of Adverse Events Associated with Use of Novel Psychoactive Substances, 2013-2016: A Review
  - SOFT 2019 Annual Meeting Scientific Sessions: Day 1 & 2
  - The Opioid Crisis: What you need to know!
  
- *Grant Funding:*
  - 20-NFSIA (2019 Coverdell) - \$99,000
  - 2020 Capacity Enhancement and Backlog Reduction (CEBR) Program - \$290,000
  - 2019 Justice Assistance Grant (JAG) – \$72,640

# FORENSIC SCIENCE LABORATORIES SERVICE OVERVIEW

## Case Submissions

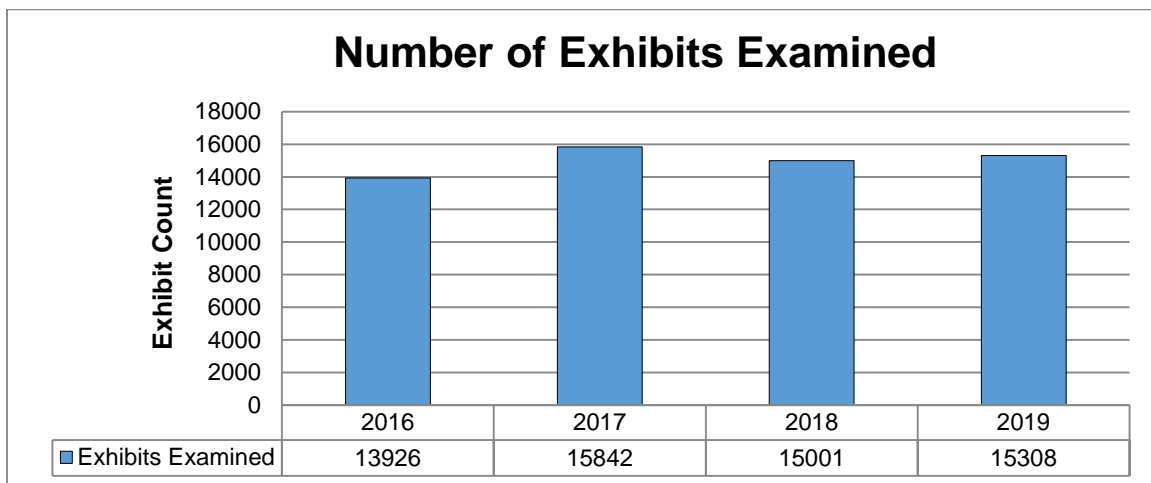
The Forensic Science Laboratory continues to experience a significant demand for its expert services. **Figure 1** illustrates the number of forensic laboratory cases first submitted for examination over the past 5 years, the average of which is 3540.

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.



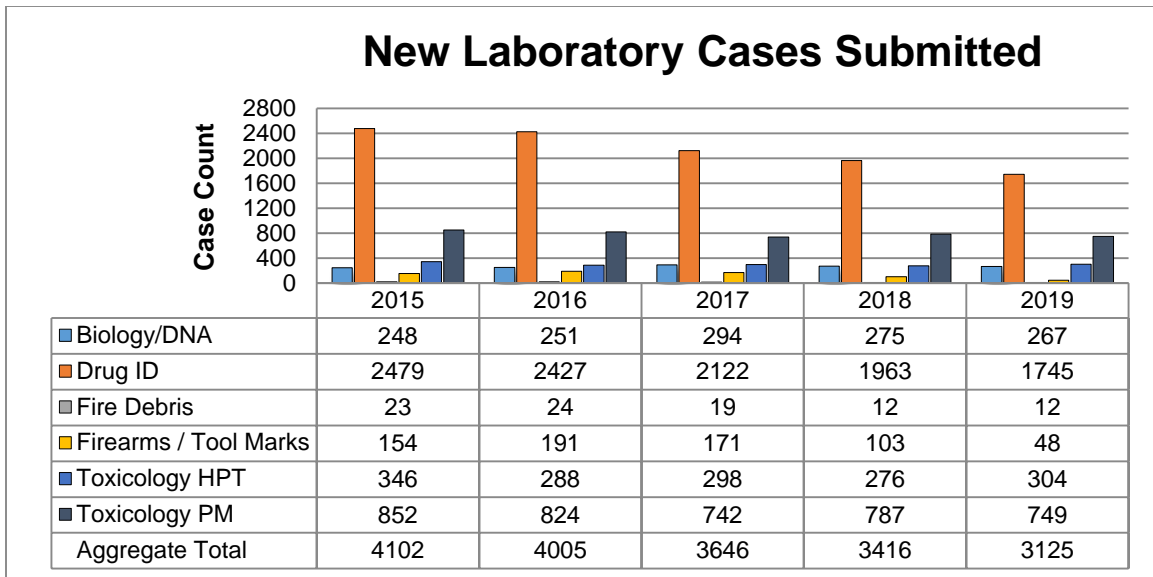
**Figure 1** Number of initial forensic laboratory cases submitted for examination (law enforcement and District Coroner post-mortem evidence submissions) from 2015 through 2019.

As illustrated in **Figure 2**, the number of exhibits examined by the Forensic Laboratory increased in 2017, but the magnitude has remained relatively stable in recent years.



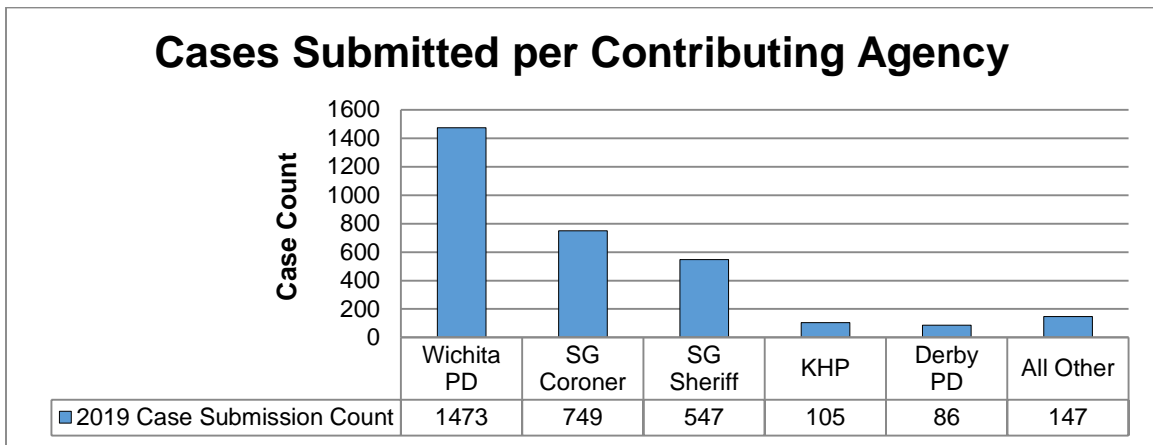
**Figure 2** The number of forensic exhibits examined between 2016 and 2019.

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 2019 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 3040 new cases submitted (see **Figure 1**), there were case submissions from an additional 186 on-going cases that were originally submitted in previous years for an aggregate total of 3226 individual cases received in 2019.

The number of case submissions associated with each functional laboratory unit is illustrated in **Table 1**. The aggregate submission count (3630) includes all submissions from contributing agencies, which includes submissions from the aggregated 3125 new cases (the sum of all new cases submitted to each laboratory) generated in year 2019 (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, although the Biology/DNA Laboratory has also experienced an increase in the number of submissions in recent years.

In addition to the 3630 submissions from contributing agencies, the evidence section also received 285 internal submissions which were generated as a result of examination derivatives, all of which were returned to the respective contributing agency.

Laboratory	2019 Aggregate Case Submissions Count
Biology / DNA	477
Drug ID	1,909
Firearms / Tool Marks	52
Fire Debris	17
Toxicology Ante-mortem	313
Toxicology Post-mortem	862
<b>Sum of Submission Count</b>	<b>3630</b>

Table 1 Number of case submissions per laboratory.

The relative percentage of cases submitted to each analytical unit is illustrated in **Figure 5**. The Criminalistics Section continues to receive the majority of evidence submitted, followed by submission to the Toxicology Laboratory.

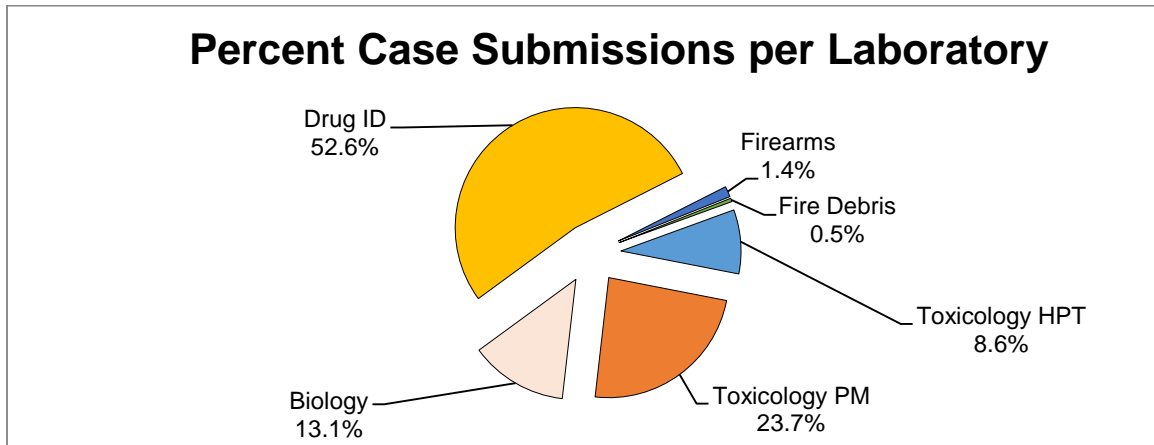
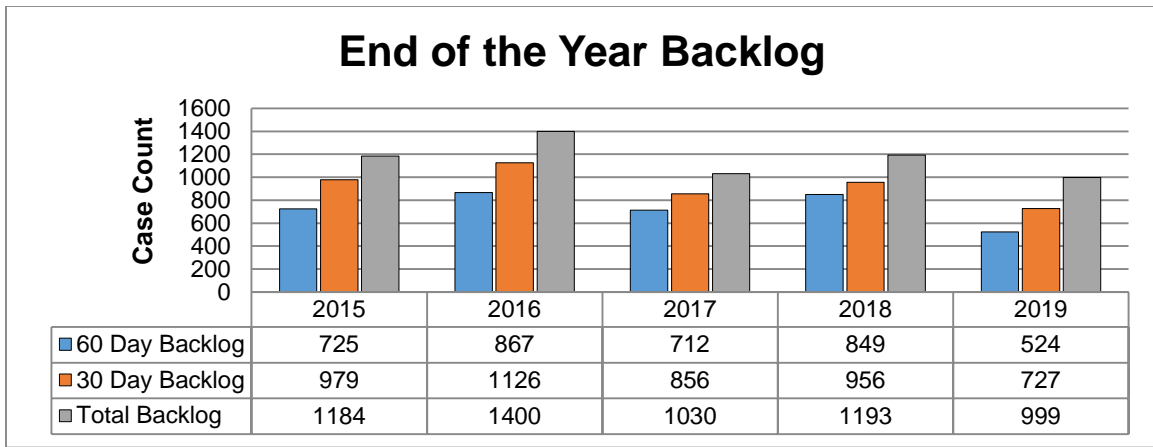


Figure 5 Percentage of case submissions per laboratory. The Criminalistics Section continues to receive the majority of evidence submitted.

## 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, 2019 the Forensic Laboratories had a 60 day backlog of 524 cases and a 30 day backlog of 999 cases (see **Figure 6**). This represents a decrease in the backlog compared to the 2018.





**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.

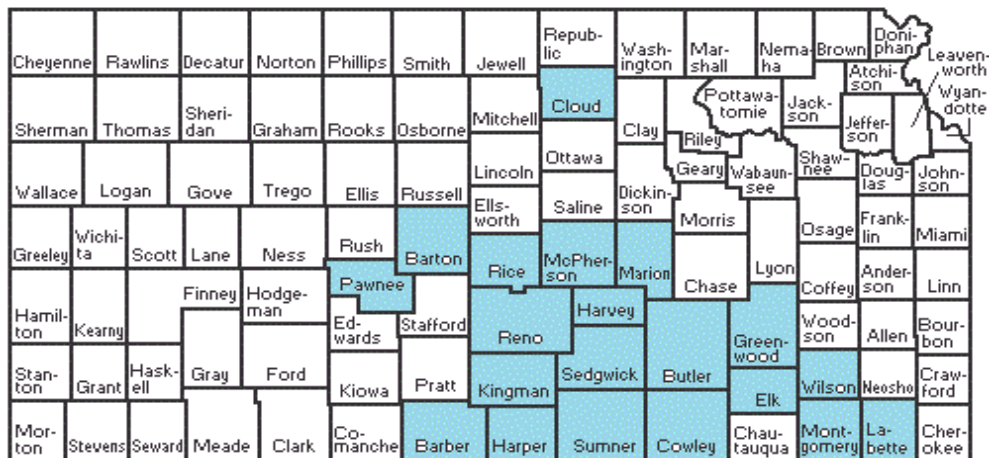
### Expert Testimony

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 2019, the Forensic Science Laboratories received 531 subpoenas for court appearances. This resulted in laboratory staff providing expert testimony in 25 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 2019, 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 2019 (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.

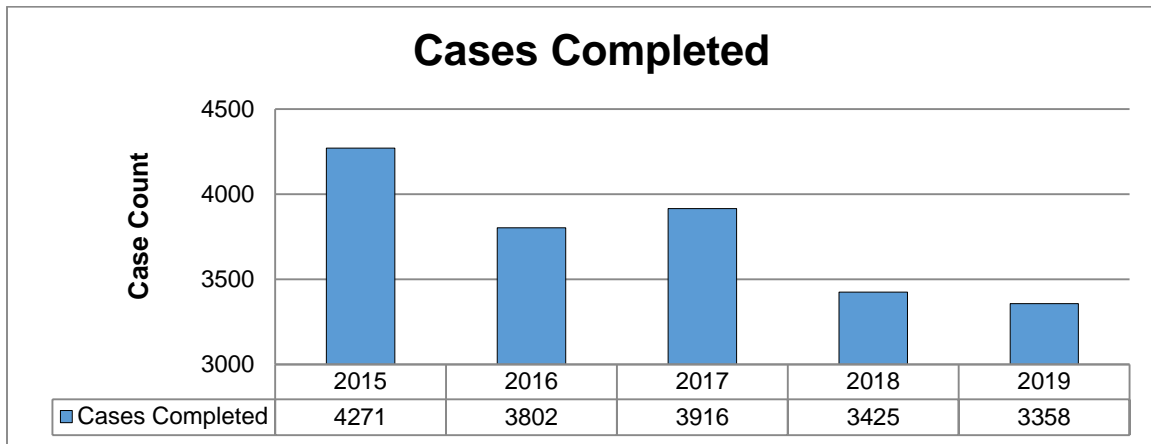
Alcohol Tobacco and Firearms	Harper County Coroner	Pawnee County Coroner
Air Force OSI	Haysville Police Department	Reno County Coroner
Barber County Coroner	Harvey County Coroner	Rice County Coroner
Barton County Coroner	Hutchinson Correctional Facility	Sedgwick County Coroner
Bel Aire Police Department	ICE	Sedgwick County Sheriff
Butler County Coroner	Kansas Department of Corrections	Sumner County Coroner
Cheney Police Department	Kansas Highway Patrol	US Postal Inspections
Clearwater Police Department	Kechi Police Department	Valley Center Police Department
Cloud County Coroner	Kingman County Coroner	Wichita Fire Department
Cowley County Coroner	Labette County Coroner	Wichita Police Department
Derby Police Department	Maize Police Department	Wichita State University Police Department
ElDorado Correctional Facility	Marion County Coroner	Wilson County Coroner
Elk County Coroner	McPherson County Coroner	Winfield Correctional Facility
Garden Plain Police Department	Montgomery County Coroner	
Goddard Police Department	Mount Hope Police Department	
Greenwood County Coroner	Mulvane Police Department	
	Park City Police Department	

**Table 2:** List of law enforcement agencies, fire departments, and county coroners for which the forensic laboratories provided services in 2019.

## 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.

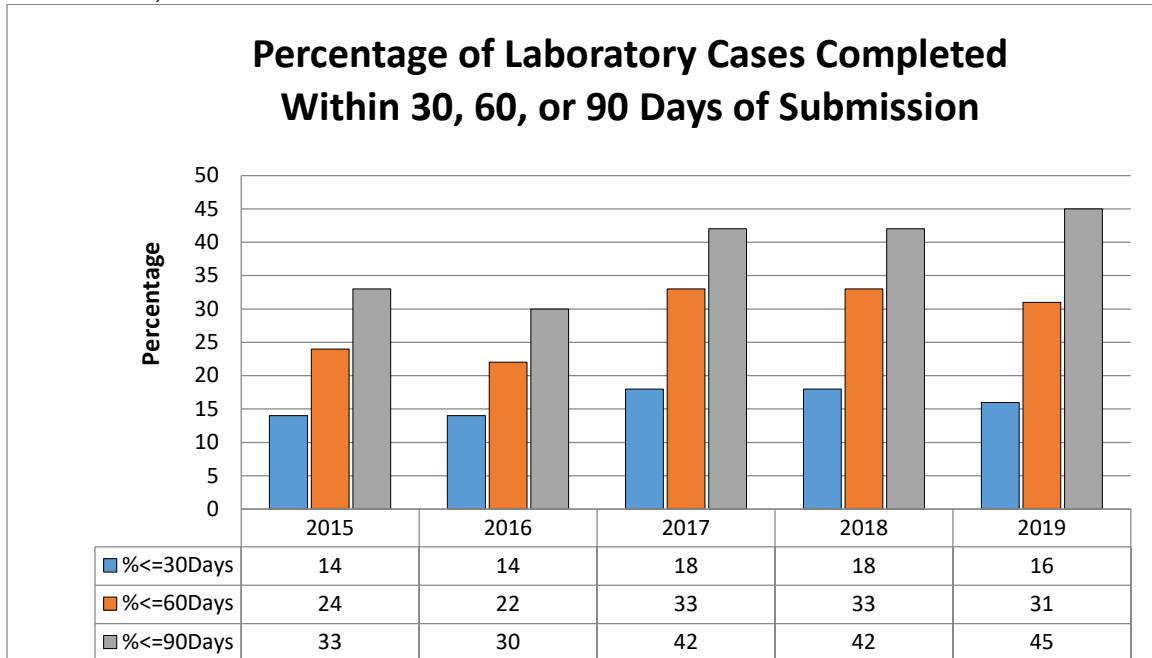
The Forensic Laboratory has faced staffing challenges throughout 2018 and 2019. This was especially true for the Firearms Laboratory, which helps explain the noticeable drop in the number of cases completed for these years.



**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**, 31% of cases submitted to the Laboratory Division in 2019 were completed within 60 days of submission, which was consistent with 2017 and 2018.



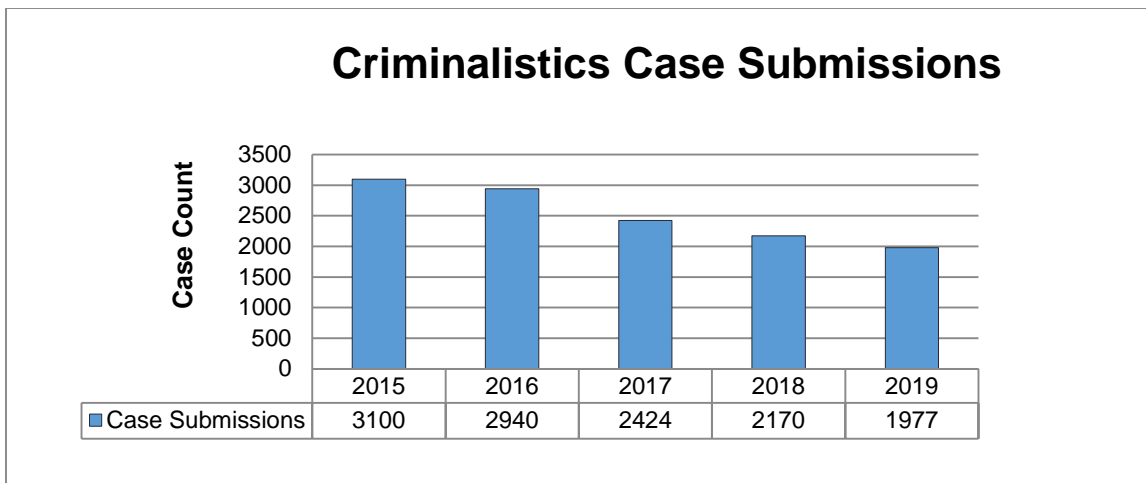
**Figure 9** Percentage of laboratory cases completed within 30, 60, or 90 days of submission.

## 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.

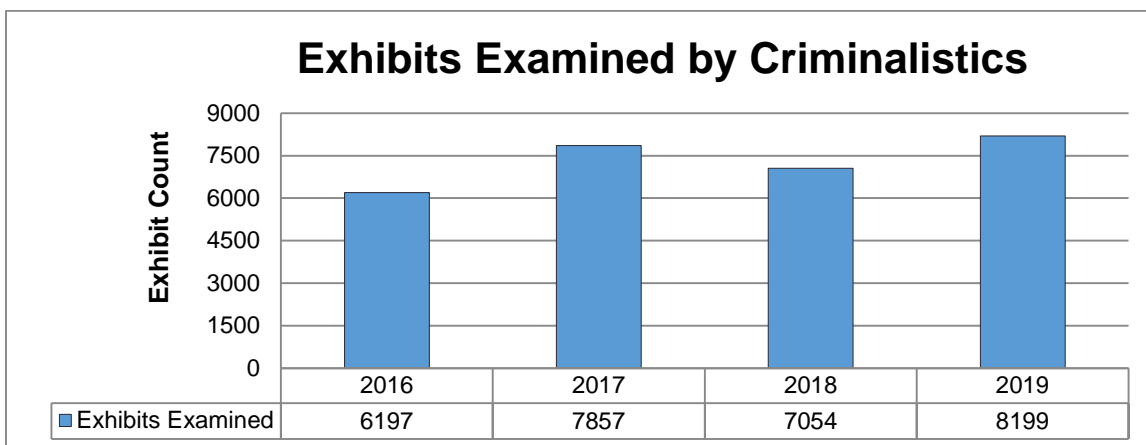
The first full calendar year that the District Attorney's Office implemented the policy to triage cases that are needed for prosecution was in 2019. This change in policy caused a decrease in case submissions. The reduction in case submission has improved turn-around-time and makes more efficient use of laboratory resources; however, the reduction in case submissions was off-set by the increased number of exhibits examined in 2019 (8199) compared to 2016 (6197), 2017 (7857), and 2018 (7054) (**see Figure 11**).

## Criminalistics Case Submissions



**Figure 10** Number of case submissions to the Criminalistics Section (Drug ID, Firearms/Tool Marks, and Fire Debris) over a five year period from 2015 through 2019.

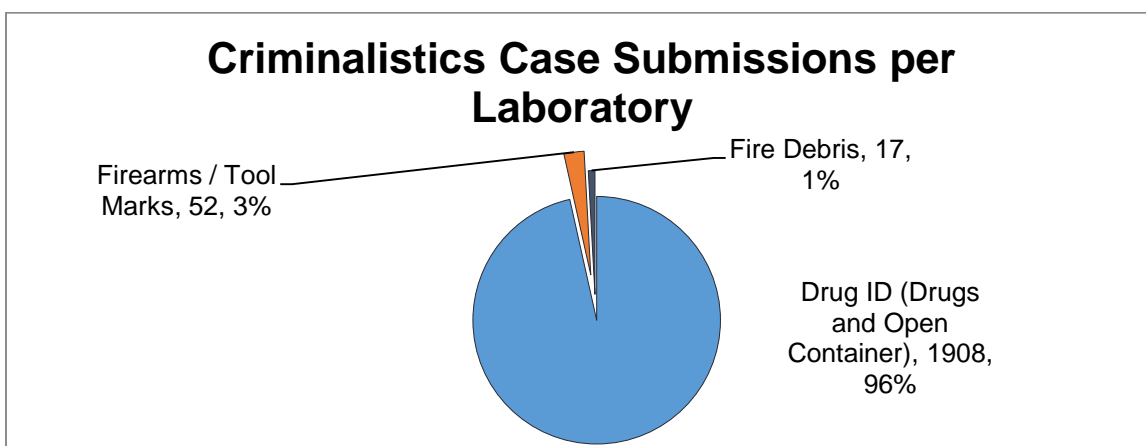
## Exhibits Examined by Criminalistics



**Figure 11** The number of exhibits examined from 2016 through 2019 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**.

## Criminalistics Case Submissions per Laboratory

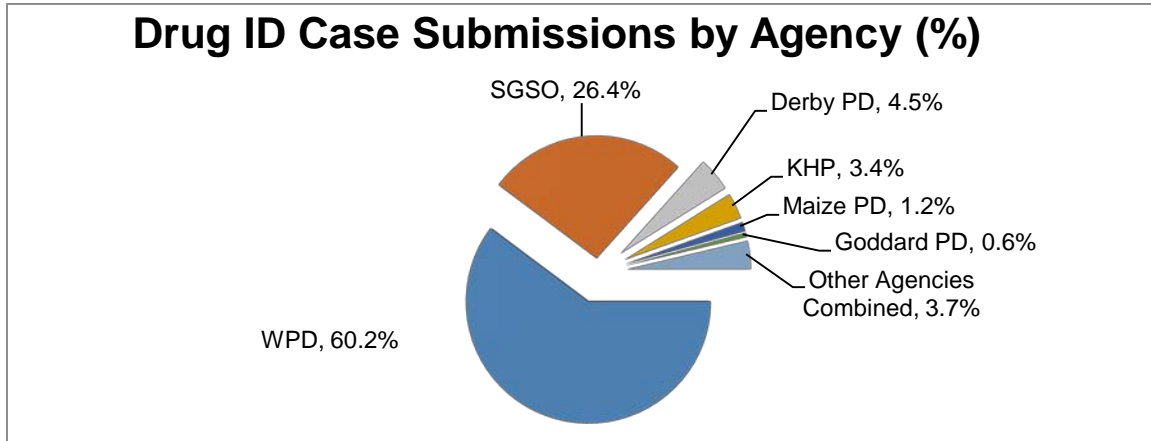


**Figure 12** Volume and percentage of cases submitted to each Criminalistics Laboratory Unit.

## DRUG ID

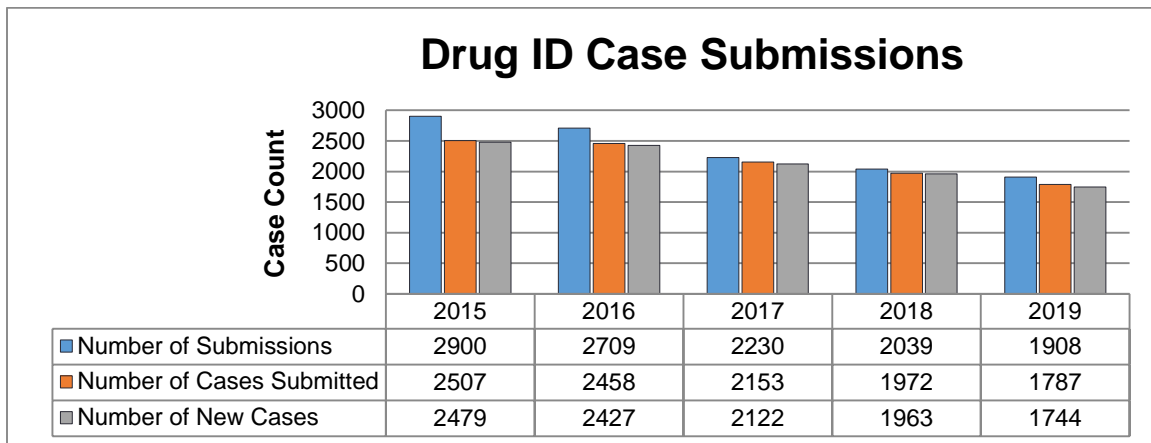
Examination requests for the identification of illicit drugs accounted for approximately 96% of the cases submitted to Criminalistics, as depicted in **Figure 12** above. Additionally, open container cases without any associated drugs accounted for 2% of the total submitted Drug ID cases. Casework requests 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 60% of cases received are from WPD. Agencies other than WPD and the Sedgwick County Sheriff's Office (SGSO) are responsible for approximately 13% 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**.

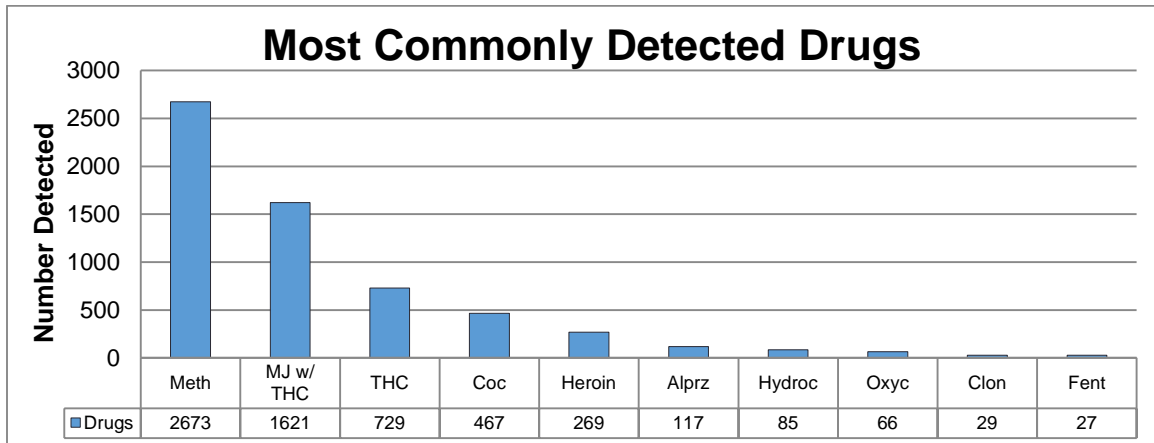


**Figure 14** The number of case submissions to the Drug ID Laboratory over a five year period.

In 2019, 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 80%, and cocaine base / salt form determinations.

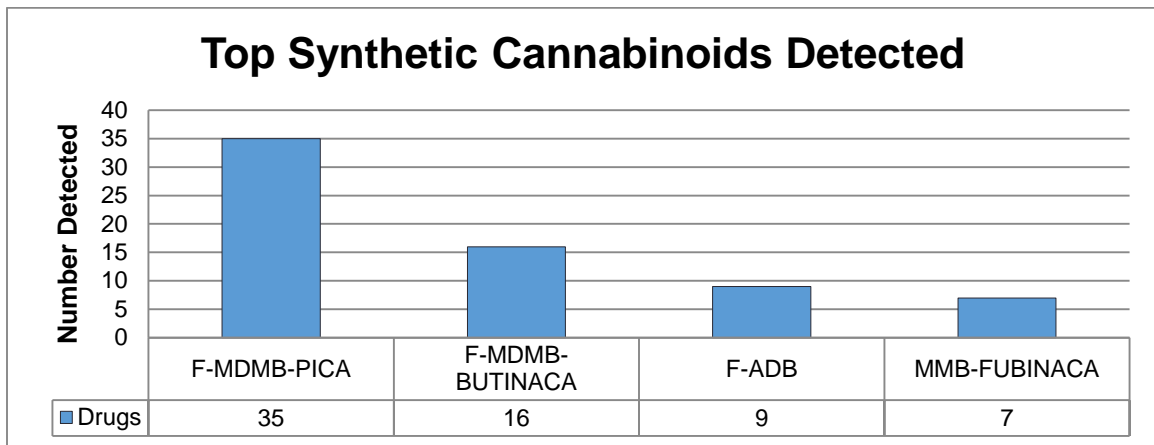
The ten most commonly detected drugs are illustrated in **Figure 15**. Methamphetamine is the most commonly detected drug, followed closely by marijuana (MJ) with THC as the second most commonly detected drug. THC without the presence of marijuana plant material is the third most commonly detected drug. 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 ten (10) most commonly detected drugs from 2019 examinations. Drug Abbreviation Key (Meth = methamphetamine, MJ = marijuana, THC = tetrahydrocannabinol, Coc = cocaine, Alprz = alprazolam, Hydroc = hydrocodone, Oxyc = oxycodone, Clon = clonazepam, Fent = fentanyl).

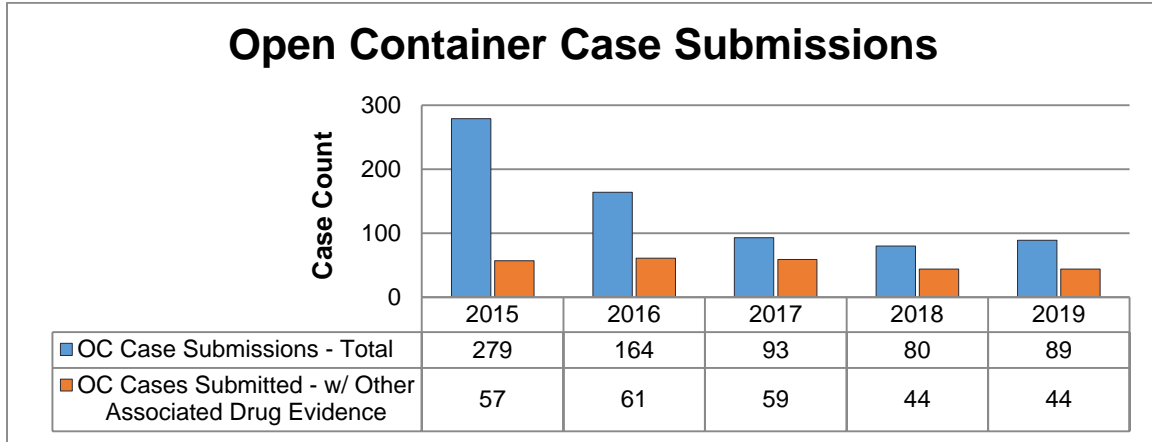
Synthetic cannabinoids, which are commonly known as K-2 or spice, have been detected in many of Drug ID casework samples in 2019. In some exhibits synthetic cannabinoids are detected alone and in other exhibits they are detected mixed with other drugs. **Figure 16** illustrates the most prevalent of the 89 detected.



**Figure 16** The four (4) most common synthetic cannabinoids detected from 2019 examinations. Drug Abbreviation Key (F-MDMB-PICA = N-(1-methoxy-3,3-dimethyl-1-oxo-2-butyl)-1-(x-fluoropentyl)indole-3-carboxamide [classified as an *Indole-3-carboxamide*], F-MDMB-BUTINACA = N-(1-methoxy-3,3-dimethyl-1-oxo-2-butyl)-1-(x-fluorobutyl)indazole-3-carboxamide [classified as an *Indazole-3-carboxamide*], F-ADB = N-(1-methoxy-3,3-dimethyl-1-oxo-2-butyl)-1-(x-fluoropentyl)indazole-3-carboxamide [classified as an *Indazole-3-carboxamide*], MMB-FUBINACA = N-(1-methoxy-3-methyl-1-oxo-2-butyl)-1-(x-fluorobenzyl)indazole-3-carboxamide [classified as an *Indazole-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 2015 and 2019.

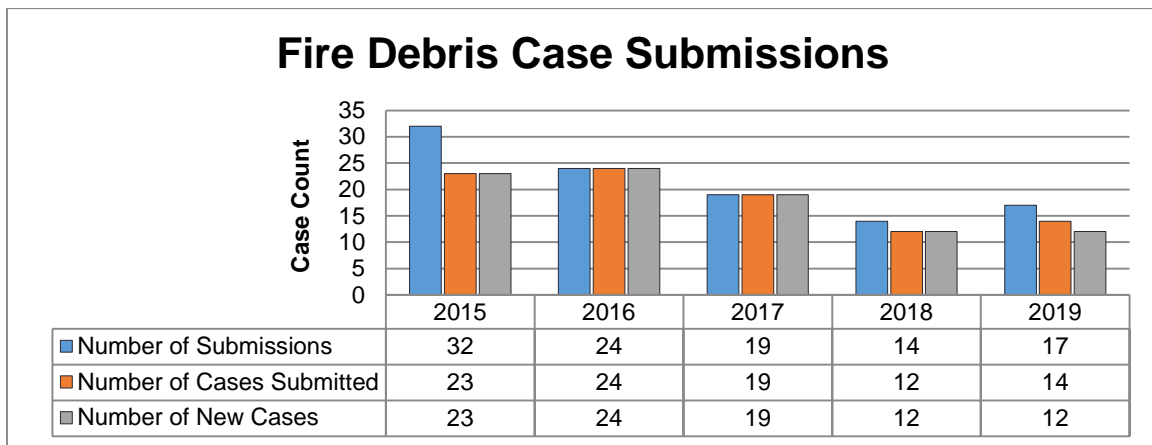


**Figure 17** Number of open container cases submitted.

## FIRE DEBRIS

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

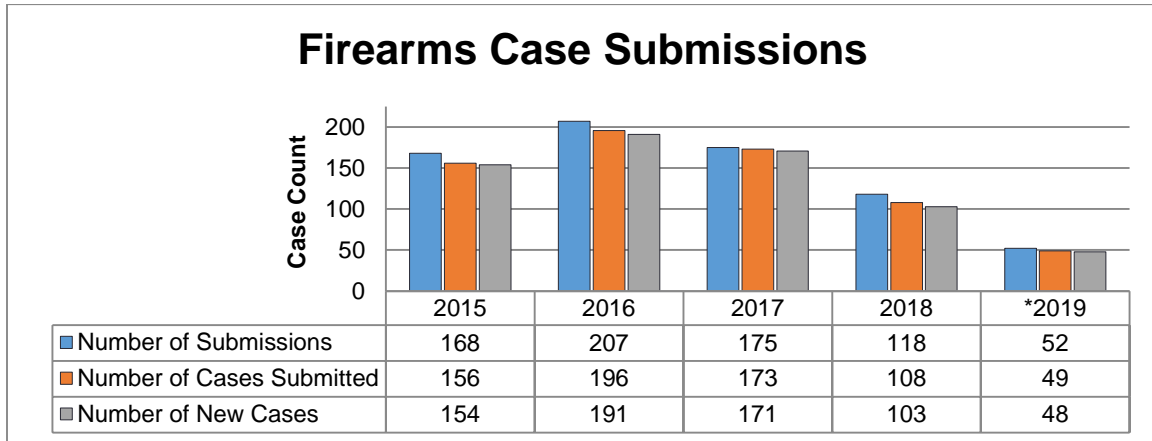
In 2019, the Fire Debris Laboratory received evidence from 12 cases with a total of 17 submissions. The trend of case submissions over the last five years is illustrated in **Figure 18**.



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

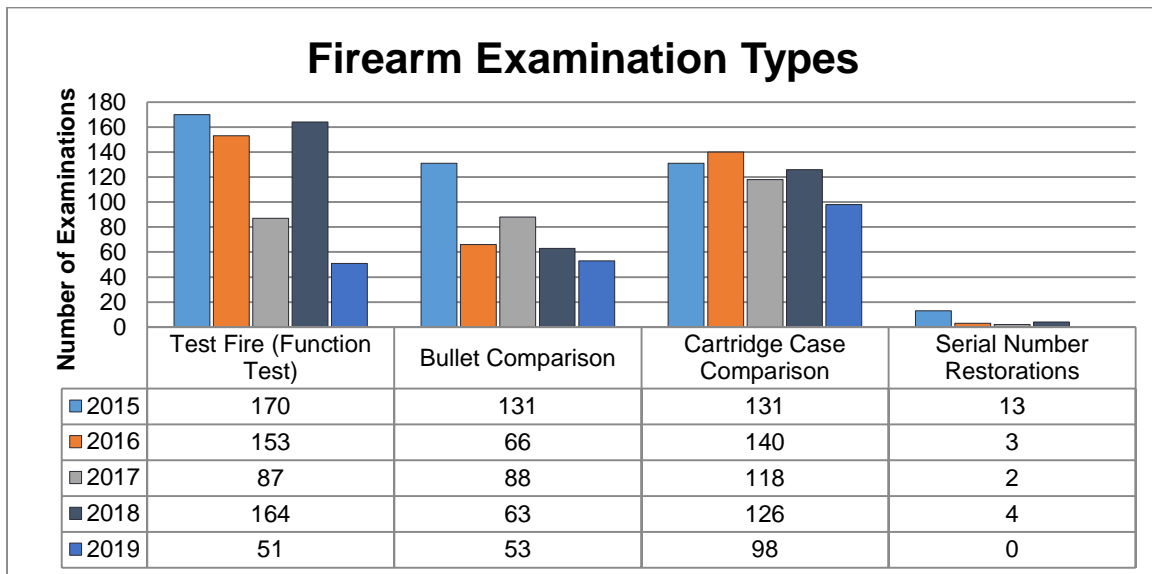
## **FIREARMS**

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 2019, the Firearms Laboratory received evidence from 49 cases with a total of 52 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.



**Figure 19** Firearm case submissions from 2015 through 2019. \*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.

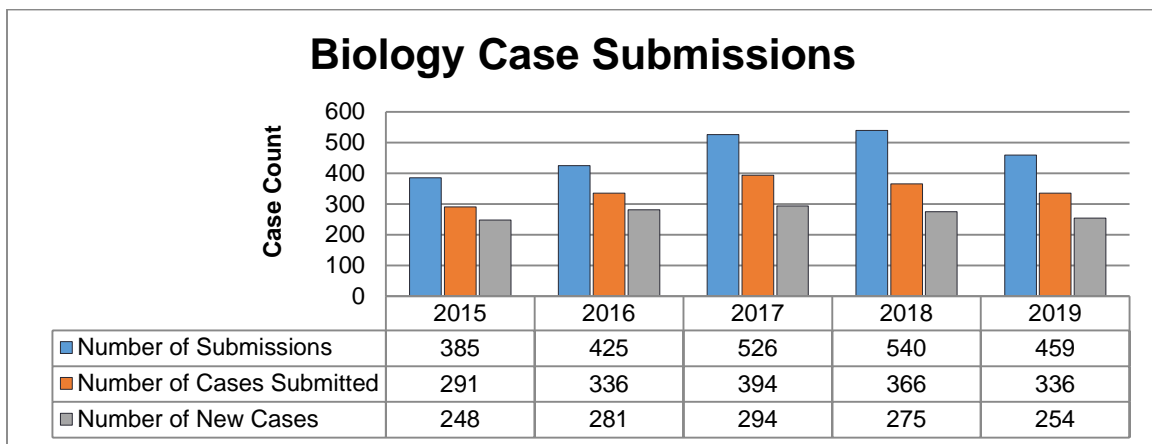


## **BIOLOGY/DNA**

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).

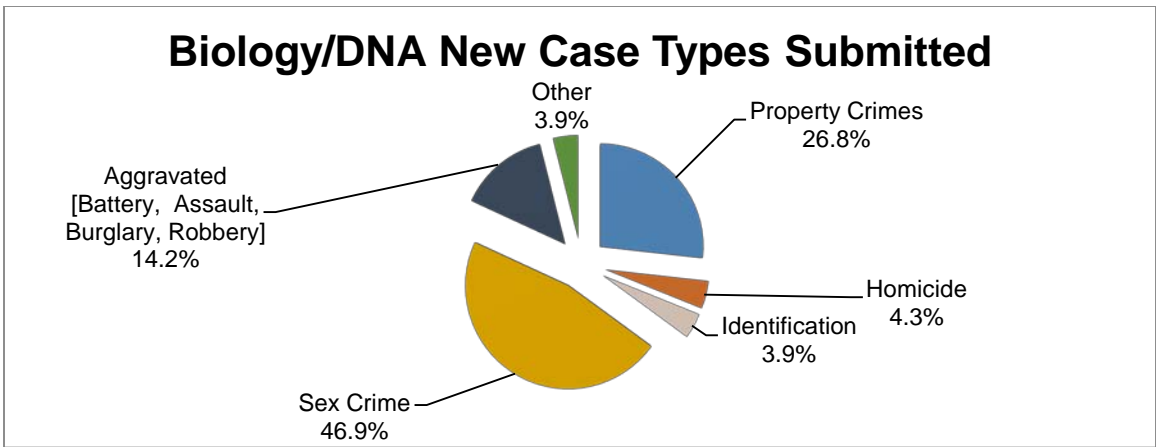
The laboratory screens evidence for the presence of biological material (blood, semen, saliva, and feces). For DNA analysis, the laboratory generates short tandem repeat (STR) profiles from the scene exhibits, those profiles can then be compared to reference standards collected from individuals believed 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 2019, the Biology/DNA Laboratory received evidence from 336 cases with a total of 459 submissions. The trends of case submissions over the past five years are illustrated in **Figure 21**.



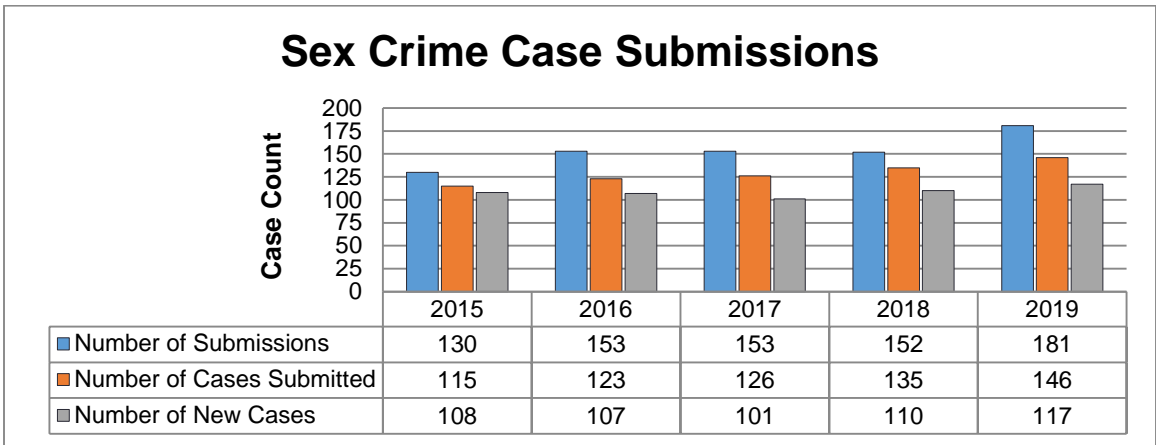
**Figure 21** Number of cases submitted to the Biology/DNA Laboratory over a five year period.

**Figure 22** illustrates the various case types commonly submitted for biological testing. Nearly half (~47%) 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 2019, the Biology/DNA Laboratory received evidence from 146 sex crime cases with a total of 181 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.



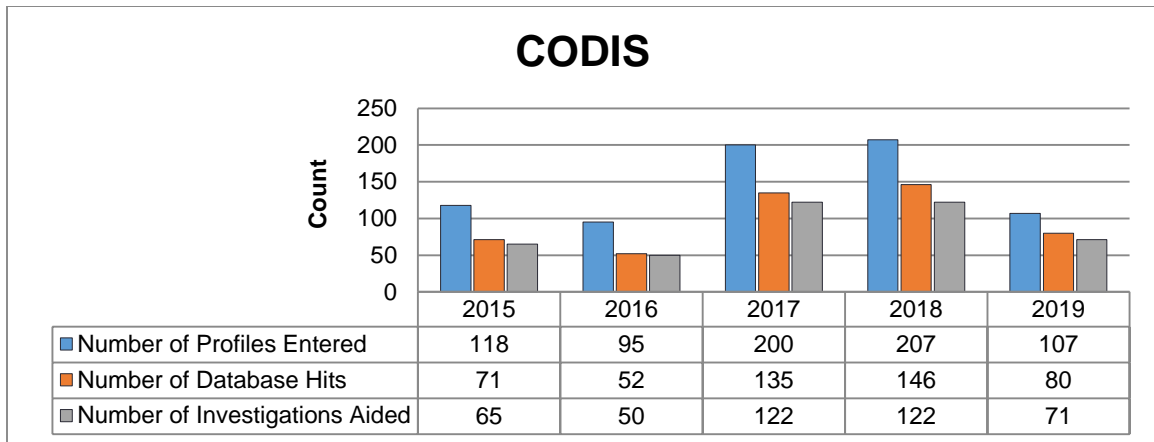
**Figure 23** The number of sex crime case submissions to the Biology/DNA Laboratory over the last five years.

## CODIS

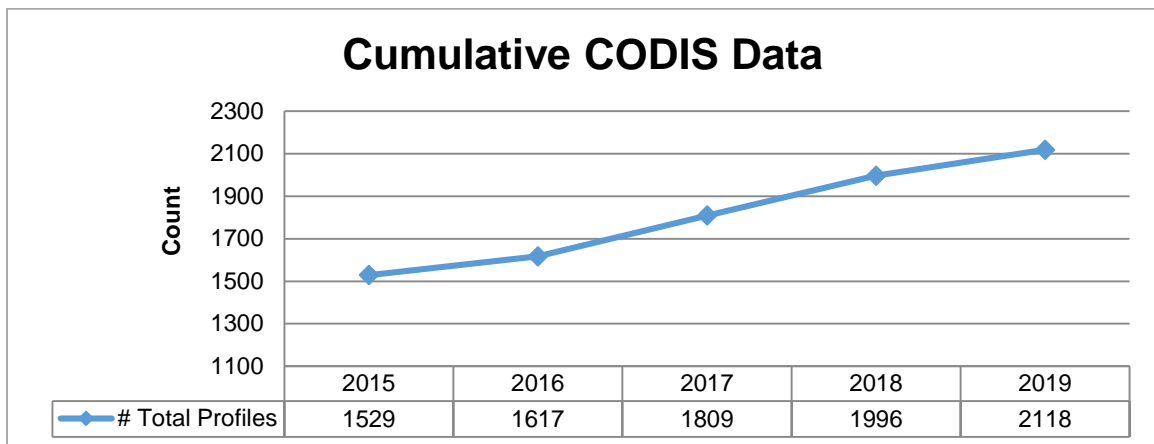
The Combined DNA Index System (CODIS) is database software used to compare DNA profiles within and between crime scene laboratories throughout the nation. In 2007 Kansas became an all arrestee state, meaning that law enforcement collects DNA samples for any person arrested for qualifying offenses. The 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 145, the average number of hits per year is 96, and the average number of investigations aided per year is 86.



**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.

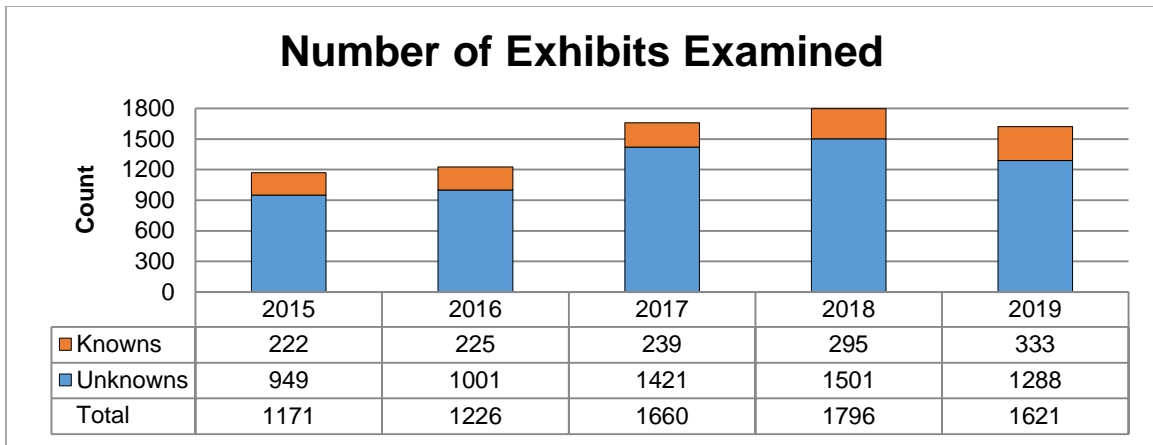


**Figure 25** The graph and chart depicts total number of profiles residing in the database (LDIS) at the end of each year.

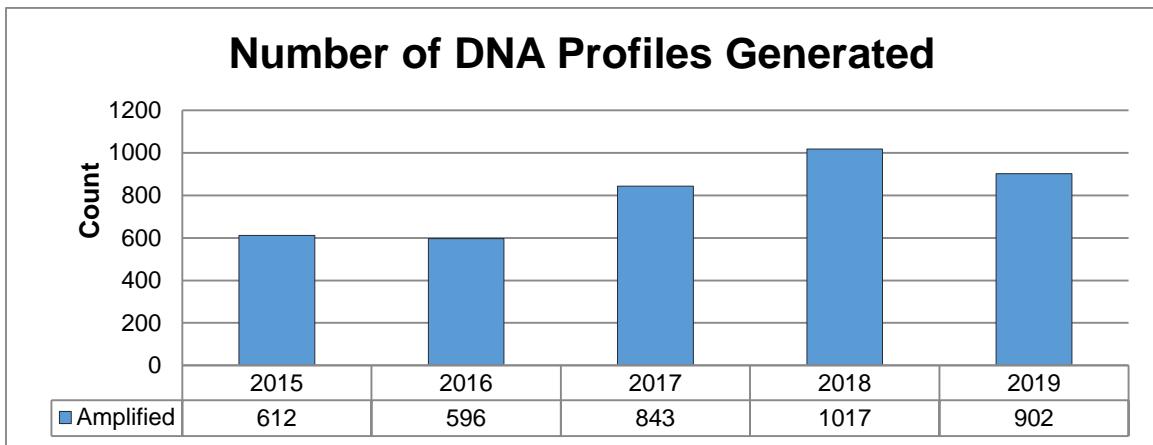
## Unknown and Known Exhibits Examined

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.



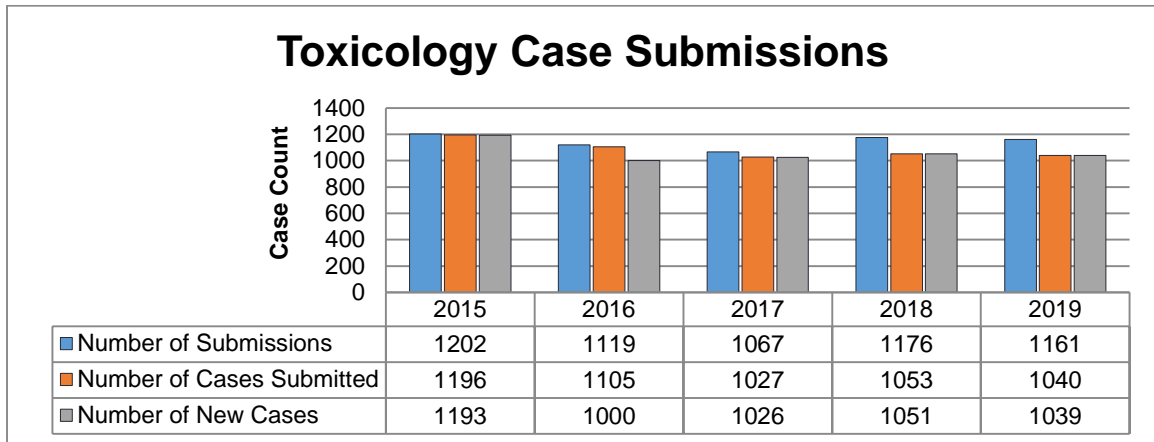
**Figure 27** The number of profile generated from PCR amplification by the Biology/DNA Laboratory in each of the past five years.

## **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.

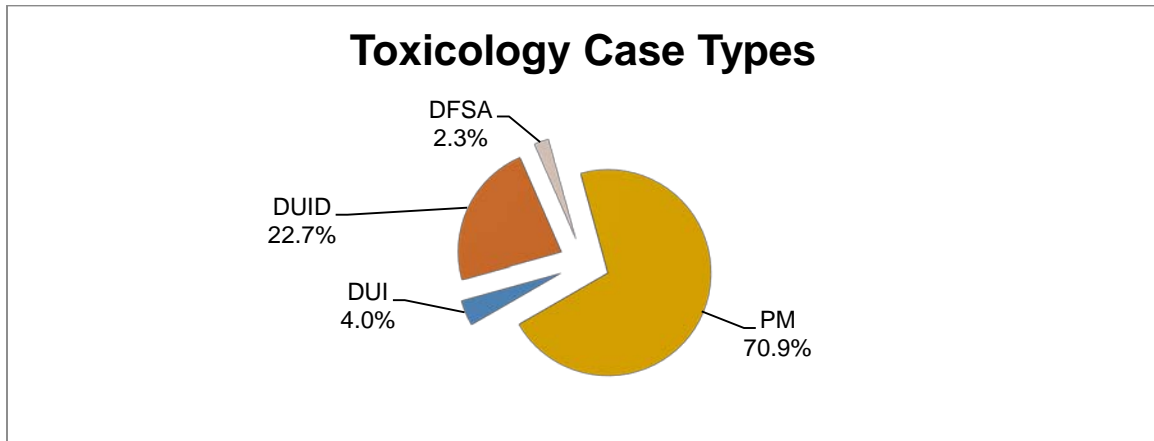
The laboratory continues to expand the number of drugs and poisons it can detect and quantitate.

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.

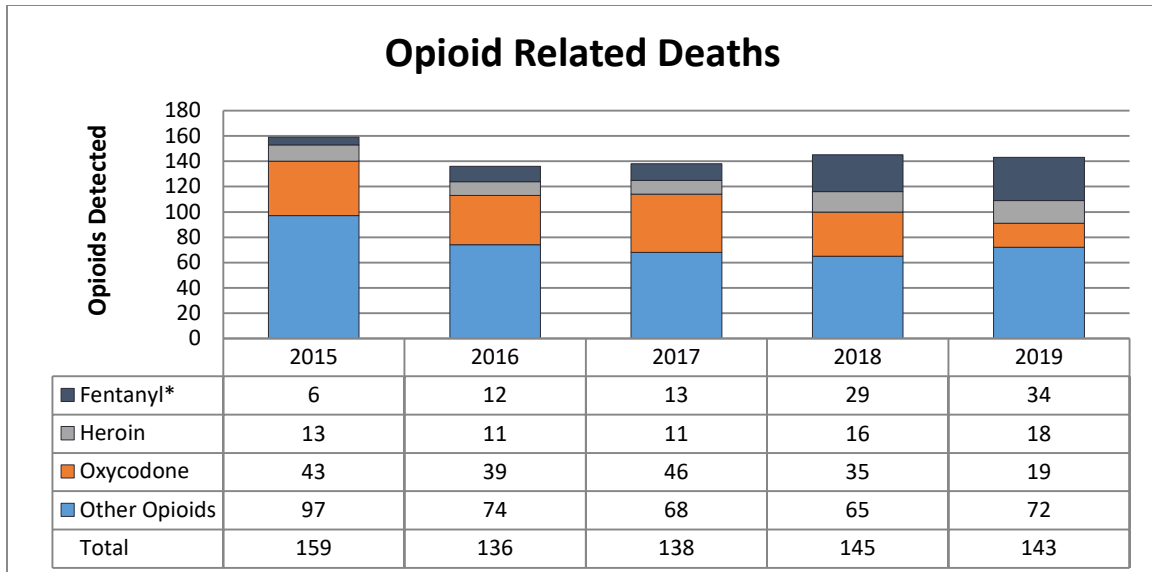
The percentage of toxicology cases submitted by case type is illustrated in **Figure 29**. Post-mortem (PM) toxicological examinations in support of the District Coroner account for approximately 71% of the forensic case work performed by the laboratory.



**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).

## Drug-Related Deaths

Opioid related deaths remained prevalent in 2019 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).



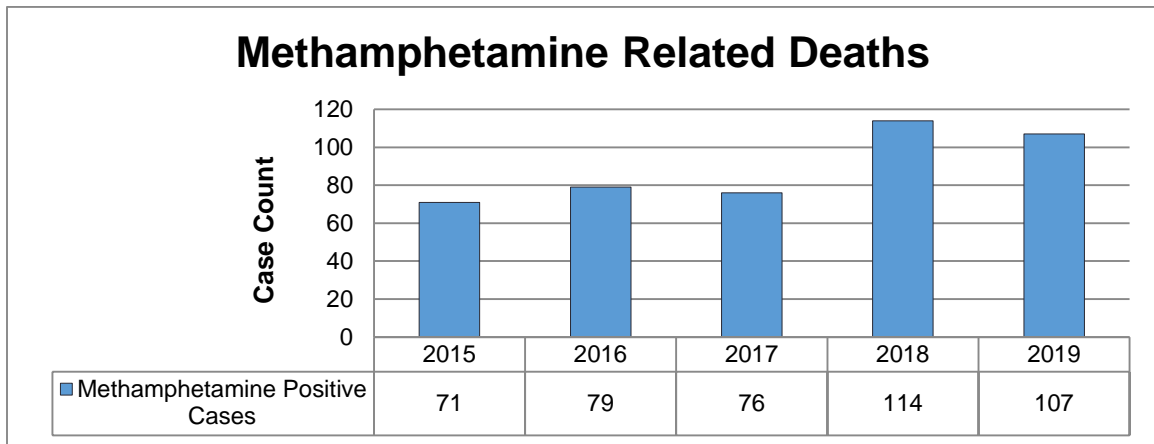
**Figure 30** Opioid related death count detected in Post-mortem Toxicology cases over the last five years. \*Fentanyl count includes fentanyl and fentanyl analogs.

In **Table 3** is a list of the number of cases that each opioid was detected in Post-mortem Toxicology specimens per submission year.

Opioids Detected in Post-mortem Specimens	2015	2016	2017	2018	2019
4-Fluoro-isobutyryl fentanyl	0	0	0	1	0
6-Acetylmorphine (Heroin)	13	11	12	16	17
4-OH Mitragynine	0	0	0	1	0
Buprenorphine	0	1	0	0	1
Codeine	14	7	5	10	7
Despropionylfentanyl	0	1	0	0	0
Fentanyl	6	11	13	28	32
Furanyl-fentanyl	0	1	0	0	0
Hydrocodone	35	31	36	35	27
Hydromorphone	13	10	4	5	4
Loperamide	0	3	0	0	0
Methadone	29	15	21	18	21
Mitragynine	0	1	0	2	1
Morphine*	48	40	26	35	40
Norfentanyl	0	0	0	1	3
Oxycodone	43	44	47	39	19
Oxymorphone	14	18	9	8	3
Propofol	0	3	0	1	2
Tramadol	8	13	9	11	10
U-47700	0	1	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, but has remained stable since.



**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 2019 Post-mortem Toxicology cases that the most frequently detected drugs and/or metabolites were detected. Excluding ethyl alcohol, there were a total of 125 different drugs and/or metabolites detected in 366 cases.

Drugs Detected in Post-mortem Cases	2019 Case Count	2019 Percent of Case Detected
Amphetamine	108	29.5
Methamphetamine	107	29.2
Tetrahydrocannabinol	90	24.5
Morphine*	40	10.9
Fentanyl	32	8.7
Benzoylcegonine	31	8.4
Alprazolam	30	8.1
Hydrocodone	27	7.3
Gabapentin	24	6.5
Diphenhydramine	21	5.7
Methadone	21	5.7
Oxycodone	20	5.4
6-Acetylmorphine	18	4.9
7-Aminoclonazepam	18	4.9
Cocaine	13	3.5
Lorazepam	13	3.5
Nordiazepam	10	2.7

**Table 4:** The most commonly detected drugs and/or metabolites detected in 2019 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.

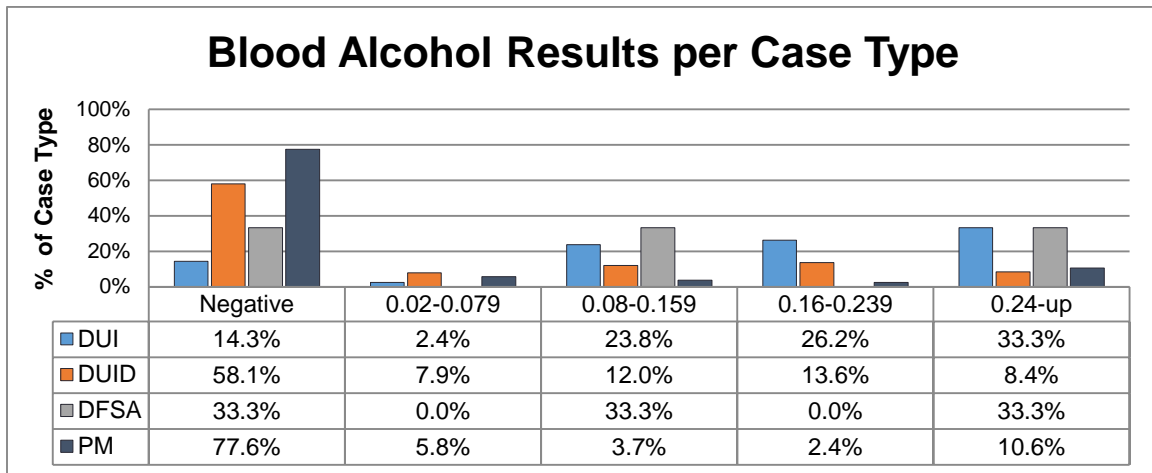
## Alcohol Analysis

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 59% of DUI cases and 22% of DUID cases.

In approximately 17% of the post-mortem case investigations and approximately 83% 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 2019, approximately 50% of the tested samples in DUI and DUID cases were negative for the presence of alcohol and approximately 86% of alcohol positive drivers were at or above “per se” limit of 0.08 gm%.

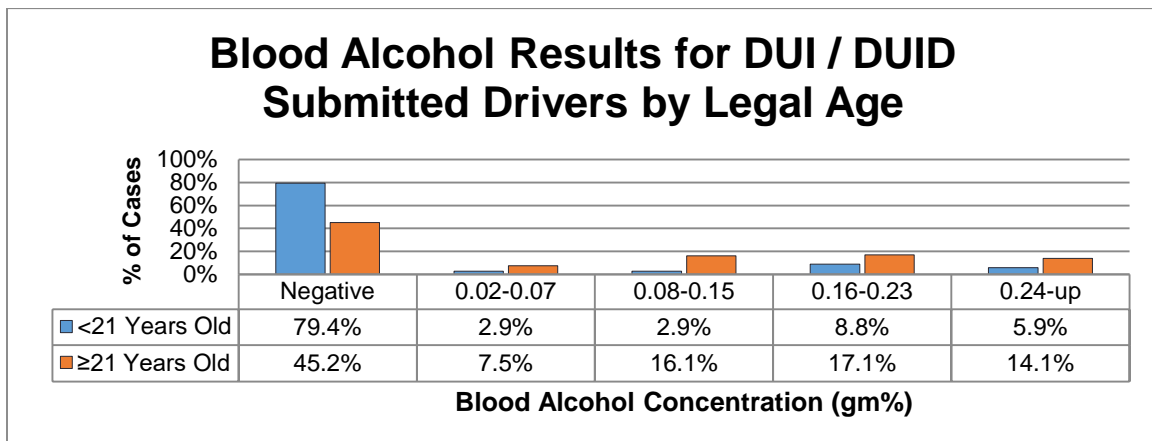
Approximately 58% of DUID cases were found to be negative for alcohol upon pre-screening, approximately 8% were cases involving blood alcohol levels below the legal limit, and 34% of the cases were at or above the legal limit (0.08 gm% and up).



**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 2019, approximately 6% 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 47% had alcohol concentrations  $\geq 0.08$  gm%.

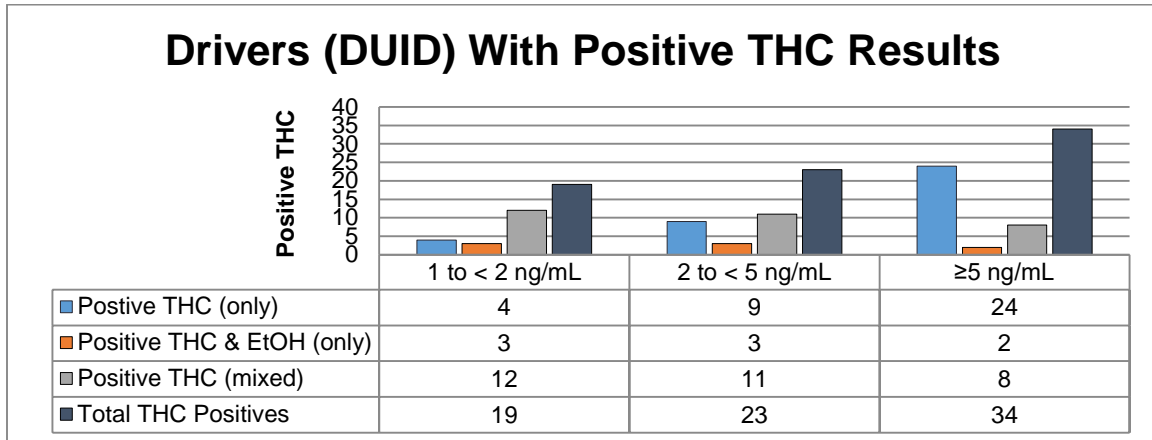


**Figure 33** DUI and DUID blood alcohol results sorted by age (minors vs. 21 years and older).



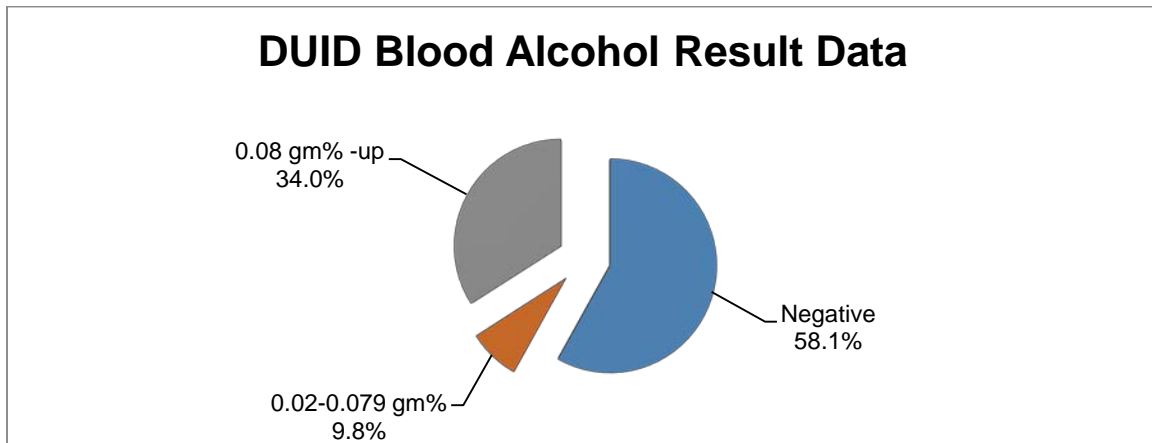
## Drugs and Driving

Many driving cases involve drivers that are under the influence of tetrahydrocannabinol (THC). **Figure 34** provides the number of positive THC results from the 191 DUID (Driving Under the Influence of Drugs) cases submitted in 2019. There was measureable THC detected in 76, or approximately 40%, of the 2019 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  $\geq 0.100$  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 2019. 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 58% 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 34% 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.

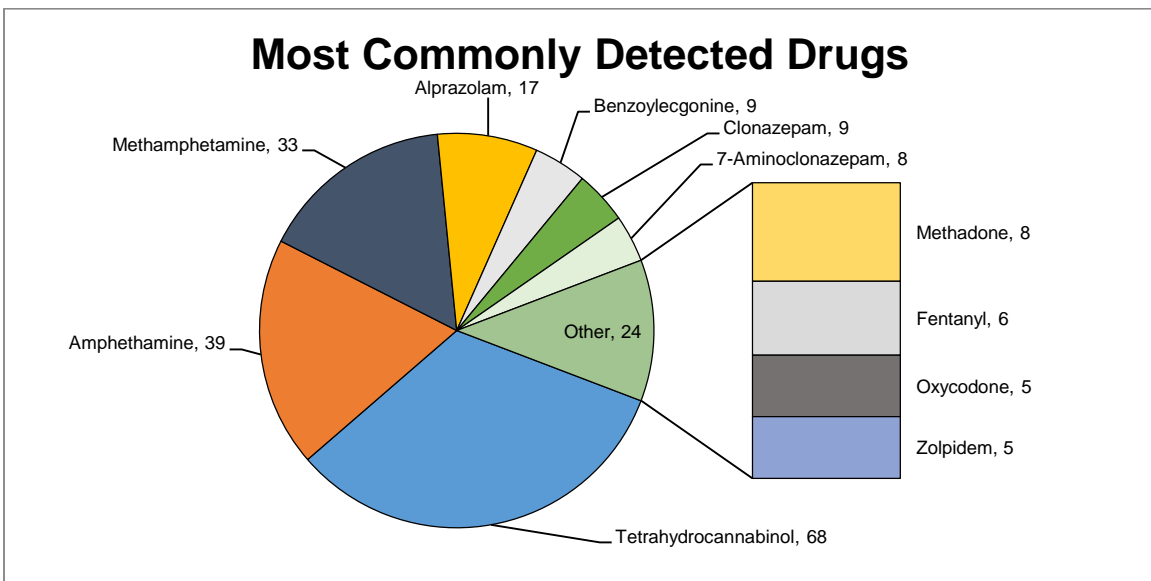
Drugs play a significant role in driving under the influence cases and can cause different levels of impairment. As depicted in **Figure 36**, the majority (75.7%) of DUID cases tested in 2019 were found to be positive for the presence of drugs.



**Figure 36** DUID blood drug results.

### Driver Drug Usage

The Toxicology Laboratory detected 36 different drugs and/or their metabolites in DUID cases. Illustrated in **Figure 37** are the most commonly detected drugs in 2019 (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.

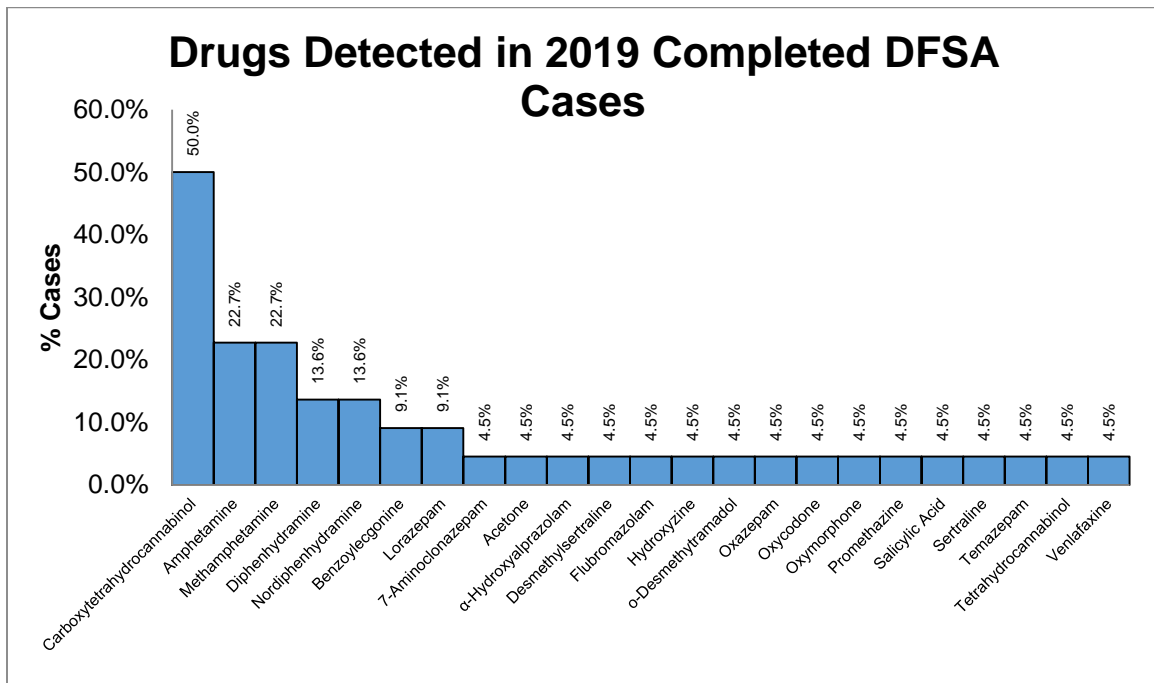
## Drug-Facilitated Sexual Assaults

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 2019 there were 24 DFSA cases submitted for analysis and the Toxicology Laboratory completed 27 DFSA cases. Ethanol was detected in 5 of the completed DFSA cases in 2019.

Year	Cases Submitted	Cases Completed
2015	12	8
2016	8	4
2017	15	18
2018	24	17
2019	24	27

**Table 5** DFSA cases submitted and completed each year since 2015.

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 27 completed DFSA cases in 2019.



**Figure 38** The percentage of DFSA cases that the listed drug was detected during analysis in 2019.