

# 2018

## Forensic Science Laboratory Annual Report



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## LABORATORY MISSION

To serve the citizens of the Sedgwick County Kansas Region, by ethically providing accurate and unbiased scientific analysis of evidence to the law enforcement and judicial communities.

## LABORATORY LEADERSHIP

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

**Director and Chief Toxicologist**  
*Timothy P. Rohrig, Ph.D., F-ABFT*

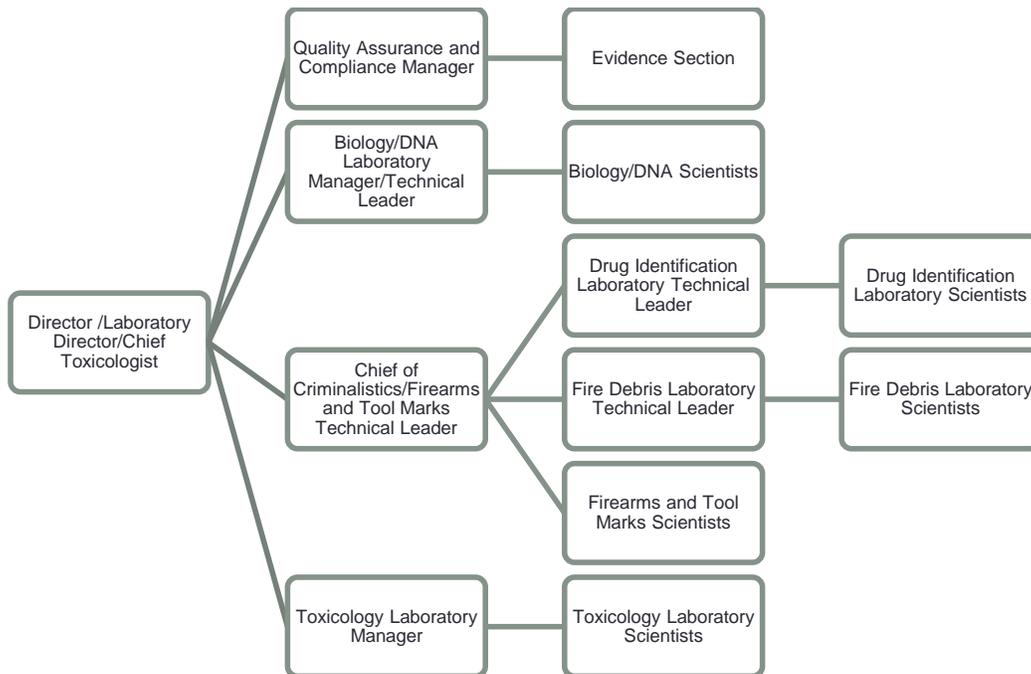
**Chief of Criminalistics**  
*Justin Rankin*

**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 2018, 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 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-deoxy nucleic 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, Human Performance Forensic Toxicology, Post-Mortem Forensic 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 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. The assessment included a team of 5 technical experts and 1 lead assessor reviewing the laboratory's quality system and technical case records over the period of several months, including a 1 week on-site assessment. This enhanced accreditation program is based upon the latest set of requirements against which a forensic testing laboratory can be evaluated.

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, TP, Miller, SA and Baird, TR. "U-47700: A Not So New Opioid", Journal of Analytical Toxicology, 42:e12-e14, 2018.
  
- *Laboratory Staff enhanced their technical and professional expertise by attending the following workshops and/or training sessions on-site, at conferences, or via webinar:*
  - Ethics Training
  - Ethics – Issues Of Cognitive Bias In Forensic Science
  - 24<sup>th</sup> Annual National CODIS Conference
  - 2<sup>nd</sup> Annual Drugged Driving Summit
  - 49<sup>th</sup> Annual AFTE Training Seminar
  - 56<sup>th</sup> Annual TIAFT Meeting Of The International Association Of Forensic Toxicologists
  - 70<sup>th</sup> Annual AAFS Scientific Meeting
  - ANAB Delta To AR3028 – Assessors Training
  - ANAB Forensic: Auditing Principles
  - ATF Introductory Fire Debris Analysis For The Forensic Chemist
  - Current Trends in Forensic Toxicology
  - Development Of A Standard For Confirmatory Method Validation In Forensic Toxicology
  - Douglas Barrels Manufacturing Tour
  - Effective GC Troubleshooting
  - Fentalogs: Chemistry, Pharmacology, And Toxicology Of Illicit Fentanyl And Emerging Opioids
  - GC/MS Operations Course
  - Glock Armorer's Course
  - Identifying Seized Drugs Using Mass Spectral Library Searching
  - KDOT Transportation Safety Conference
  - Marshall University Advanced Manufacturing Technology Tour
  - Mid-America 2018 Forensic DNA Conference
  - National DNA Technical Leaders Training
  - Pharmacokinetic Profile Of Oral Cannabis In Humans: Blood And Oral Fluid Disposition And Relation To Pharmacodynamic Outcomes
  - Practical Considerations In Designing Method Validation Studies For NPS Assays
  - Preserving Peak Performance Of Your GC/MS
  - Profiting from Probability; Combining Low And High Probability Isotopes As A Tool Extending The Dynamic Range Of An Assay Measuring Amphetamine And Methamphetamine In Urine
  - Prosecutor And Toxicologist Guide To Effective Communication In Impaired Driving Cases
  - Quantifying Cannabinoids In Oral Fluid To Determined Driving Impairment Following Marijuana Consumption
  - RTI International On-demand Online Symposium: Current Trends In Forensic Toxicology [Agilent]Separation Superhero 2018 Seminar
  - Session II: Analysis Of NPS – Practical Consideration And Analytical Approaches
  - Stability Of Synthetic Cathinones In Blood

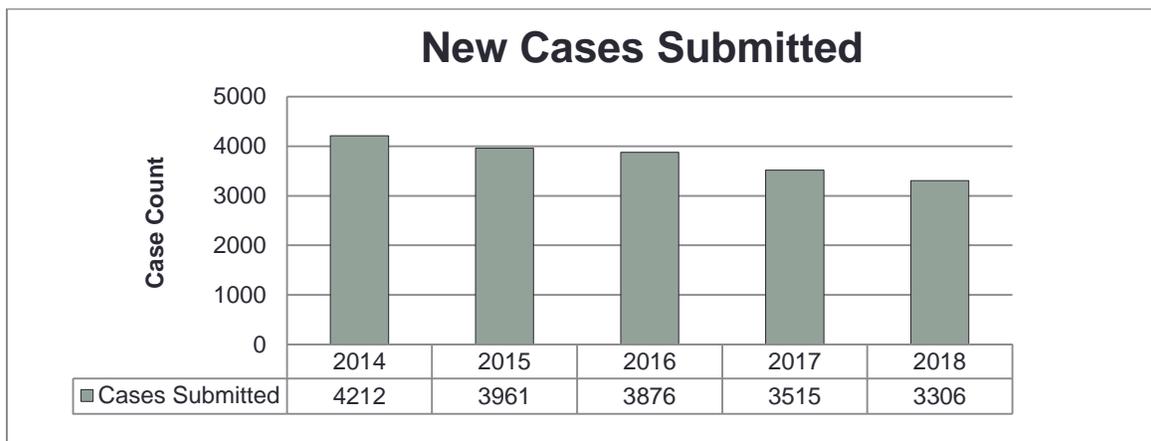
- SWGDAM Recommendations On Communicating Likelihood Ratios
  - The Chromacademy Essential Guide To: Top Tips To Improve Reproducibility And Sensitivity In Solid Phase Extraction
  - Thinking Outside The C18 Box
  - Ultra-Fast High Res LC-MS Analysis In Forensic Toxicology Testing
  - Your HPLC/MS; Solutions For Your Instrument
- *Appointments*
    - Timothy P. Rohrig, Ph.D., Forensic Laboratory Needs Technology Working Group [FLN-TWG]
    - Timothy P. Rohrig, Ph.D., Office of Justice Programs (OJP) National Institute of Justice (NIJ)
- *Grant Funding:*
    - NIJ FY18 Capacity Enhancement and Backlog Reduction (CEBR) Program, \$245,000.
    - Justice Assistance Grant, \$48,730.
    - Coverdell Grant, \$45,300.

## **FORENSIC SCIENCE LABORATORIES SERVICE OVERVIEW**

### **Case Submissions**

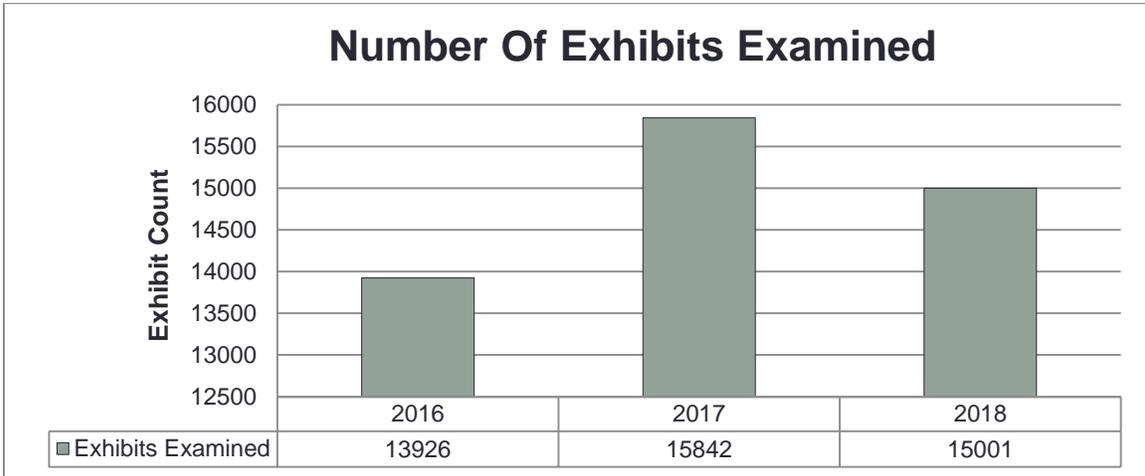
The Forensic Science Laboratory continues to experience a significant demand for its expert services. **Figure 1** illustrates the number of forensic laboratory cases first submitted for examination over the past 5 years, the average of which is 3774.

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.



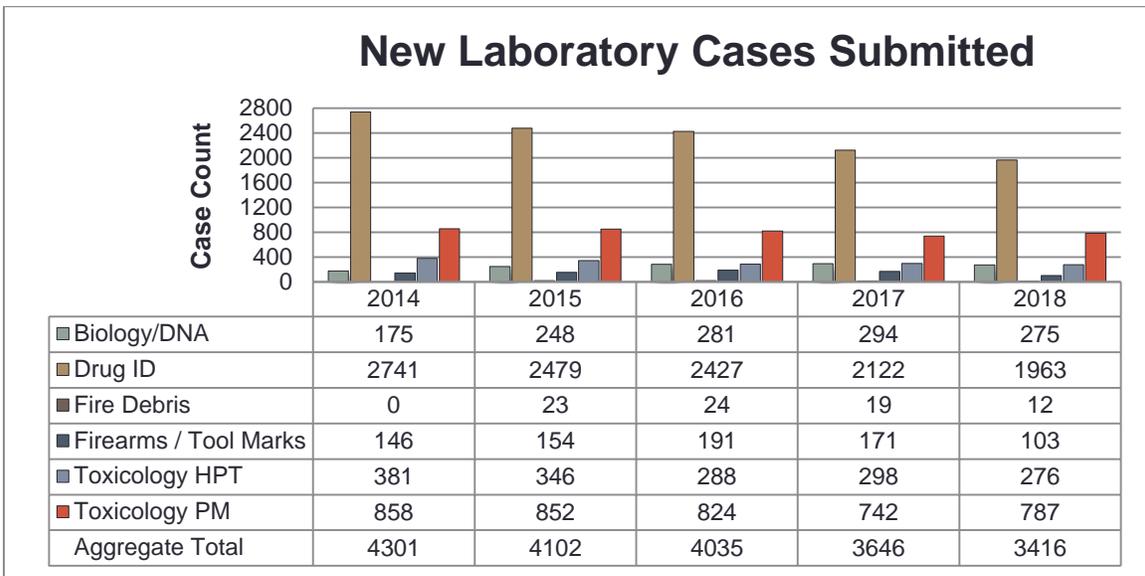
**Figure 1** Number of initial forensic laboratory cases submitted for examination (law enforcement and District Coroner post-mortem evidence submissions) from 2014 through 2018.

Compared to 2016 the number of exhibits examined by the Forensic Laboratory has increase, although there was a decrease between 2017 and 2018 [Figure 2].



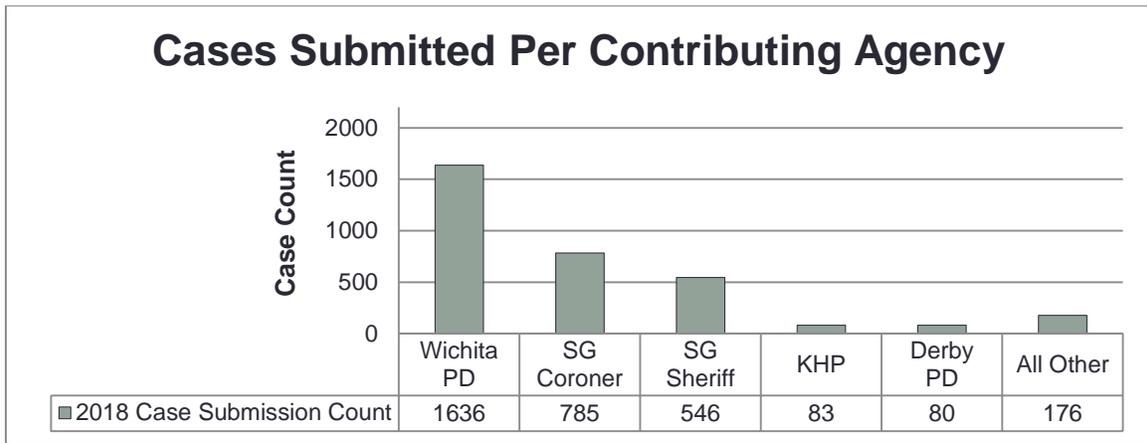
**Figure 2** The number of forensic exhibits examined between 2016 and 2018.

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 submitting agencies that submitted evidence to the laboratory division for forensic analysis and the number of new cases that were submitted by each contributing agency in 2018 is provided in **Figure 4**. The Sedgwick County Coroner Division submits evidence for analysis in support of the division’s 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, KHP = Kansas Highway Patrol).

Cases are submitted for forensic examination under five analytical disciplines, Biology / DNA, Drug ID, Firearms / Tool Marks, Fire Debris, and Toxicology (post-mortem and ante-mortem (human performance testing (HPT))). Toxicology receives ante-mortem evidence from law enforcement through the evidence unit and post-mortem specimens directly from the District Coroner.

In addition to the 3306 new cases submitted **[Figure 1]**, there were case submissions from an additional 152 on-going cases that were originally submitted in previous years for an aggregate total of 3458 individual cases received in 2018, which are described as the “Number of Cases Submitted” in various charts below.

The number of case submissions associated with each functional laboratory unit is illustrated in **Table 1**. The aggregate submission count (3899) includes all submissions from contributing agencies, which includes submissions from the aggregated 3416 new cases generated **[Figure 3]** and submissions from cases generated in previous years in support of on-going investigations by law enforcement.

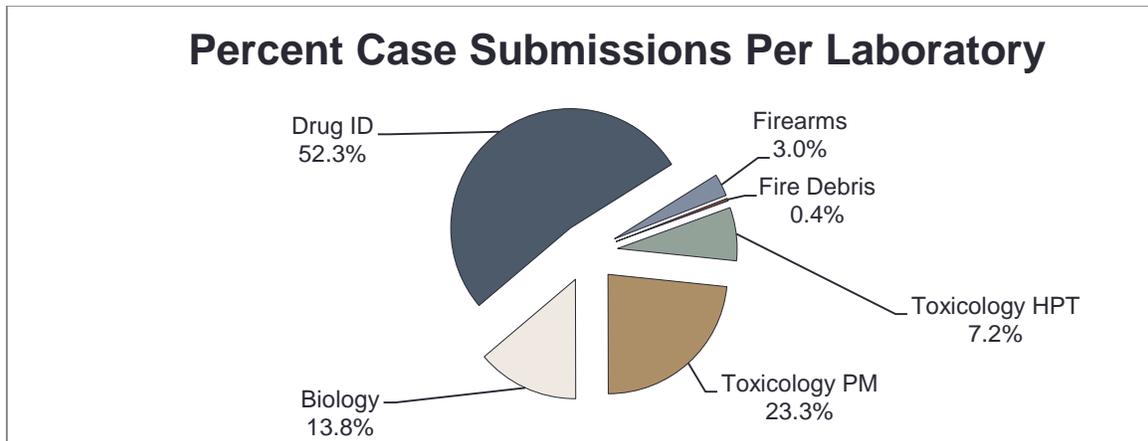
The Criminalistics Section continues to receive the majority of evidence submitted, although the Biology/DNA Laboratory has seen a large increase in the number of submissions in recent years.

In addition to the 3899 submissions from contributing agencies, the evidence section also received 137 internal submissions which were generated as a result of examination derivatives, all of which were returned to the respective contributing agency.

Laboratory	2018 Aggregate Case Submissions Count
Biology / DNA	540
Drug ID	2038
Firearms / Tool Marks	118
Fire Debris	14
Toxicology HPT	281
Toxicology PM	908
<b>Sum of Submission Count</b>	<b>3899</b>

**Table 1** Number of case submissions per laboratory.

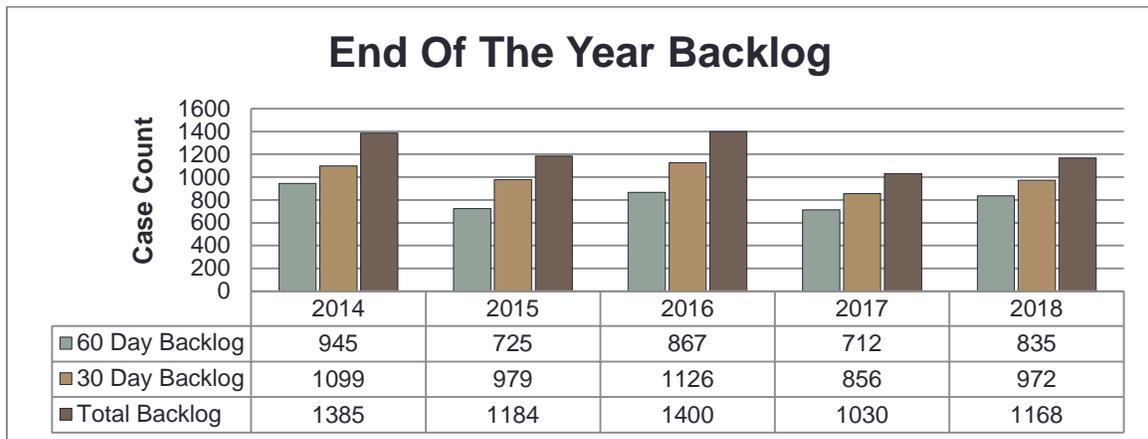
The relative percentage of cases submitted to each analytical unit is illustrated in **Figure 5**. The Criminalistics Section continues to receive the majority of evidence submitted, followed by submission to the Toxicology Laboratory.



**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, 2018 the Forensic Laboratories had a 60 day backlog of 835 cases and a 30 day backlog of 972 cases [**Figure 6**].



**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.

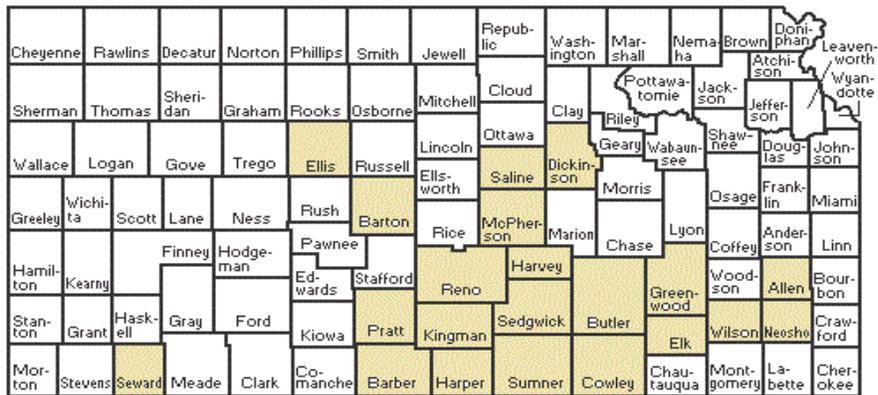
## Expert Testimony

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 2018, the Forensic Science Laboratories received 991 subpoenas for court appearances. The RFSC, in conjunction with the District Attorney's (DA) Office, worked on having the DA's Office only submit subpoenas for cases that have a high likelihood of needing expert testimony.

## 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 2018, the Forensic Science Laboratories provided expert testing services and consultations to 47 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 2018 (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 [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 cases was in support of the Sedgwick County Coroner’s out-of-county autopsies.

Alcohol Tobacco and Firearms	Greenwood County Coroner	Reno County Coroner
Allen County Coroner	Harper County Coroner	Saline County Coroner
Barber County Coroner	Harvey County Coroner	Sedgwick County Coroner
Barton County Coroner	Haysville Police Department	Sedgwick County Courthouse
Bel Aire Police Department	Hutchinson Correctional Facility	Police Department
Butler County Coroner	ICE	Sedgwick County Sheriff
Cheney Police Department	Kansas Department of Corrections	Seward County Coroner
Clearwater Police Department	Kansas Highway Patrol	Sumner County Coroner
Cowley County Coroner	Kingman County Coroner	Sumner County Sheriff
Dickinson County Coroner	Maize Police Department	Valley Center Police Department
Derby Police Department	McPherson County Coroner	Wichita Fire Department
Eastborough Police Department	Mt. Hope Police Department	Wichita Police Department
EIDorado Correctional Facility	Mulvane Police Department	Wichita State Univ. Police Dept.
Elk County Coroner	Neosho County Coroner	Wilson County Coroner
Ellis County Coroner	Park City Police Department	Winfield Correctional Facility
Garden Plain Police Department	Pratt County Coroner	
Goddard Police Department		

**Table 2:** List of law enforcement agencies, fire departments, and county coroners for which the forensic laboratories provided services in 2018.

## 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 had significant staffing losses throughout 2018. This was especially true for the Drug ID Laboratory, which explains the noticeable drop in the number of cases completed in 2018.

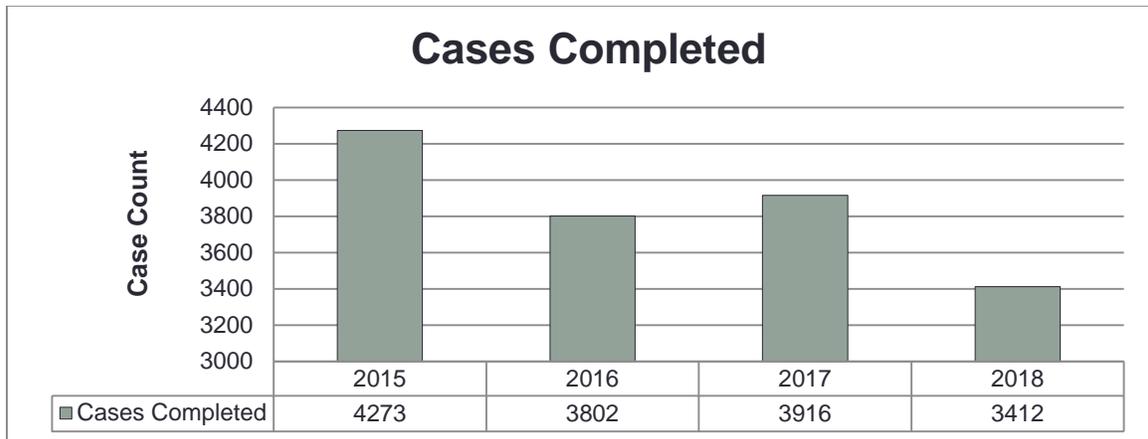


Figure 8 Number of cases completed per year.

### 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**, 33% of cases submitted to the Laboratory Division in 2018 were completed within 60 days of submission, which was flat with 2017 and a 50% increase compared to 2016 cases.

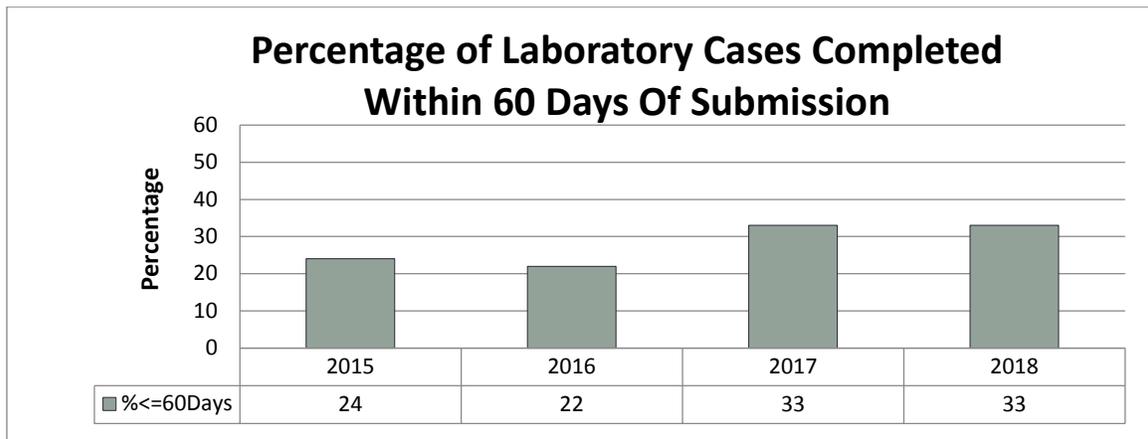


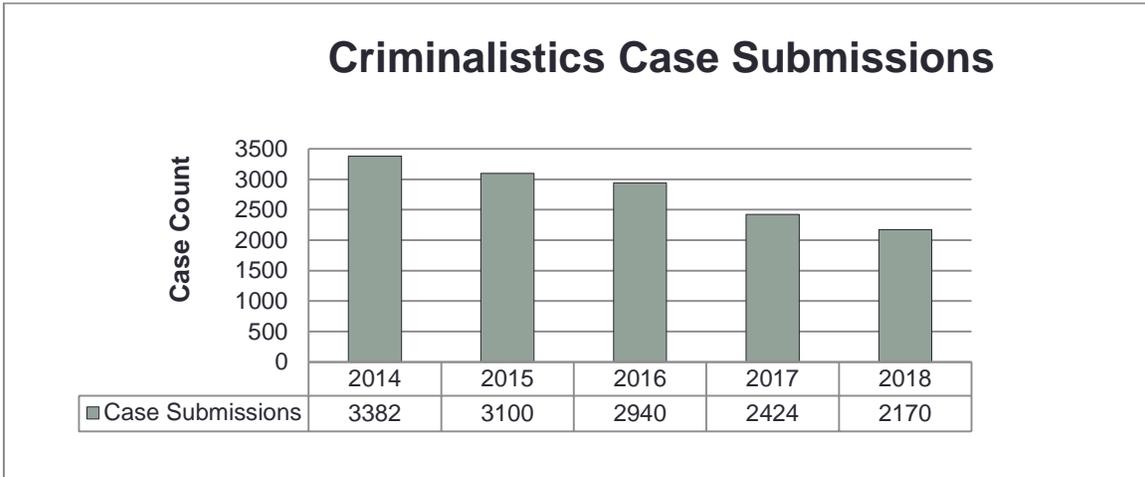
Figure 9 Percentage of laboratory cases completed within 60 days of submission.

## CRIMINALISTICS

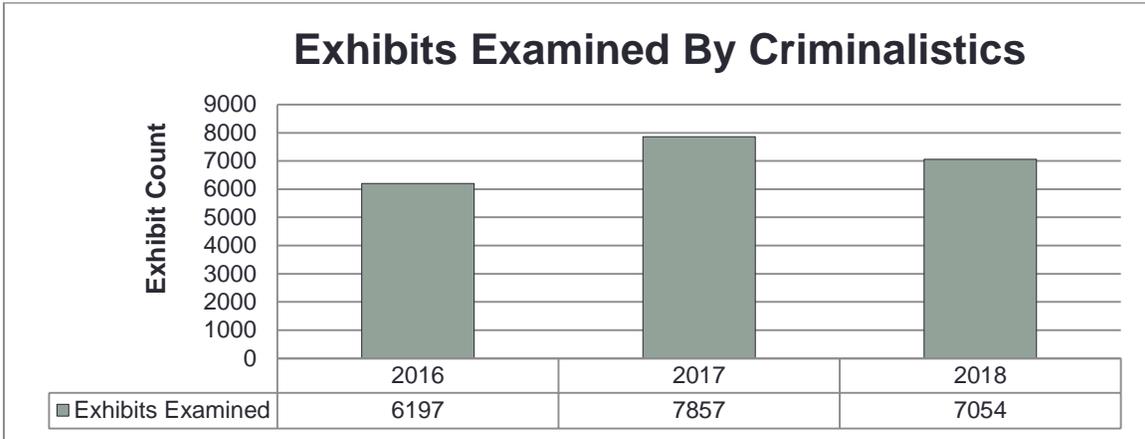
The Criminalistics Section receives the majority of the cases submitted to the Forensic Laboratories. The Criminalistics Section provides forensic examinations in Drug Identification, Open Container Analysis, Firearms & Tool Marks, Serial Number Restoration and Fire Debris Evidence. **Figure 10** illustrates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

In 2013, the Drug ID Laboratory started actively working with the Wichita City Prosecutors Office and Wichita Police Department on being more selective on case submissions. In addition, the Drug ID Laboratory worked with the Sedgwick County District Attorney's Office in 2018 to triage the cases that are needed for prosecution. With these efforts, cases that are submitted are those requiring analysis for charging and/or prosecution for both the Wichita City District Court and the Sedgwick County District Court. 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 2017 (7857) and 2018 (7054) compared to 2016 (6197) [Figure 11].

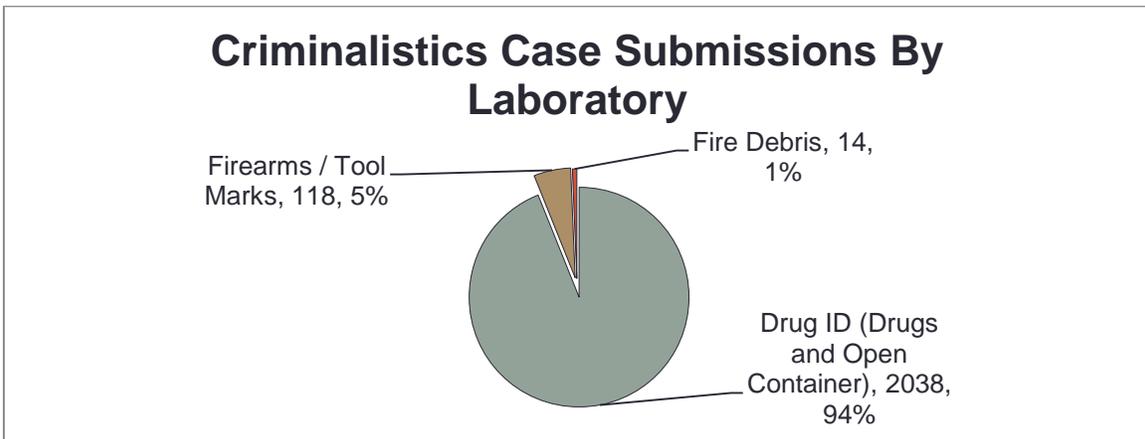


**Figure 10** Number of case submissions to the Criminalistics Section (Drug ID, Firearms/Tool Marks, and Fire Debris) over a five year period from 2014 through 2018.



**Figure 11** The number of exhibits examined from 2016 through 2018 by the Criminalistics Section (Drug ID, Firearms/Tool Marks, and Fire Debris).

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

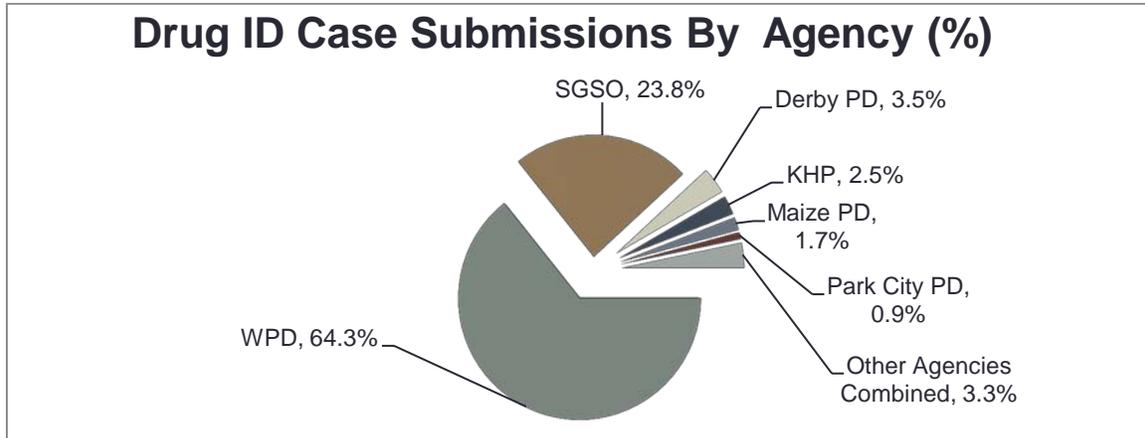


**Figure 12** Volume and percentage of cases submitted to each Criminalistics Laboratory Section.

## DRUG ID

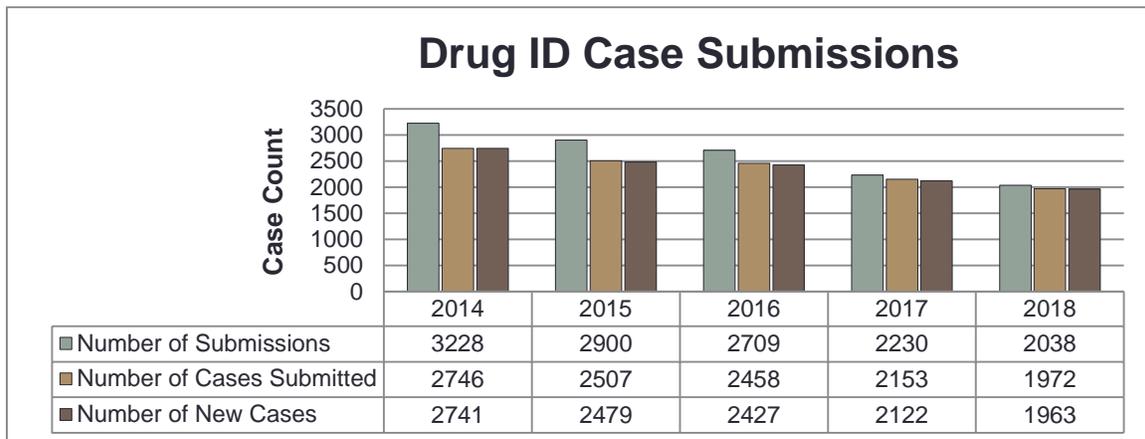
Examination requests for the identification of illicit drugs accounted for approximately 94% of the cases submitted to Criminalistics, as depicted in **Figure 12** above. Additionally, open container cases without any associated drugs accounted for 2% of the total submitted Drug ID cases. Casework requests for both illicit drug and open container examination accounted for 3% 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 12% of the total cases submitted.



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

The number of case 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.

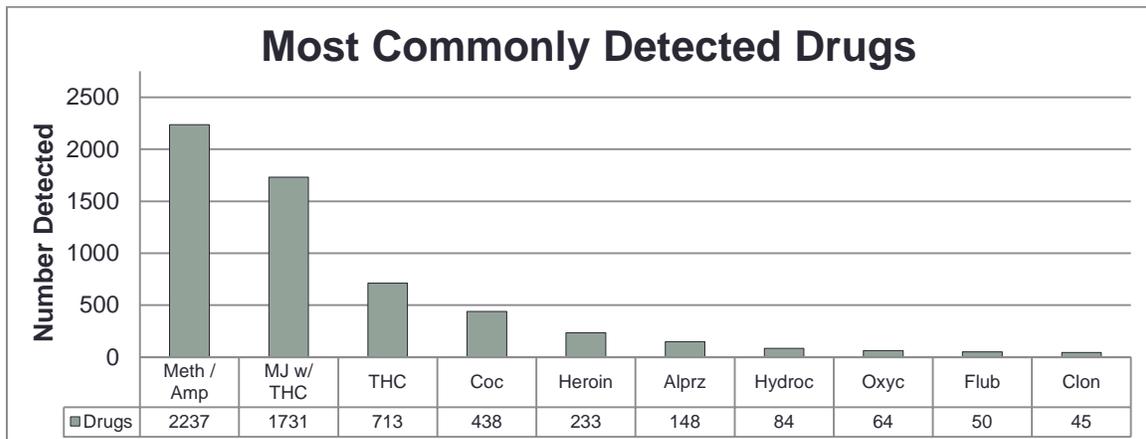
In 2018, the Drug Identification Laboratory examined thousands of exhibits for the presence of controlled substances. Consistent with years past, the majority of drug exhibits were identified as marijuana w/ THC, THC, cocaine, and methamphetamine. The Forensic Laboratory supported federal drug prosecution by performing methamphetamine quantitations, with an average purity of 78%, and cocaine base / salt form determinations.

The ten most commonly detected drugs by the Drug ID Laboratory is illustrated in **Figure 15**. Methamphetamine/amphetamine is the most commonly detected drug,

followed closely behind by marijuana (MJ) with THC as the second most commonly detected drug.

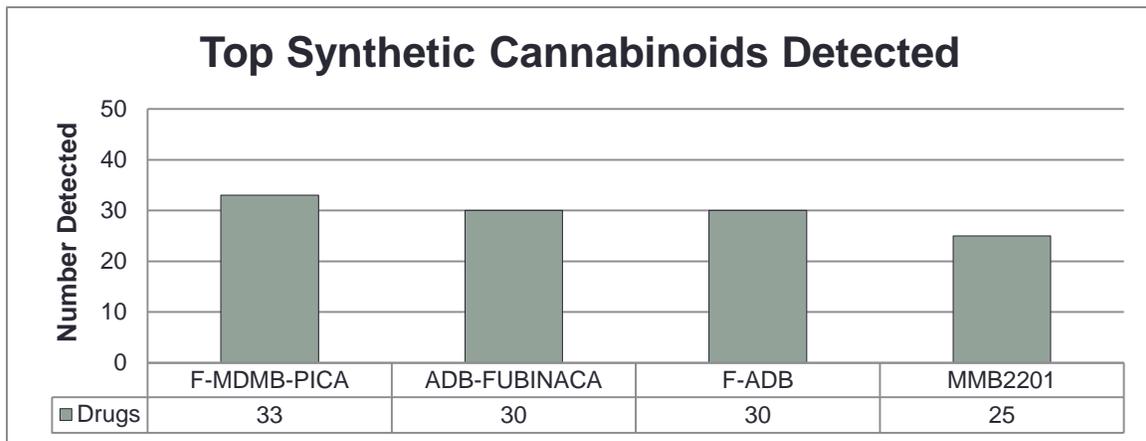
THC without the presence of marijuana plant material is the third most commonly detected drug. THC is the psychoactive component of cannabis and can be extracted out of the marijuana plant for use. It is often found in forensic samples as a residue or added to any other drug or material prior to being 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.

Three Opioids (Heroin, Hydrocodone, and Oxycodone) are included in the ten most commonly detected drugs.



**Figure 15** The ten (10) most commonly detected drugs from 2018 examinations. Drug Abbreviation Key (Meth = methamphetamine, Amp = amphetamine, MJ = marijuana, THC = tetrahydrocannabinol, Coc = cocaine, Alprz = alprazolam, Hydroc = hydrocodone, Oxyc = oxycodone, Flub = flubromazolam, and Clon = clonazepam).

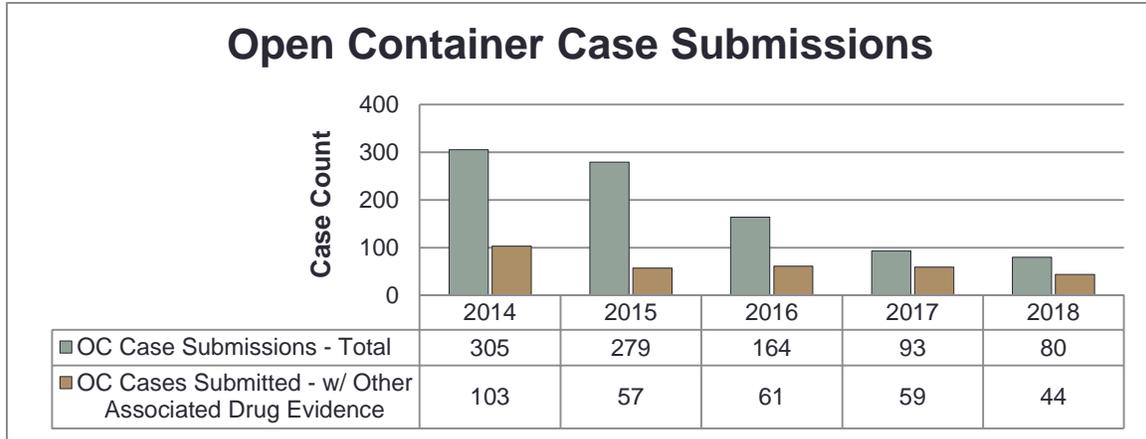
Synthetic Cannabinoids, which are commonly known as K-2 or Spice, have been detected in many of Drug ID casework samples in 2018. Often times these drugs are detected mixed with other drugs. **Figure 16** illustrates the most commonly detected.



**Figure 16** The four (4) most common synthetic cannabinoids detected from 2018 examinations. Drug Abbreviation Key (F-MDMB-PICA = N-(1-methoxy-3,3-dimethyl-1-oxo-2-butanyl)-1-(x-fluoropentyl)indole-3-carboxamide [classified as an *Indole-3-carboxamide*], ADB-FUBINACA = N-(1-amino-3,3-dimethyl-1-oxo-2-butanyl)-1-(x-fluorobenzyl)indazole-3-carboxamide [classified as an *Indazole-3-carboxamide*], F-ADB = N-(1-methoxy-3,3-dimethyl-1-oxo-2-butanyl)-1-(x-fluoropentyl)indazole-3-carboxamide [classified as an *Indazole-3-carboxamide*], MMB2201 = N-(1-methoxy-3-methyl-1-oxo-2-butanyl)-1-(x-fluoropentyl)indole-3-carboxamide [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 2014 and 2018.



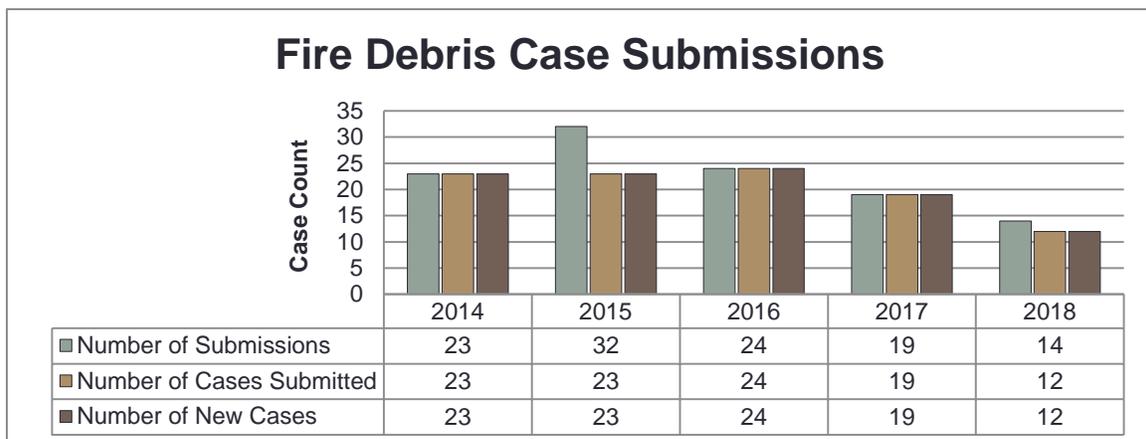
**Figure 17** Number of open container cases submitted.

## FIRE DEBRIS

The Fire Debris Laboratory examines fire debris cases 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 December 2017 the laboratory lost its only fully trained scientist, which caused the laboratory to not accept or analyze any casework until September 2018 when the laboratory was able to complete the training of two qualified scientists.

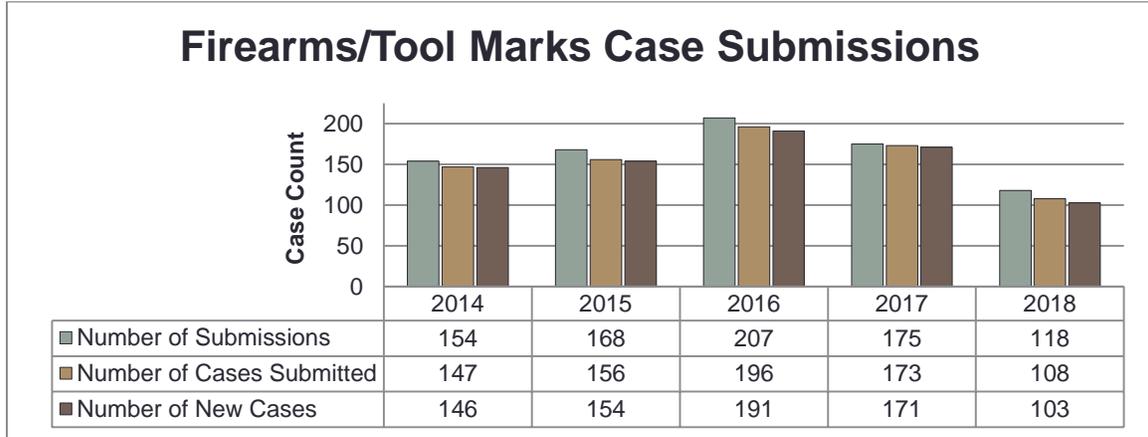
Since September 2018, the Fire Debris Laboratory received evidence from 12 cases with a total of 14 submissions. The trend of case submissions over the last five years is illustrated in **Figure 18**.



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

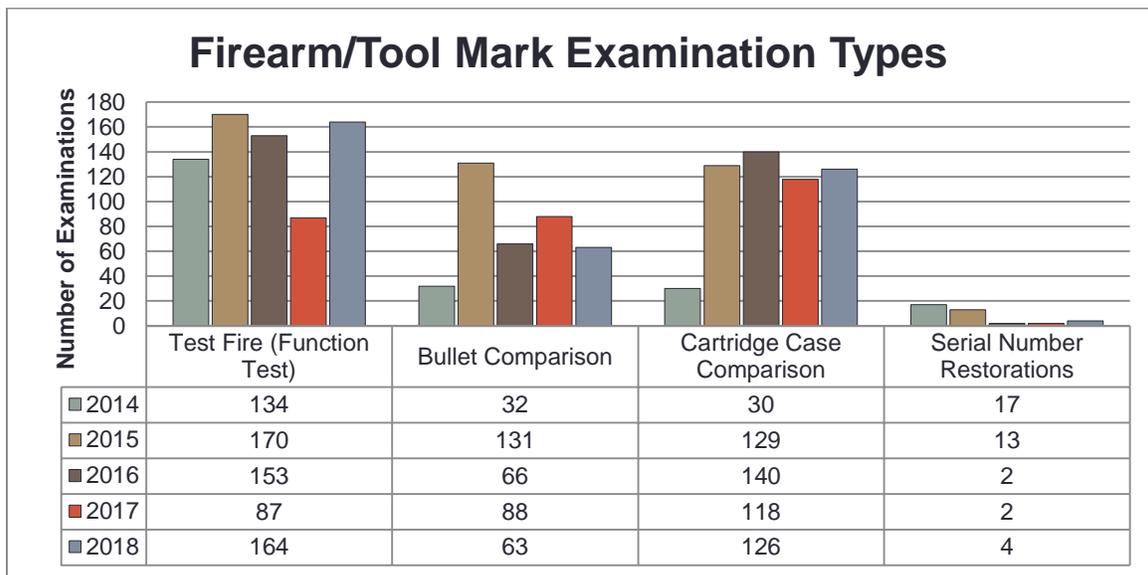
## **FIREARMS/TOOL MARKS**

Firearm and Tool Mark examination is conducted in support of state and federal law enforcement. The Firearms/Tool Marks 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/Tool Marks Laboratory include bullet comparisons, cartridge case comparisons, and serial number restorations. In 2018, the Firearms/Tool Marks Laboratory received evidence from 108 cases with a total of 118 submissions. The trend of case submissions over the last five years is illustrated in **Figure 19**.



**Figure 19** Firearm/Tool Mark case submissions from 2014 through 2018.

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**.



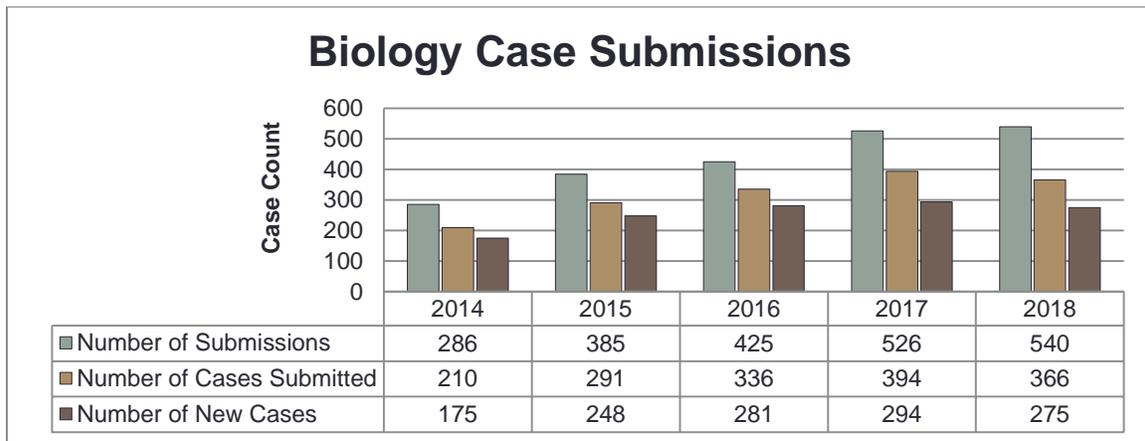
**Figure 20** Case examination requests in the Firearms/Tool Marks Laboratory; classified as test fires, bullet comparisons, cartridge case comparisons, and serial number restorations.

## **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.

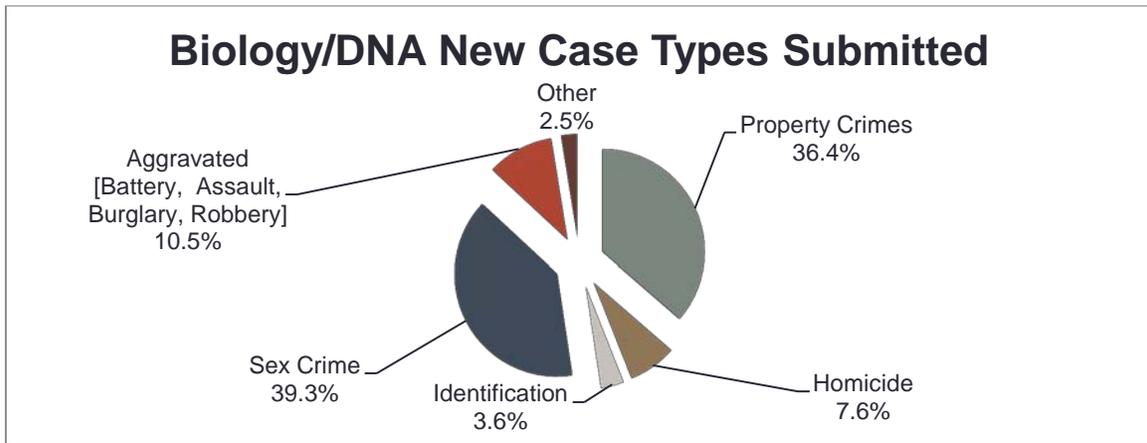
In 2018, the Biology/DNA Laboratory received evidence from 366 cases with a total of 540 submissions. The trends of case submissions over the past five years are illustrated in **Figure 21**. Since 2014, there has been a steady increase in the number of exhibits submitted for analysis along with the increase of submissions.



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

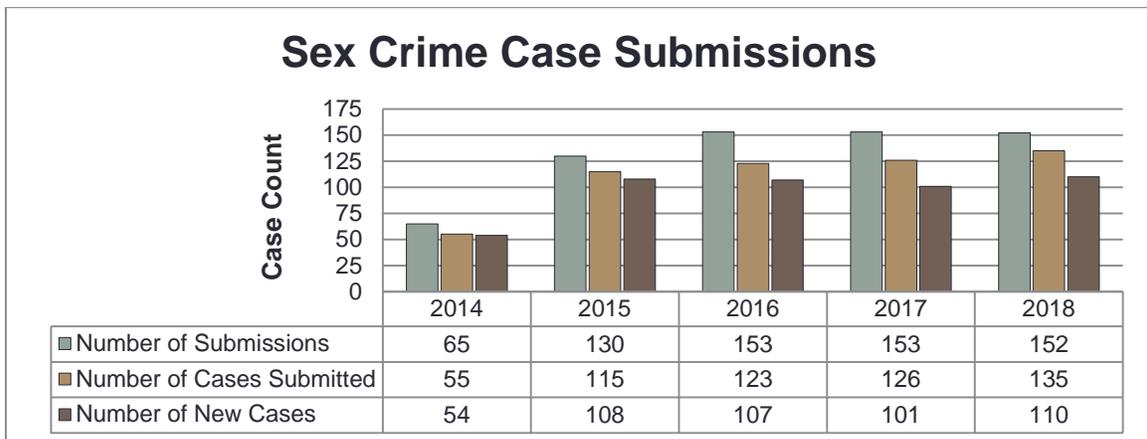
As depicted in **Figure 22**, approximately 36% of the cases submitted for biological examination were property crimes (auto theft, burglary, larceny) and sex crimes being highest overall with nearly 40% of the new case submissions.

Since 2014, the number of sex crimes investigated has risen, and has surpassed property crimes as the most common case type analyzed in the DNA/Biology Section. **Figure 22** illustrates the various case types commonly submitted for biological testing. 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 6% 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 Coroner cases 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 2015, the laboratory saw a 100% increase in case submissions of the total sex crime cases and new sex crime cases over the number submitted in 2014. The laboratory also had an 18.6% increase of new sex crime submissions over the previous four year average. In 2018, the Biology/DNA Laboratory received evidence from 135 sex crime cases with a total of 152 submissions, marking a record high for new case submissions in any single year.



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

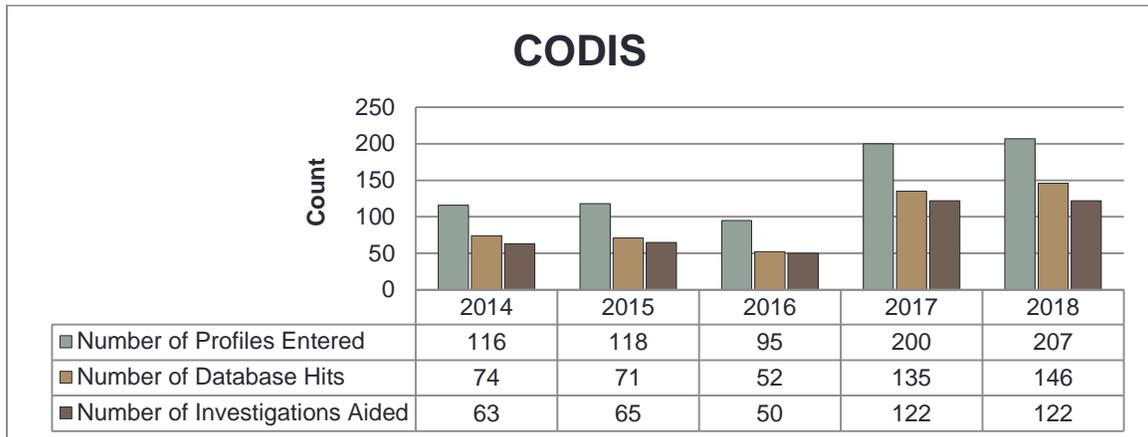
## CODIS

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.

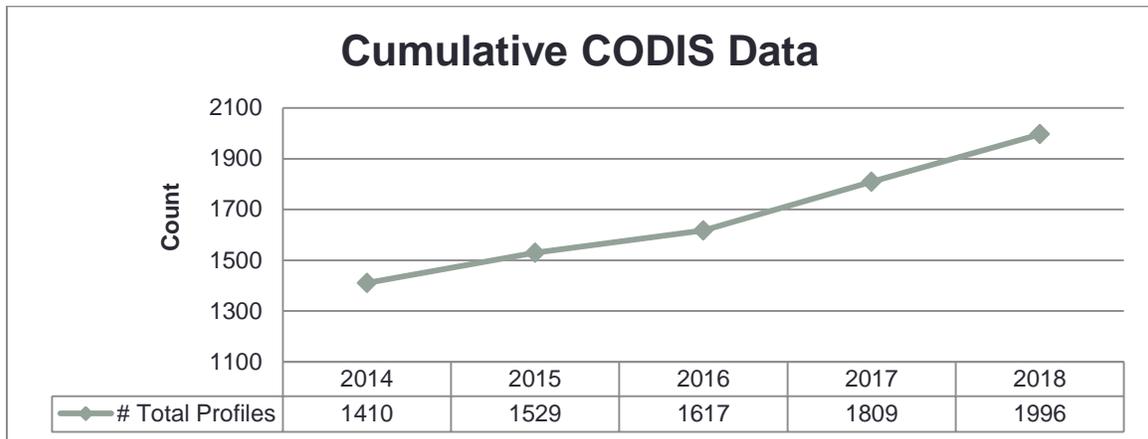
Over the years, the increased number of associations identified through CODIS resulted in an increase in reports generated, as well as an increase in the number of known samples processed to confirm and prosecute these additional CODIS hits. The number of CODIS entries, associated hits generated, and 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 2018, the laboratory entered more profiles into the database and experienced more hits than any of the previous 4 years. In the last 5 years, the average number of case profiles entered into CODIS is 147, the average number of hits per year is 95, and the average number of investigations aided per year is 84.



**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.



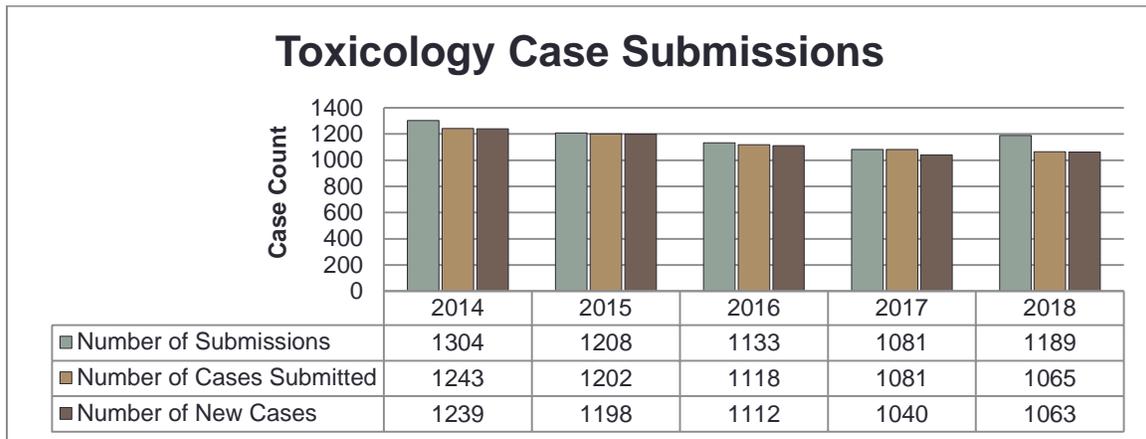
**Figure 25** The graph and chart depicts total number of profiles residing in the database (LDIS) at the end of each year.

## 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.

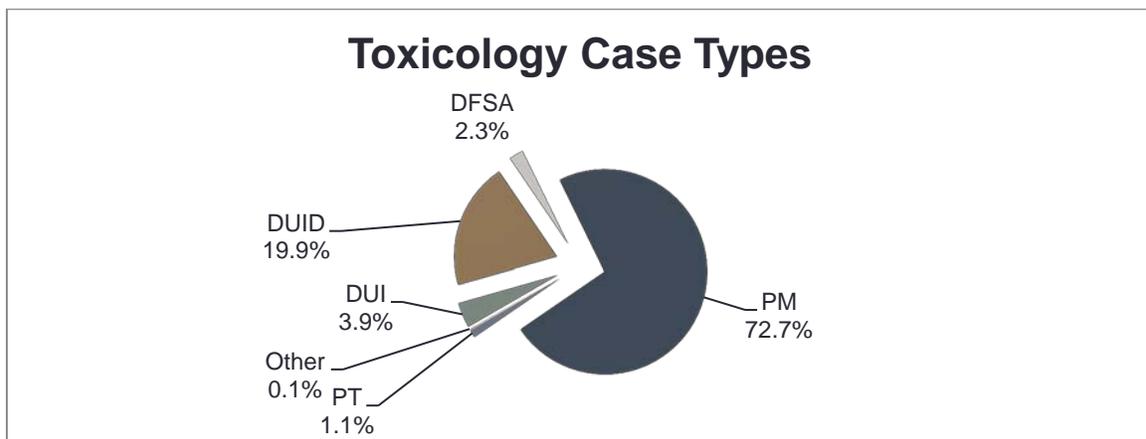
The laboratory continues to expand the number of drugs and poisons it can detect and quantitate.

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 remainder 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 human performance testing cases submitted by law enforcement agencies. Illustrated in **Figure 26** is the total number of case submissions to the Toxicology Laboratory over a 5 year period.



**Figure 26** 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.

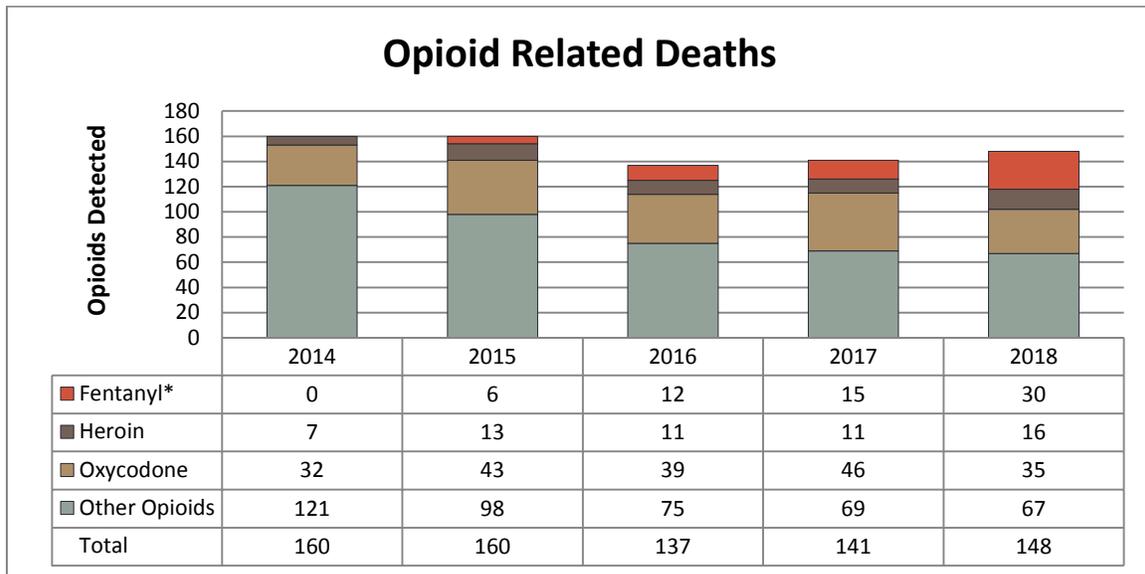
The percentage of toxicology cases submitted by case type is illustrated in **Figure 27**. Post-mortem (PM) toxicological examinations in support of the District Coroner account for approximately 73% of the forensic case work performed by the laboratory.



**Figure 27** 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), Proficiency Tests (PT), and Other (one homicide case submitted to the ante-mortem toxicology laboratory).

## Drug-Related Deaths

Opioid related deaths became more prevalent in 2018 with a total of 148, which was a 7 case increase from the year before. The range of opioid related deaths over the past five years is 137 to 160 with an average of 149 deaths. **Figure 28** provides the count of opioid related deaths broken down into four categories (Fentanyl, Heroin, Oxycodone, and Other Opioids). Note that fentanyl data was not captured separately prior to 2015, and that all fentanyl positive cases for 2014 are included in the other opioids case count.



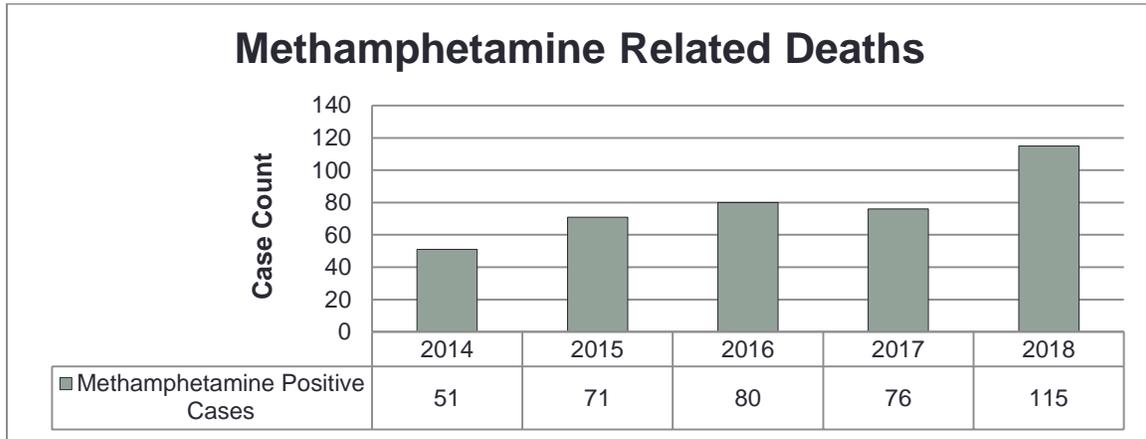
**Figure 28** Opioid related death count detected in Post-mortem Toxicology cases over the last five years. \*Fentanyl count includes fentanyl and fentanyl analogs.

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	2014	2015	2016	2017	2018
4-Fluoro-isobutyryl fentanyl	0	0	0	0	1
6-Acetylmorphine (Heroin)	9	13	11	12	16
7-OH Mitragynine	0	0	0	0	1
Buprenorphine	-	0	1	0	0
Codeine	41	14	7	5	10
Despropionylfentanyl	-	0	1	0	0
Fentanyl	12	6	12	15	29
Furanyl-fentanyl	-	0	1	0	0
Hydrocodone	60	35	31	37	35
Hydromorphone	-	13	10	5	5
Loperamide	-	0	3	0	0
Methadone	46	29	15	21	19
Mitragynine	0	0	0	0	3
Morphine*	-	48	40	27	35
Oxycodone	32	43	44	48	39
Oxymorphone	-	14	18	9	8
Propofol	-	0	3	0	0
Tramadol	12	8	13	9	11
U-47700	-	0	1	0	0

**Table 3:** Opioids detected in death cases over the last 5 years. Previous to 2015, data was captured in categories for Codeine / Morphine [Codeine], Hydrocodone / Hydromorphone, Methadone, Oxycodone / Oxymorphone [Oxycodone], and Tramadol instead of individually. \*Some positive morphine cases may be due to a delayed heroin related death.

Aside from alcohol, amphetamine / methamphetamine was the most commonly found drug in post-mortem cases. As illustrated in **Figure 29**, methamphetamine related deaths have shown a steady increase over the last five years. In fact, in 2018 methamphetamine was detected in the highest number of cases (115) ever recorded at the RFSC.



**Figure 29:** Methamphetamine related deaths detected in Postmortem 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** depicts in alphabetical order the 10 most common drug findings in post-mortem toxicology cases [excluding ethyl alcohol] for 2018 cases.

Alprazolam / $\alpha$ -Hydroxyalprazolam
Amphetamine / Methamphetamine
Cocaine / Benzoylcegonine / Cocaethylene
Diphenhydramine
Fentanyl
Gabapentin
Hydrocodone / Hydromorphone
Morphine / Codeine
Oxycodone / Oxymorphone
Tetrahydrocannabinol / Carboxytetrahydrocannabinol

**Table 4:** The 10 most commonly detected drugs / metabolites (post-mortem) detected in 2018 listed alphabetically.

## Alcohol Analysis

Alcohol continues to play a significant role in all of the Toxicology Laboratory case types as depicted below in **Figure 30**. Blood alcohol results that were at least twice the legal limit of 0.08 gm% were detected in approximately 62% of DUI cases and 20% of DUID cases.

In approximately 18% 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 2018, approximately 69% of the tested samples in DUI and DUID cases were negative for the presence of alcohol and approximately 80% of alcohol positive drivers were at or above “per se” limit of 0.08 gm%.

Approximately 63% of DUID cases were found to be negative for alcohol upon pre-screening, 10% were cases involving blood alcohol levels below the legal limit, and 28% of the cases were at or above the legal limit (0.08 gm% and up).

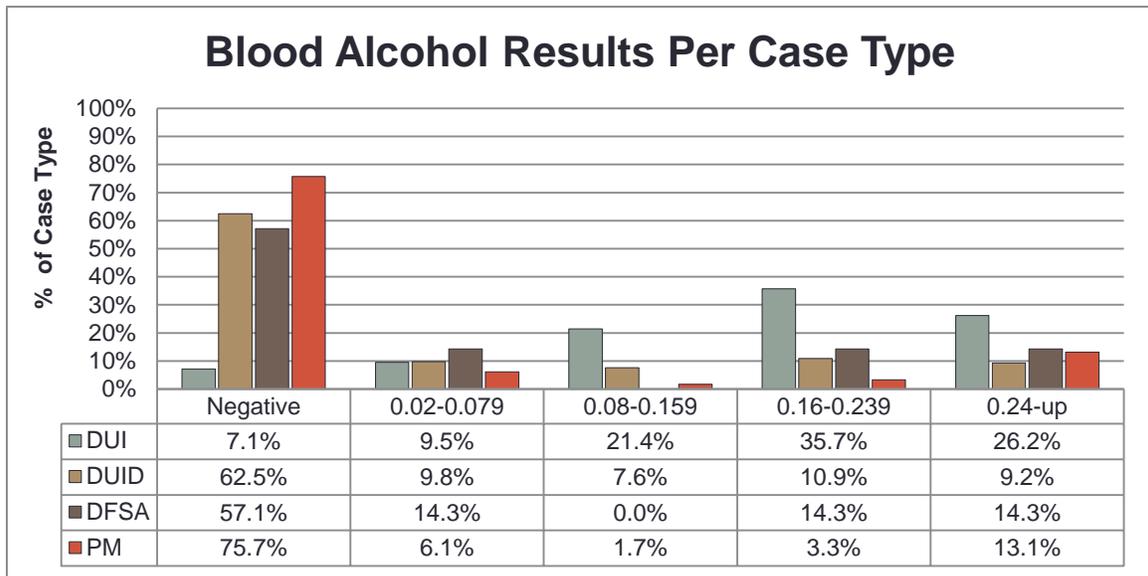


Figure 30: Percentage of alcohol test result ranges for each type of case.

### Alcohol Positive Drivers – Under the Age of 21

The legal age for possession of alcohol is 21 years of age. In 2018, approximately 13% of all motor vehicle drivers testing positive for alcohol were under the age of 21. **Figure 31** 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 42% had alcohol concentrations  $\geq 0.08$  gm%.

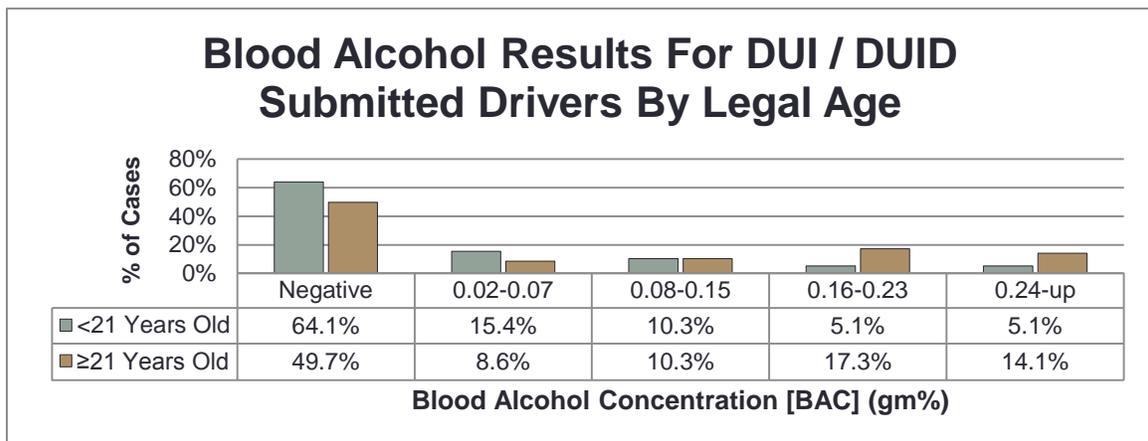
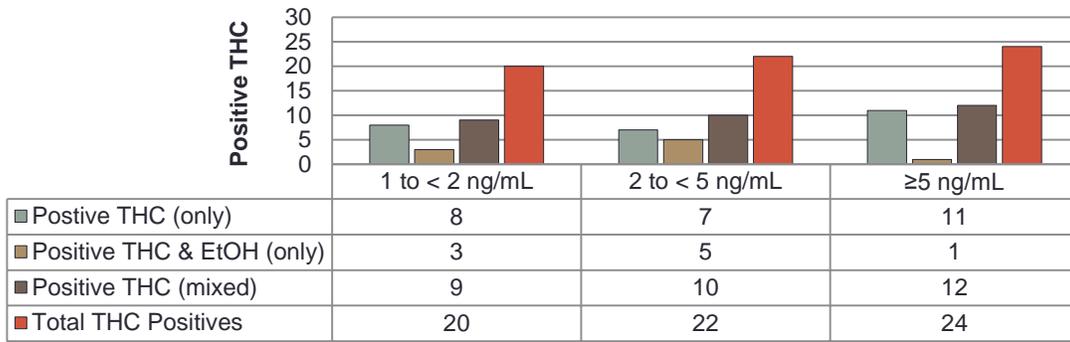


Figure 31 DUI and DUID blood alcohol results sorted by age (minors vs. 21 years and older).

### Drugs and Driving

Many driving cases involve drivers that are under the influence of tetrahydrocannabinol (THC). **Figure 32** provides the number of positive THC results from the 184 DUID [Driving Under the Influence of Drugs] cases submitted in 2018. There was measurable THC detected in 66, or 35.8%, of the 2018 cases. As a result of 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 an underestimation.

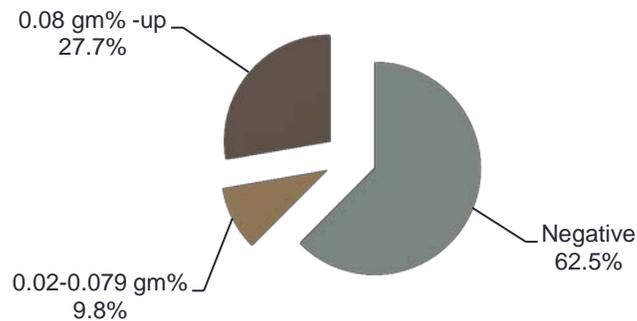
## Drivers [DUID] With Positive THC Results



**Figure 32** The number of DUID case specimens that tested positive for tetrahydrocannabinol (THC) that were submitted in 2018. 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.

Approximately 63% of DUID cases were found to be negative for alcohol upon pre-screening, 10% were cases involving blood alcohol levels below the legal limit, and 28% of the cases were at or above the legal limit (0.08 gm% and up) **[Figure 33]**.

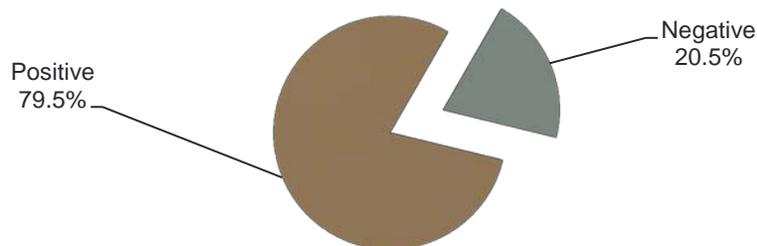
## DUID Blood Alcohol Result Data



**Figure 33** 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 34**, the majority (79.5%) of DUID cases tested in 2018 were found to be positive for the presence of drugs.

## DUID Blood Drug Result Data



**Figure 34** DUID blood drug results.

## Driver Drug Usage

In DUID cases where drugs were detected, approximately 68% were prescription drugs and 32% were illicit [Figure 35]. Prescription drugs can be abused by individuals with or without a prescription for the drug, as a result drugs that are classified as prescription drugs can also be considered illicit in use.

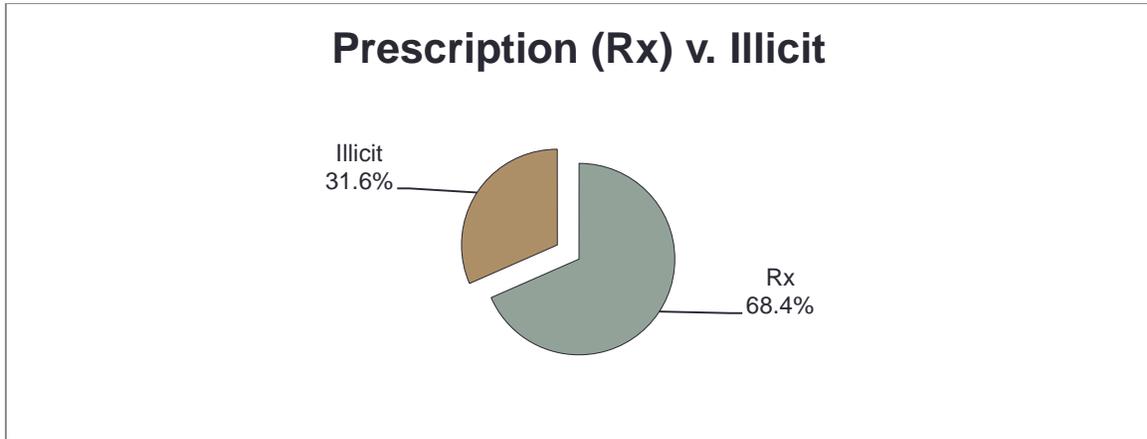


Figure 35 Percentage of prescription (Rx) and illicit drugs detected in DUID cases.

The Toxicology Laboratory detected 40 different drugs and/or their metabolites in driving under the influence of drug [DUID] cases. Illustrated in Figure 36 are the most commonly detected drugs in 2018 (excluding ethyl alcohol).

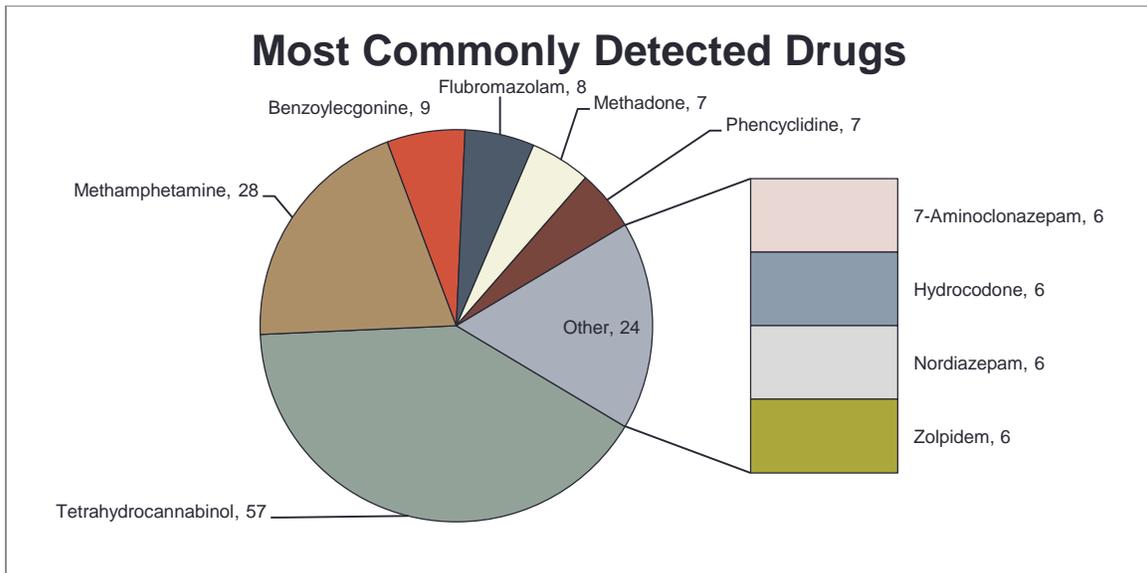


Figure 36 The most commonly detected drugs in driving under the influence of drugs (DUID) toxicology cases [excluding ethyl alcohol] and the number of positive exhibits.

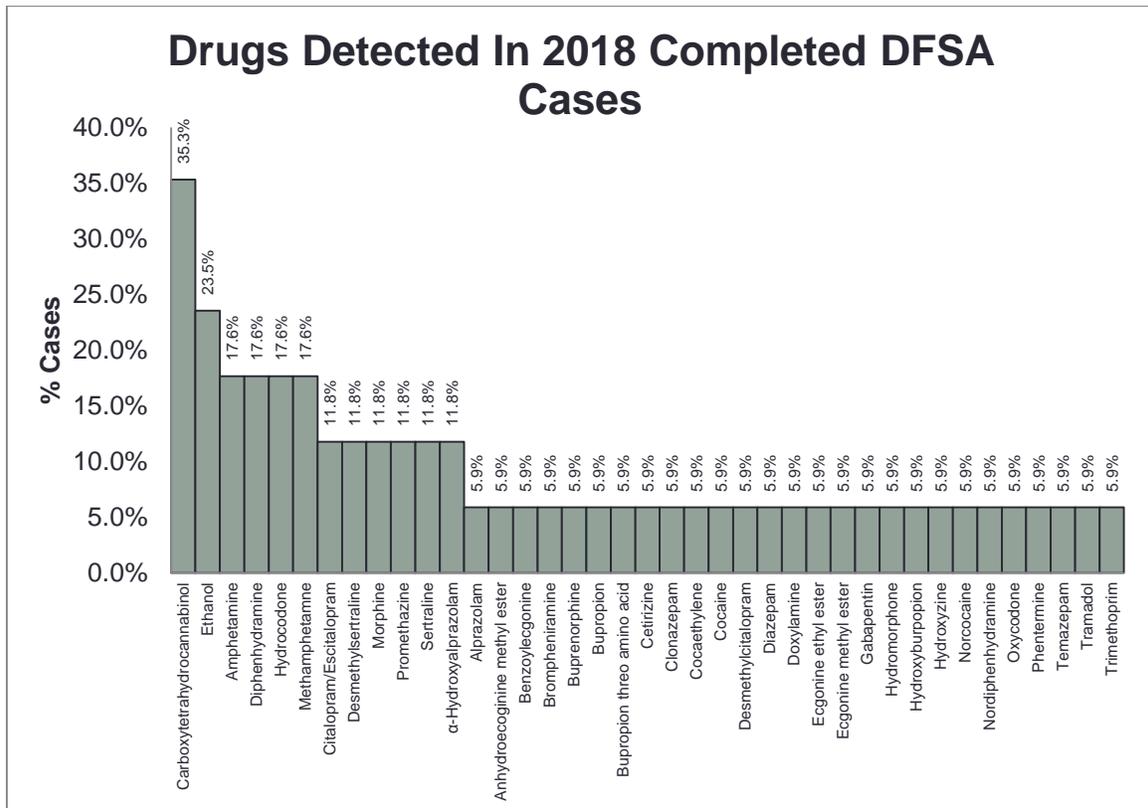
## Drug-Facilitated Sexual Assaults

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 2018 there were 24 DFSA cases submitted for analysis and the Toxicology Laboratory completed 17 DFSA cases. Ethanol was detected in 4 of the completed DFSA cases in 2018.

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

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

DFSA case specimens often have several different drugs present. **Figure 37** illustrates the percentage of cases that each of the listed drugs were detected during analysis of the 17 completed DFSA cases in 2018.



**Figure 37** The percentage of DFSA cases that the listed drug was detected during analysis in 2018.