

2017

Forensic Laboratories Annual Report

Sedgwick County, Kansas

Regional Forensic Science Center
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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.

Forensic Biology/DNA Manager

Shelly Steadman, Ph.D.

Quality Assurance Manager

Robert Hansen, M.S.F.S.

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.

INTRODUCTION

The Regional Forensic Science Center officially opened on December 21st, 1995. The Center houses the Office of the District Coroner and the Forensic Science Laboratories [FSL]. The Forensic Science Laboratories are comprised of three major sections: Criminalistics, Forensic Biology/DNA and Forensic Toxicology. Within the Criminalistics there are the Drug Identification Unit, Firearms / Tool Mark Unit, and the Trace (Fire Debris) Unit.

The FSL is staffed with highly-trained and experienced forensic scientists, many who have advanced scientific degrees [MS, MSFS, Ph.D.]. The technical staff has well over 200 years of combined professional experience. For 2017 laboratory staff consisted of 19 scientist and 3 support personnel.

In April of 1996, the Forensic Science Laboratories 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 FSL 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 Center opened the first STR DNA Laboratory in the State of Kansas.

Since 2003, the Forensic Science Laboratories have been accredited by the American Society of Crime Laboratory Directors/Laboratory Accreditation Board [ASCLD/LAB] under the ASCLD/LAB-*Legacy* program.

In February 2014, the Laboratory Division 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*, the testing laboratory requirements of the *ASCLD/LAB-International* Supplemental Requirements.

Striving for and meeting the requirements of the ASCLD/LAB-*International* program demonstrates the Center's commitment to excellence in the services we provide to our submitting agencies.

SIGNIFICANT ACHIEVEMENTS

- *Publications:*
 - Rohrig TP, Moore CM, Stephens K, et al. "Roadside drug testing: An evaluation of the Alere DDS[®]2 mobile test system", *Drug Test Anal.* 2017;1-8.
<https://doi.org/10.1002/dta.2297>

- *Presentations:*
 - R.C. Hansen II, "A Post-mortem Toxicology Laboratory's Measurement Uncertainty Budget Considerations", Presented at the 2017 Southwestern Association of Forensic Toxicologist Meeting, April 2017, Wichita, KS.
 - T.P. Rohrig, "Road-Side Drug Testing: An Evaluation of the Alere DDS[®]2 Mobile Test System", Invited presentation at the 12th Annual Joint LEO/Prosecutor: Impaired Driving Seminar, October 2017; Wichita, KS
 - T.P. Rohrig, "Social Drink and the Common Cold: Alcohol and Antihistamines in Drug Facilitated Sexual Assault", Invited presentation at the International Association of Forensic Nurses – Kansas Chapter Meeting, August 2017; Wichita, KS
 - T.P. Rohrig, "Driving Impairment Due To Inhalant Abuse", Presented at the Graduate Seminar Series in Forensic Science at Emporia State University, April 2017; Emporia, KS
 - T.P. Rohrig, "Carbon Monoxide Intoxications: Unusual Sources", Presented at the Southwestern Association of Toxicologists Spring Meeting, April 2017; Wichita KS
 - S.A. Miller and T.P. Rohrig, "U-47700: A Not So New Opioid", Presented at the Southwestern Association of Toxicologists Spring Meeting, April 2017; Wichita KS
 - T.P. Rohrig, "Prescription Medications: They Can Impair Driving", Invited Presentation at OSU Center for Health Sciences Friday Seminar Series, April 2017; Tulsa, OK
 - T.P. Rohrig, Invited Instructor for the Southwestern Association of Toxicologists sponsored Spring Workshop [2.5 hours] on "ADME: General Principles of Drug Pharmacokinetics", April 2017; Wichita, KS
 - P. Smith, "Fire Debris Analysis" Presented at the Kansas Chapter of the International Association of Arson Investigators Annual Conference October 2017; Wichita, KS
 - L. Huhman, "OSAC/SWGDRUG Updates", Kansas Drug Chemist Meeting, April 2017, Topeka, KS
 - K. Youso, "Forensic Toxicology", Presented at the Graduate Seminar Series in Forensic Science at Emporia State University, November, 2017, Emporia, KS

- *Laboratory Staff enhanced their technical and professional expertise by attending the following workshops and/or training sessions on site, at conferences, or via webinar:*
 - American Academy of Forensic Sciences, 69th Annual Scientific Meeting, New Orleans, LA, February, 2017
 - 23rd Annual National CODIS Conference
 - STRmix Training Workshop
 - 48th Annual AFTE Training Seminar
 - Spring 2017 SAT Meeting, Flying High in Wichita: A Look at Psychotropic Drugs
 - Smith & Wesson Academy Armorers School
 - Mid-America 2017 Forensic DNA Conference
 - Responding to the Challenge of New Psychoactive Substances in Forensic Toxicology with Targeted and Non-Targeted Informatics Workflows
 - LCMS: Drugs of Abuse
 - The History and Chemistry of SPE: Theory, Method Development, and Applications
 - Exploiting the Power of LC/TOF Data Mining
 - Whole Blood: Overcoming Matrix Challenges
 - Fundamental Topics in Forensic Toxicology: Present and Future
 - LC-MS Maintenance and Troubleshooting – Tips and Tricks for New Users
 - Communication Strategies to Mitigate Bias and Strengthen Scientific Foundations in Forensic Science
 - Ethics Training
 - Various Safety Trainings, Including NARCAN Usage Training
 - Kansas Drug Chemist Meeting, April 2017 Topeka KS
 - Kansas Firearms Examiner Meeting, December 2017
 - KDIAI Educational Conference, March 2017
 - FN Herstal Armorers Courses

- *Grant Funding:*
 - Coverdell: \$25,000
 - Capacity Enhancement and Backlog Reduction: \$99,990

FORENSIC SCIENCE LABORATORIES SERVICE OVERVIEW

Case Submissions

The Forensic Science Laboratory [FSL] continues to experience a significant demand for its expert services. **Figure 1** illustrates the number of forensic laboratory cases submitted for examination over the past 5 years, the average of which is 4047.

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, each with more exhibits associated. **Figure 1** illustrates the increase in the number of exhibits examined in 2017 compared to 2016 (the only two years that there is complete data available to make comparison).

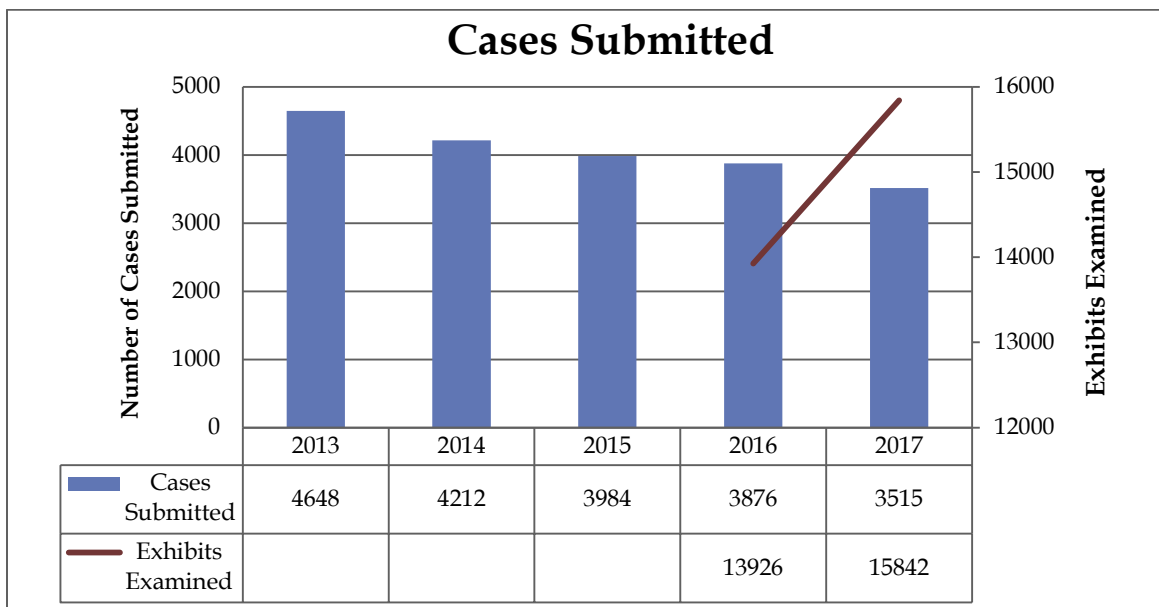


Figure 1 Number of forensic laboratory cases submitted for examination (law enforcement and District Coroner post-mortem evidence submissions). Totals in this chart include Proficiency Tests for the Toxicology Laboratory [14 for y2017].

Figure 2 provides the listing of submitting agencies that submitted evidence to the laboratory division for forensic analysis and the number of new cases that were generated in 2017, respectively. 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.

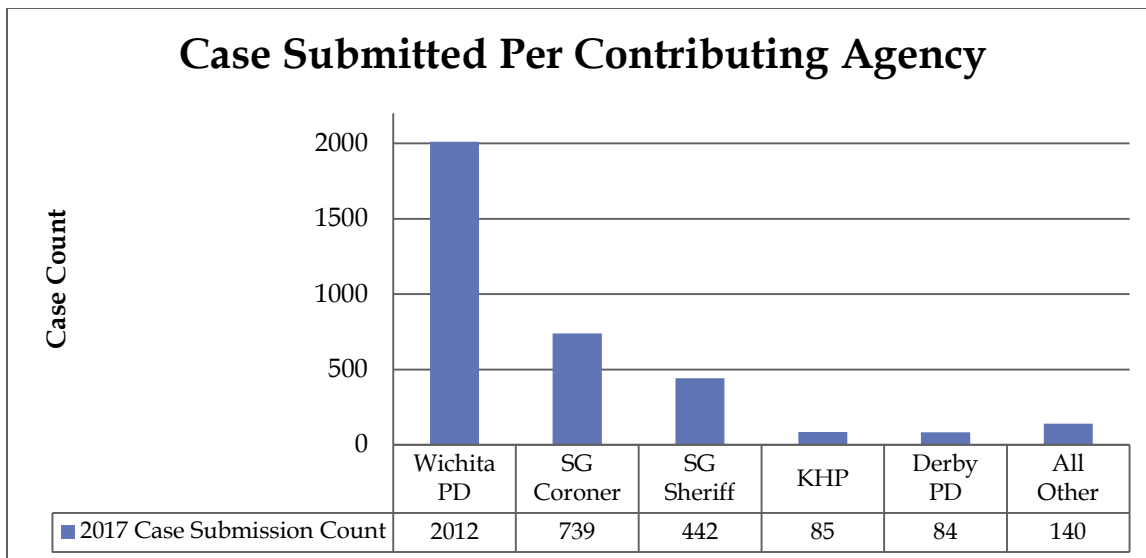


Figure 2: Count of new case submissions received from each contributing law enforcement agency.

Cases are submitted for forensic examination to our six analytical units, Biology / DNA, Drug ID, Firearms / Tool Marks, Fire Debris, Toxicology HPT (human performance testing), and Toxicology PM (post-mortem). 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 3515 new cases submitted [Figure 1]; there were case submissions from an additional 155 on-going cases that were originally submitted in previous years for a total of 3670 individual cases being submitted in 2017.

Table 1 illustrates the number of case submissions associated with each functional laboratory unit. The aggregate submission count (4026) includes all submissions from contributing agencies. The Criminalistics Section continues to receive the majority of evidence submitted, although the Biology/DNA Laboratory has seen a large increase (~24%) in the number of submissions when compared to 2016.

In addition to the 4026 submissions from contributing agencies, the evidence section also received 141 internal submissions which were generated as a result of examination derivatives that were returned to the respective contributing agency. **Table 1** further illustrates the fact that cases often have multiple submissions.

Laboratory	2016 Aggregate Submission Count	2017 Aggregate Submission Count
Biology / DNA	425	526
Drug ID	2709	2225
Firearms / Tool Marks	208	175
Fire Debris	24	19
Toxicology HPT	303	306
Toxicology PM	828	775
Sum of Submission Count	4497	4026

Table 1 Number of case submissions per laboratory.

Sedgwick County vs. Out-of-County Cases

The Sedgwick County 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	Grant County Coroner	Pratt County Coroner
Arkansas City Fire Department	Greenwood County Coroner	Reno County Coroner
Barber County Coroner	Harvey County Coroner	Rice County Coroner
Barton County Coroner	Haysville Police Department	Salina Police Department
Bel Aire Police Department	Hutchinson Correctional Facility	Saline County Coroner
Butler County Coroner	Kansas Bureau of Investigations	Sedgwick County Coroner
Cheney Police Department	Kansas Department of Corrections	Sedgwick County Sheriff
Clearwater Police Department	Kansas Highway Patrol	Sumner County Coroner
Cowley County Coroner	Kechi Police Department	Sumner County Sheriff
Derby Police Department	Kingman County Coroner	Valley Center Police Department
ElDorado Correctional Facility	Leavenworth Police Department	Veteran Affairs Medical Center
Elk County Coroner	Maize Police Department	Wichita Fire Department
Ellsworth County Coroner	McPherson County Coroner	Wichita Police Department
Finney County Coroner	Mt. Hope Police Department	Wichita State Univ. Police Dept.
Goddard Police Department	Mulvane Police Department	Winfield Correctional Facility
Goddard USD265 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 2017.

Cases Worked

Cases worked 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 5** illustrates the number of cases worked by the laboratories in the given year.

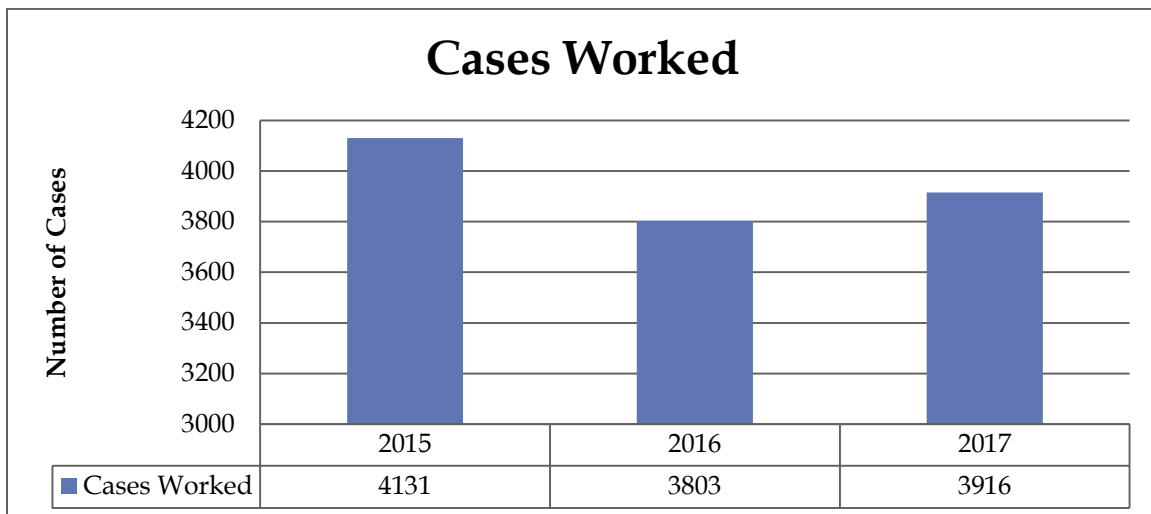


Figure 5: Number of cases worked per year.

CASE SUBMISSION TURN-AROUND-TIME

One metric of the Forensic Laboratories casework output is the amount of time it takes for a case to be completed following submission. As illustrated in **Figure 6**, 33% of cases submitted to the Laboratory Division in 2017 were completed within 60 days of submission, which was an 50% percent increase compared to 2016 cases.

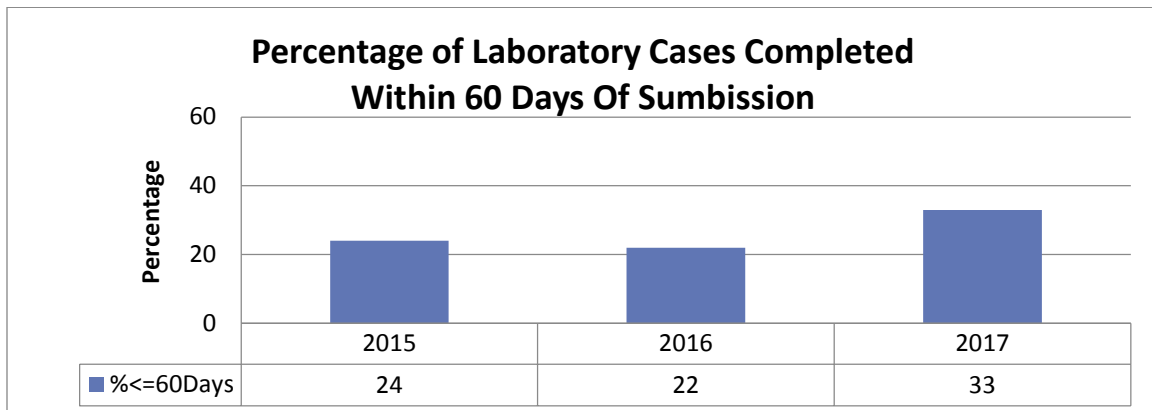


Figure 6: Percentage of laboratory cases completed within 60 days of submission.

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 [Beverage Alcohol] Analysis, Firearms & Tool Marks, Serial Number [Firearms] Restoration and Trace Evidence [Fire Debris]. **Figure 7** 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. Since that time, cases that are submitted are those requiring analysis for charging and/or prosecution. This change in policy is responsible for the decrease in case submissions [**Figure 7**]. The reduction in case submission has expedited turn-around-time and makes more efficient use of laboratory resources. However, with the reduction in case submissions, Criminalistics has increased the number of exhibits examined in 2017 (7857) compared to 2016 (6197). Note that 2016 and 2017 are the only two years that there is complete data available to make a comparison.

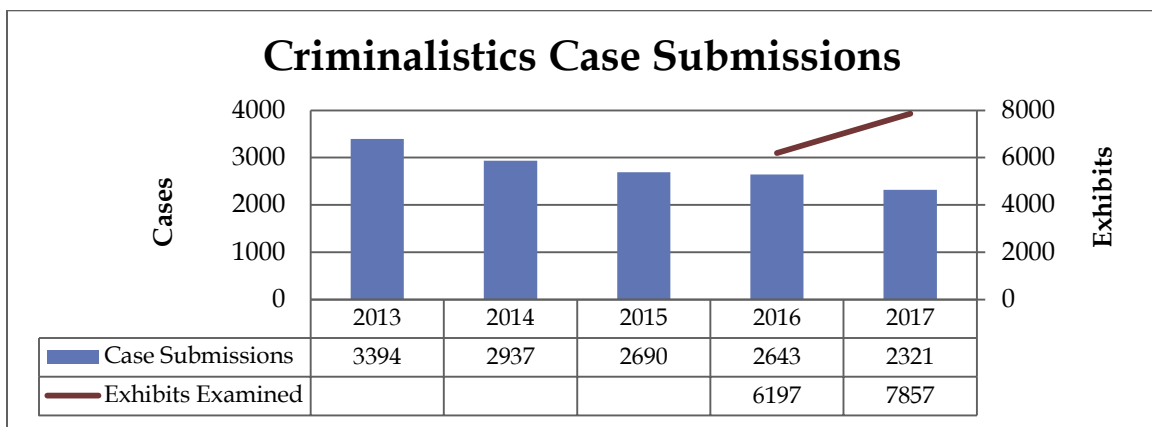


Figure 7: Number of cases submitted for analysis to the Criminalistics Section (Drug ID, Firearms/Tool Marks, and Fire Debris) over a five year period.

Figure 8 illustrates the volume and percentage of cases submitted to each unit of the criminalistics section.

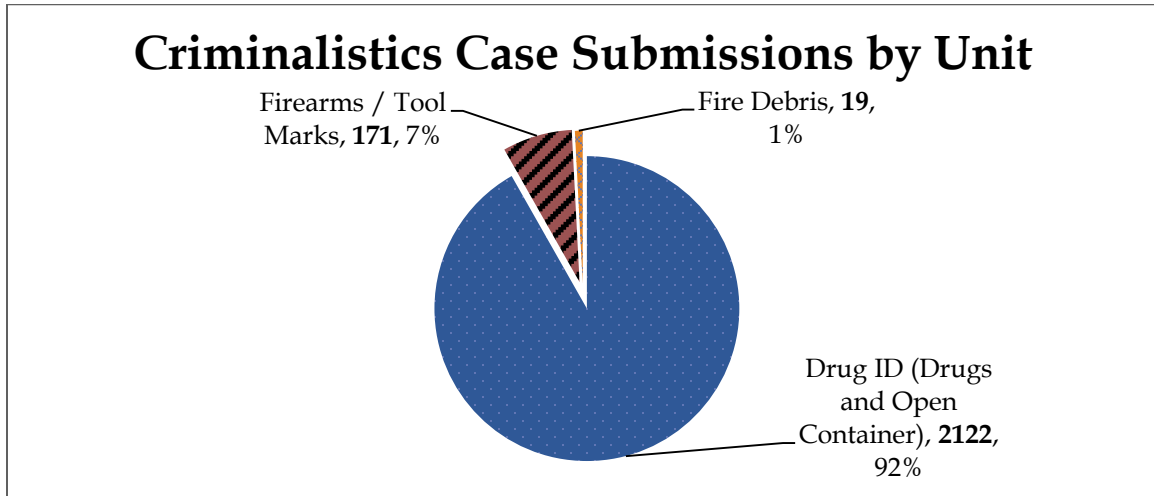


Figure 8: Volume and percentage of cases submitted for each Criminalistics Laboratory Section.

Drug ID Unit

Examination requests for the identification of illicit drugs accounted for over 92% of the cases submitted [Figure 8] to Criminalistics. Additionally, open container only cases accounted for 2% of the total submitted Drug ID cases. Casework requests for both illicit drug and open container examination accounted for 4% 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 9, as nearly 73% of cases received are from WPD. Agencies other than WPD and the Sedgwick County Sheriff’s Office [SGSO] are responsible for approximately 10% of the total cases submitted.

Late in 2017, the Drug ID Unit filled a vacancy that had been open since mid-2015. Once the new chemist completes the necessary training, there should be a very positive impact on the backlog and turn-around-time should drop significantly. The unit has been functioning at 80% staffing since mid-2015, but is on track to be back to 100% staffing in mid-2018.

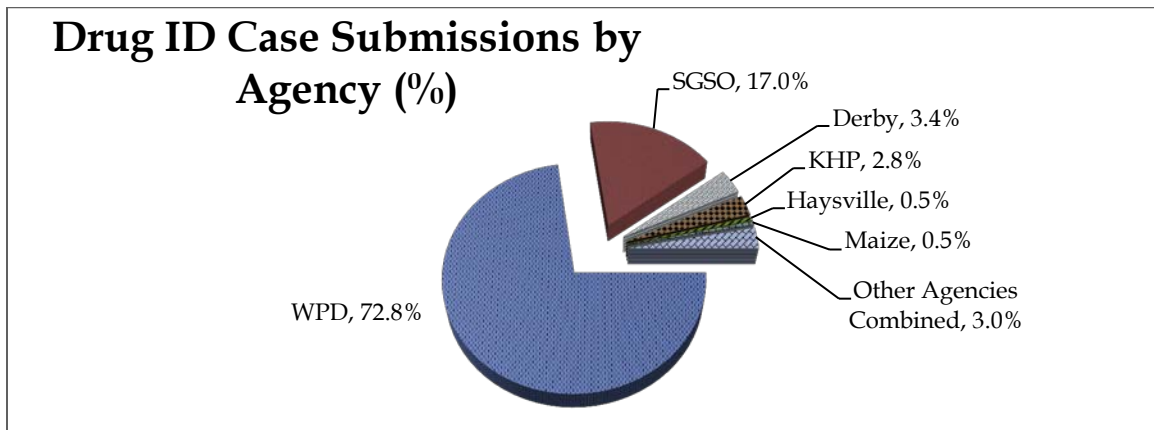


Figure 9: Percentages of Drug ID cases submitted per contributing agency.

The Drug ID Unit provides reports to law enforcement to support criminal drug trafficking and possession investigations. The unit had a 10% increase in case reports issued compared to the previous year, despite being at 80% staffing for most of the year.

In 2017, the Drug Identification Unit 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 unit continues to see a steady submission of synthetic cannabinoids (“K2”, “spice”, “potpourri”) and designer stimulants (substituted cathinones aka “bath salts”). There were 90 synthetic cannabinoids and 16 designer stimulants detected in 2017. Also, the unit performed 182 methamphetamine quantitations and 39 cocaine base / salt form determinations, which are required for federally charged cases.

Figure 10 illustrates the ten most commonly detected drugs by the Drug ID Unit. Methamphetamine/amphetamine is the most commonly detected drug, followed closely behind by marijuana (MJ) with THC as the second most commonly detected drug. Of note is the fact that this is the first year that methamphetamine/amphetamine was the most commonly detected drug. This is likely due to the change in the way prosecutors are charging and prosecuting marijuana possession cases.

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 as well as the synthetic cannabinoid ADB-FUBINACA.

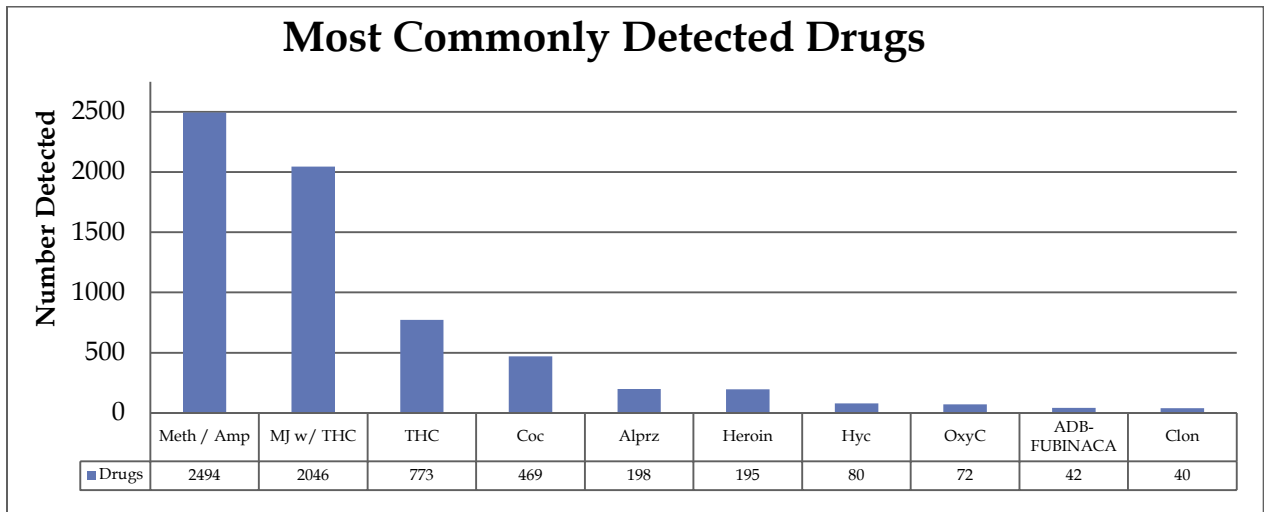


Figure 10: The ten (10) most commonly detected drugs from 2017 examinations.

Synthetic Cannabinoids have been detected in many of Drug ID casework samples in 2017. Often times these drugs are detected mixed with other drugs. **Figure 11** illustrates the seven most commonly detected.

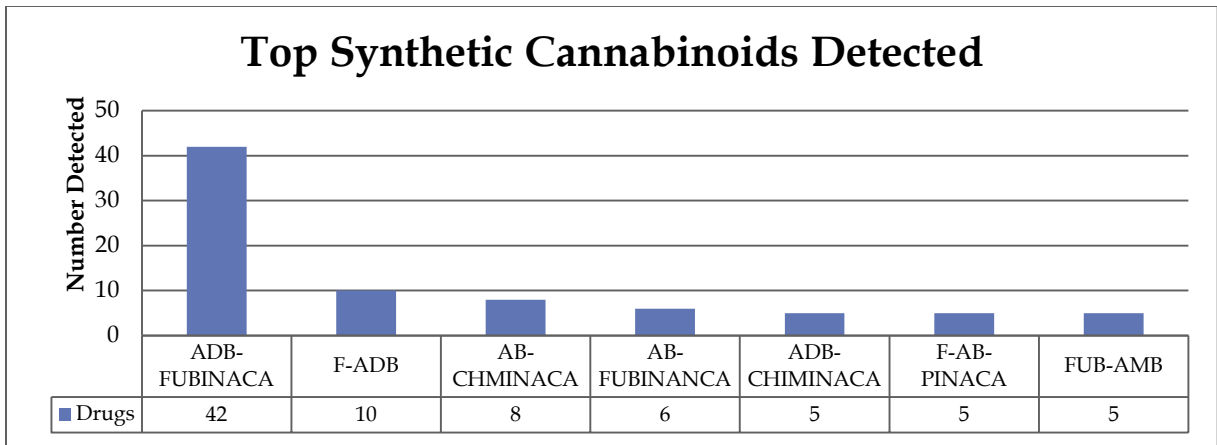


Figure 11: The seven (7) most common synthetic cannabinoids detected from 2017 examinations.

Open Container / Beverage Alcohol

Open Container/Beverage Alcohol analysis is conducted in support of criminal cases with associated drug charges, weapons violations, aggravated assaults and also to support the state and local DUI laws, prohibition of minors to possess alcohol, and other liquor law violations. **Figure 12** illustrates the number of open container cases submitted between 2013 and 2017.

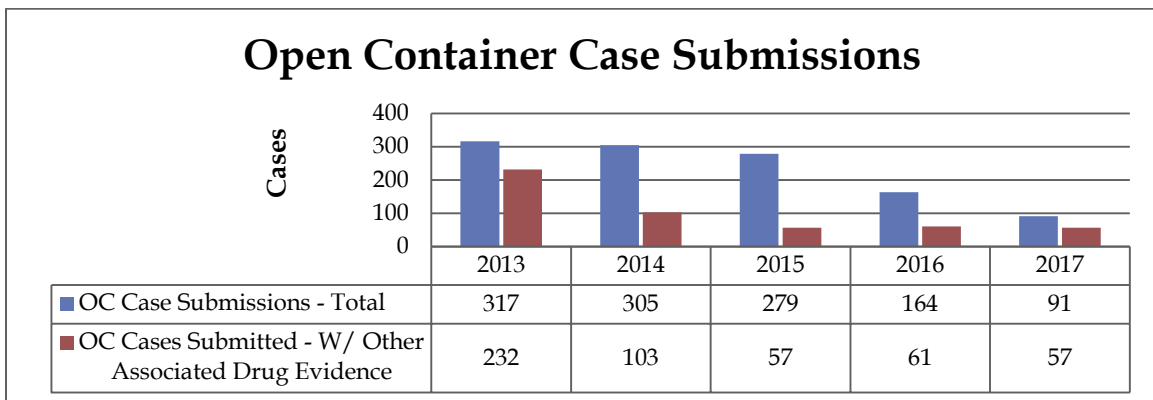


Figure 12: Number of open container cases submitted.

Trace Evidence Unit

The Trace Evidence Unit at the Center 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 2017, the Fire Debris Laboratory received evidence from 19 cases. The trend of case submissions over the last five years is illustrated in **Figure 13**.

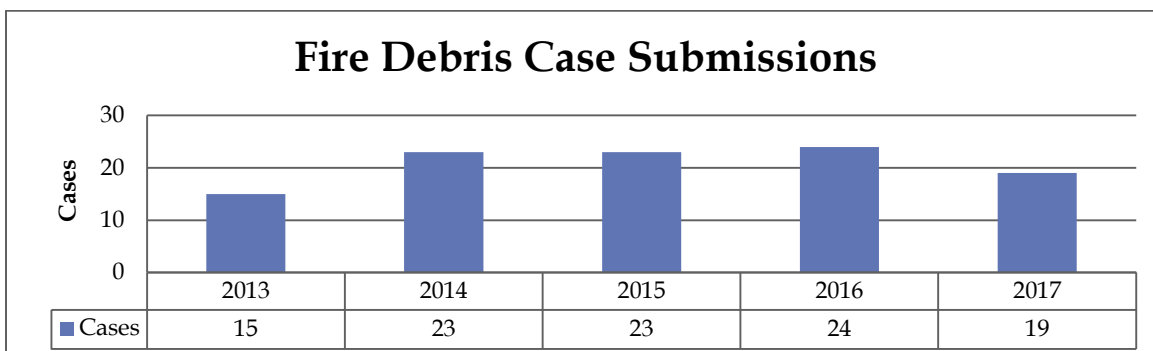


Figure 13 Number of fire debris cases submitted over a five year period.

Firearms/Tool Marks Unit

Firearm and Tool Mark examination is conducted in support of state and federal law enforcement. The Firearms/Tool Marks Unit conducts many types of forensic examinations. The majority of examinations involve operability (function) tests on the submitted firearms. Other exams performed by the Firearms and Tool Marks Unit include bullet comparisons, cartridge casing comparisons, and serial number restorations. As shown in **Figure 14**, the number of cases submissions to the unit has remained relatively constant over the last five years.

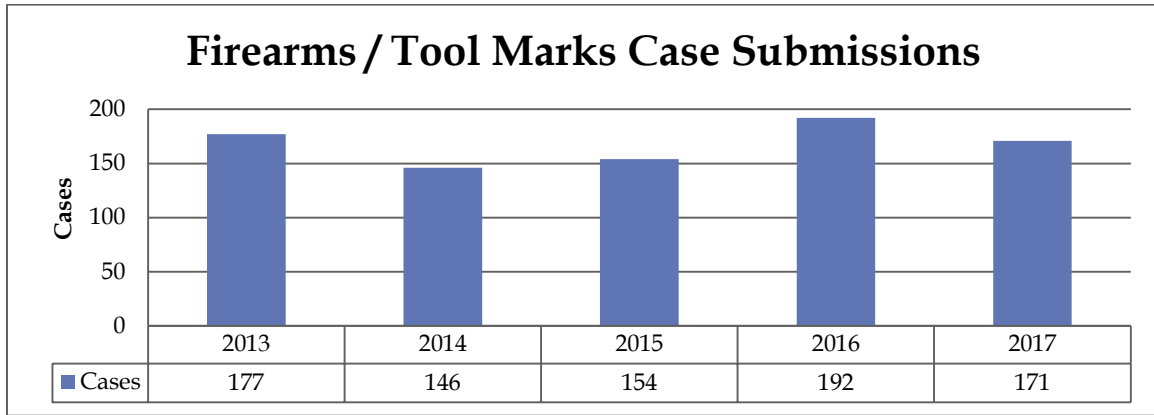


Figure 14 Firearm / Tool Mark case submissions from 2013 through 2017.

Examination types (test fire, bullet comparison, cartridge casing comparison, serial number restoration) that were performed during each of the last five years are illustrated in **Figure 15**.

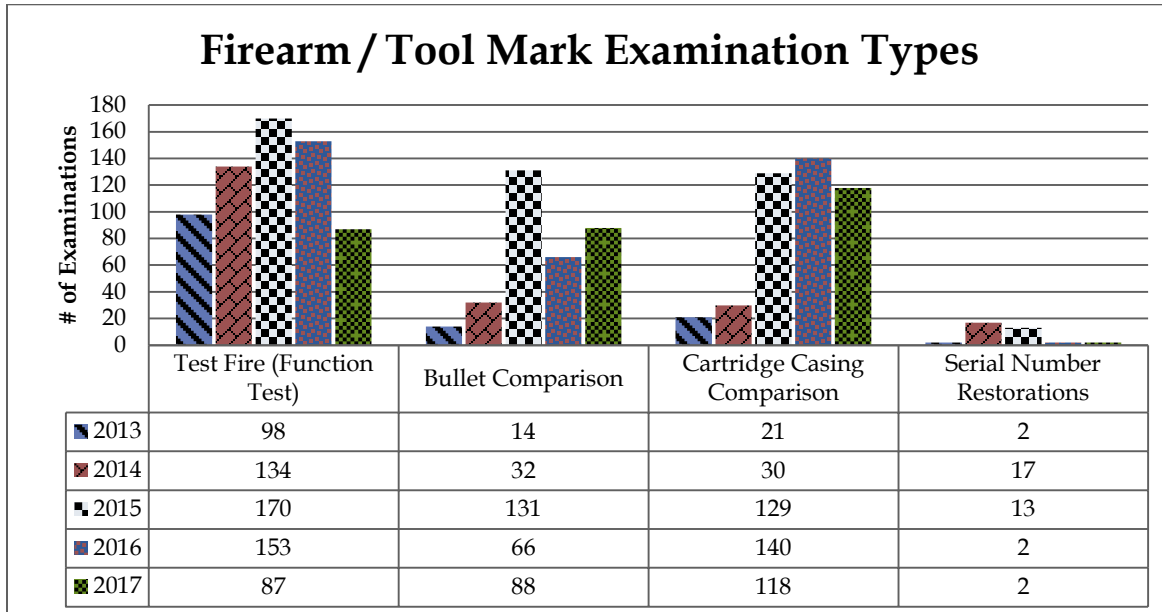


Figure 15 Case examination requests in the Firearms / Tool Marks unit; classified as test fires, bullet comparisons, cartridge case comparisons, and serial number restorations.

FORENSIC 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 evidence (blood, semen, saliva, and feces). For DNA analysis, the laboratory generates short tandem repeat (STR) profiles from biological material left at crime scenes. Once profiles are established from the scene exhibits, they can be compared to reference standards collected from individuals believed to have some association 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 (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 2017, the Biology/DNA laboratory received 294 new cases for forensic DNA examination. The trends of case submissions over the past five years are illustrated in **Figure 16**. Since 2014, there has been a steady increase in the number of cases submitted for analysis. Not only is there an increase in the number of cases, but the number of exhibits per case has increased, as has the complexity of the exhibits.

The challenging nature of the DNA samples submitted for DNA analysis is illustrated by the routine need to consume the evidence for testing due to the limited size and/or compromised nature of samples collected at crime scenes. In 2017, 39% of Biology/DNA cases involved extracting a sample in full and 34% of all forensic questioned exhibits in which there was an attempt to generate a genetic profile using PCR were extracted in full. Notification processes involved with consumptive testing lengthen the timeline for conducting the analysis, and the associated judicial processes generally commence after evidence has already been submitted to the lab.

Also, 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 below.

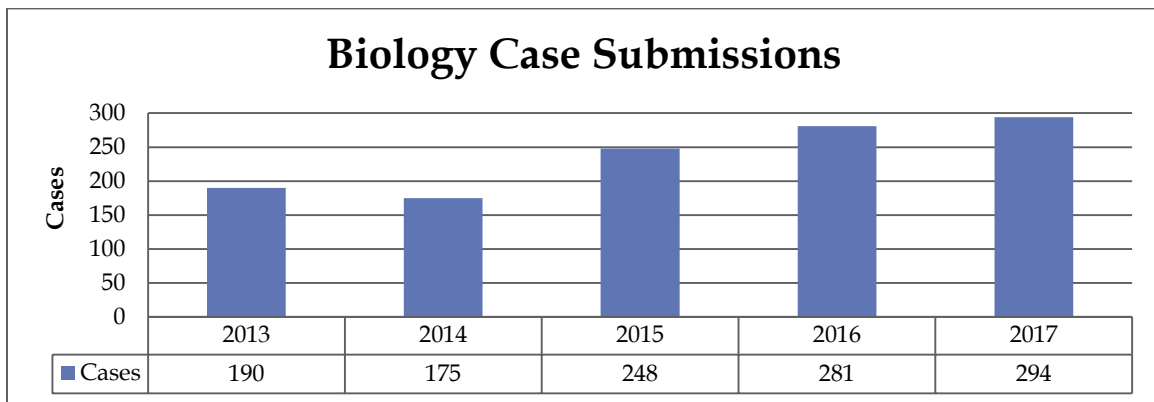


Figure 16 Number of new cases submitted to the Biology / DNA Laboratory over a five year period.

As depicted in **Figure 17**, approximately half of the cases submitted for biological examination was robbery/burglary (50.2%) with sex crimes (34.1%) being second overall.

Property crimes continue to be processed if the evidence submitted has 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 percent (6%) of the case types are categorized as other. This category may include cases involving attempted murder, auto theft, DUID, larceny, vandalism, narcotics, stalking, etc. The laboratory identified human remain(s) in twelve (12) cases through Forensic DNA analysis.

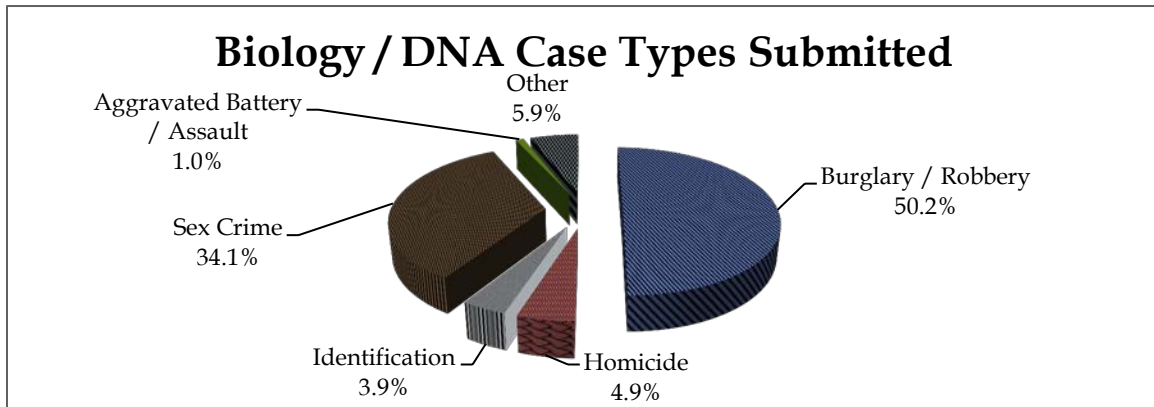


Figure 17 Classification of cases submitted for Biology/DNA analysis.

Figure 18 illustrates the number of Sex Crime cases submitted to the Biology / DNA Laboratory over the last five years. In 2015, the laboratory saw a 100% increase in case submissions over the number submitted in 2014 and a 61% increase over the previous four year average. This increase in cases remained essentially unchanged for 2017.

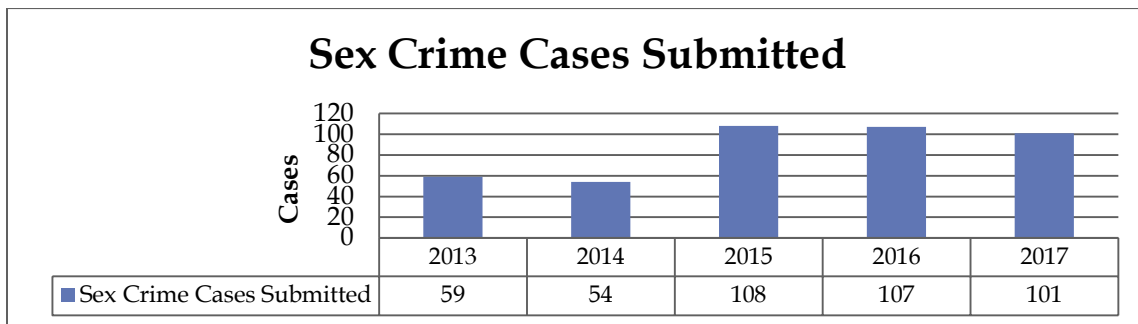


Figure 18 Number of Sex Crime cases submitted to the Biology / DNA Laboratory over the last five years.

CODIS

In 2007 Kansas became an all arrestee state, meaning that law enforcement will collect DNA samples for any person arrested for qualifying offenses. The DNA profile generated from the arrestee/offender is inputted 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 Sedgwick County DNA Laboratory adopted new procedures for the release of investigative lead information, to include formal written and reviewed notifications for database associations.

Ultimately, the increased number of associations 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. All factors taken together caused a spike in workload that was realized in 2010 and continued throughout 2011. By 2012, the vast majority of the backlogged offender

samples had been added to the database and the increase in workload due to CODIS investigative leads began to level off.

Trends in CODIS activity are illustrated in **Figure 19** and **Figure 20**. In 2017, there were 200 profiles entered into CODIS, 135 database hits, and 122 investigations aided. The average number of case profiles entered into CODIS each of the last 5 years is 128, the number of hits each of the last 5 years average 82, and the number of investigations aided each of the last 5 years average 74.

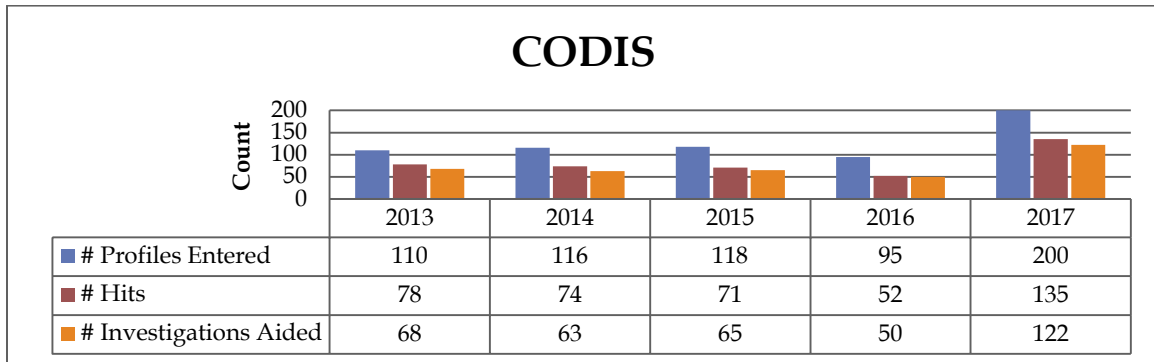


Figure 19 Five (5) year depiction of the number of DNA profiles entered into CODIS as well as the number of hits and number of investigations aided.

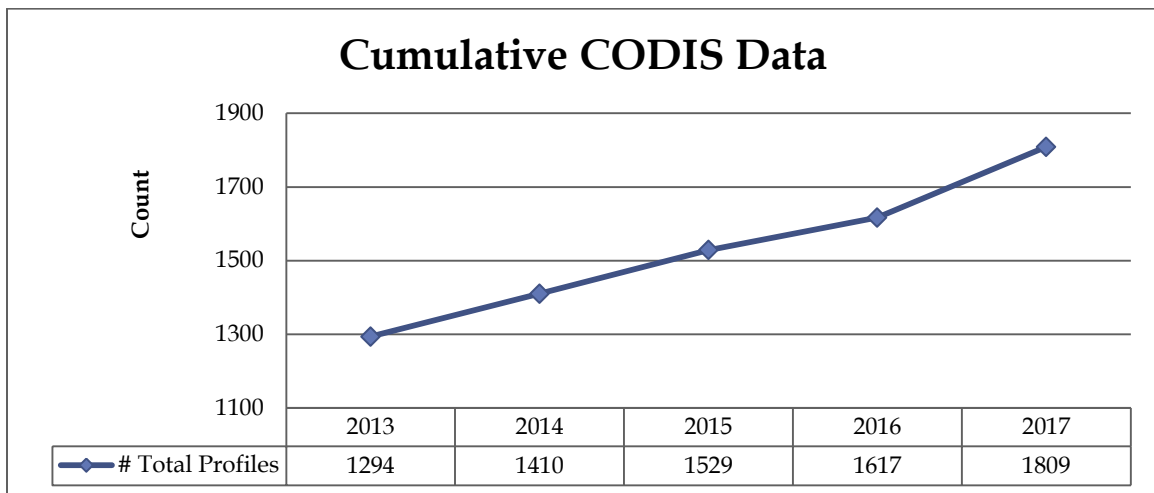


Figure 20 The graph and chart depicts total number of profiles residing in the database (LDIS) at the end of each year.

FORENSIC TOXICOLOGY

The Forensic 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/alcohol cases and drug-facilitated sexual assault cases are also examined 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 of the cases are ante-mortem cases (DUI [Driving Under The Influence], DUID [Driving Under The Influence Of Drugs], DFSA [Drug Facilitated Sexual

Assault], etc.) submitted by law enforcement agencies. Illustrated in **Figure 21** is the total number of cases submitted to the Toxicology Laboratory over a 5 year period.

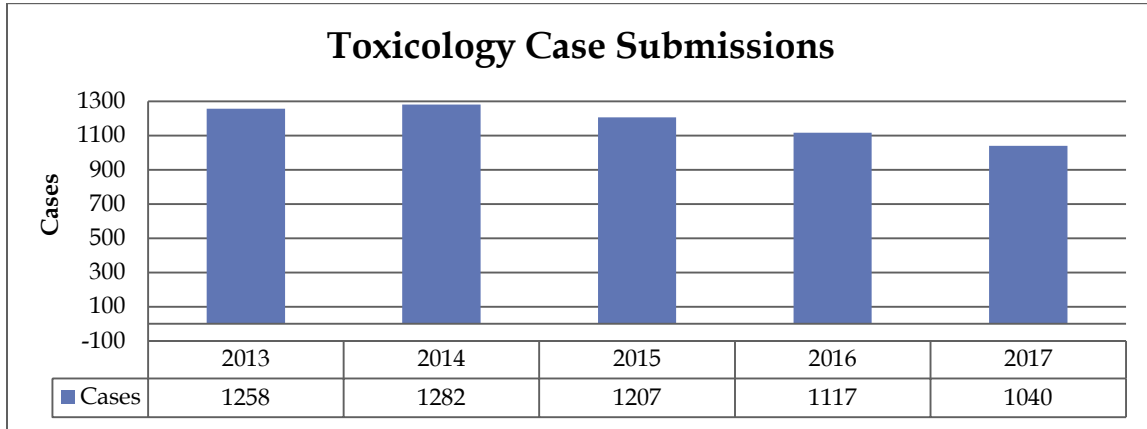


Figure 21 Number of cases submitted to the Toxicology Laboratory for analysis over a five year period.

Figure 22 depicts the percentage of toxicology cases submitted by case type. Toxicological examinations in support of the District Coroner (PM) account for approximately 70% of the forensic case work performed by the laboratory.

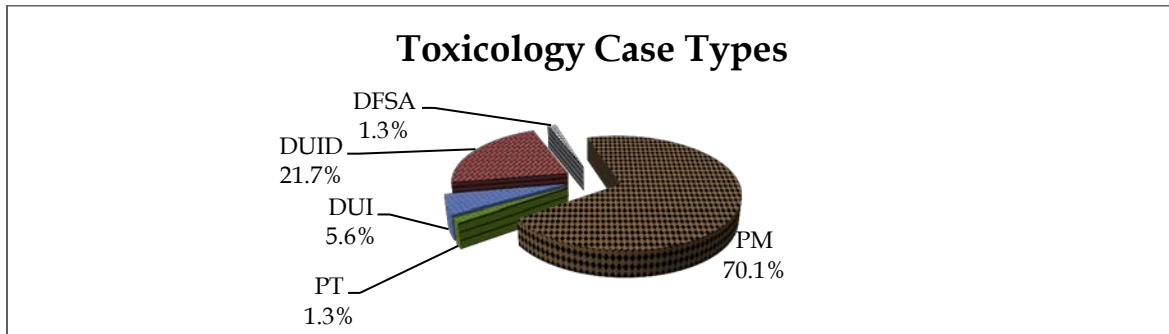


Figure 22 Submission of toxicology cases, sorted by case type. DUI (Driving Under the Influence of Alcohol), DUID (Driving Under the Influence of Drugs), PM (Post-Mortem), DFSA (Drug Facilitated Sexual Assault), and Proficiency Tests (PT).

Alcohol and Drugs

Alcohol continues to play a significant role in all of the FSL toxicology case types as depicted below in **Figure 23**. Blood alcohol results that were at least twice the legal limit of 0.08 gm% were detected in approximately 60% of DUI cases and 17% of DUID cases.

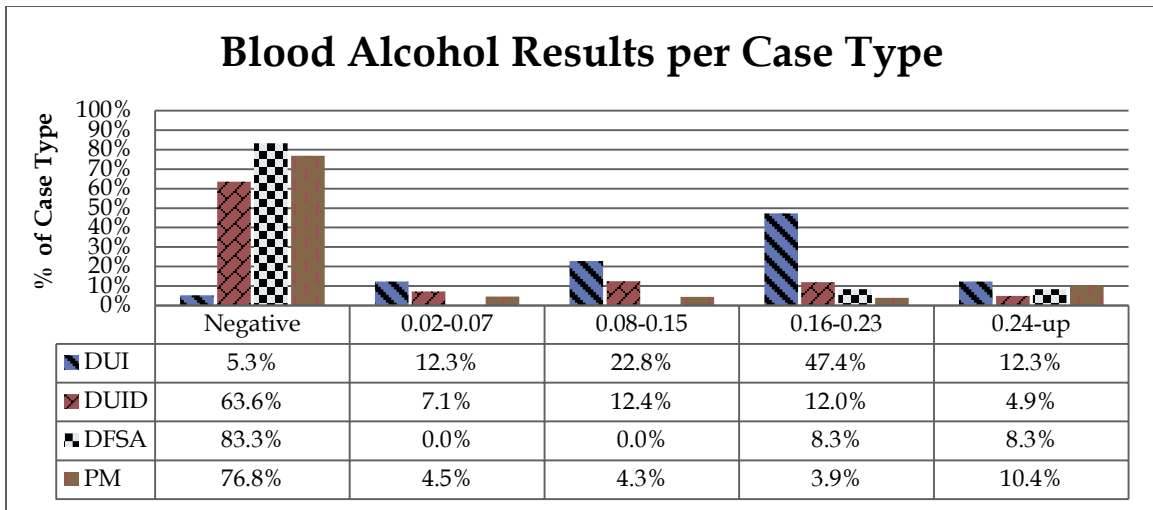


Figure 23 Percentage of alcohol test result ranges for each category of cases.

In approximately 23% of the post-mortem case investigations there was a positive finding of alcohol as depicted below in **Figure 24**.

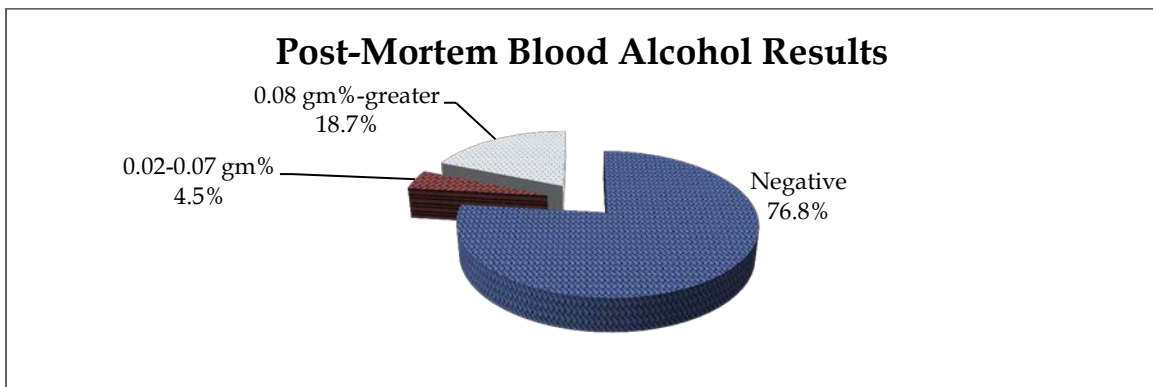


Figure 24 Post-mortem blood alcohol results for 2017.

Drug-Related Deaths

Opioid deaths remained high for 2017 with a total of 139. The range of opioid related deaths over the past five years is 135 to 160 with an average of 148 deaths. In 2016, designer opioids (Despropionylfentanyl, Furanylfentanyl, and U-47700) were detected in specimens from two cases, none were detected in 2017 submitted specimens. **Figure 25** 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 2013 and 2014 are included in the other opioids case count.

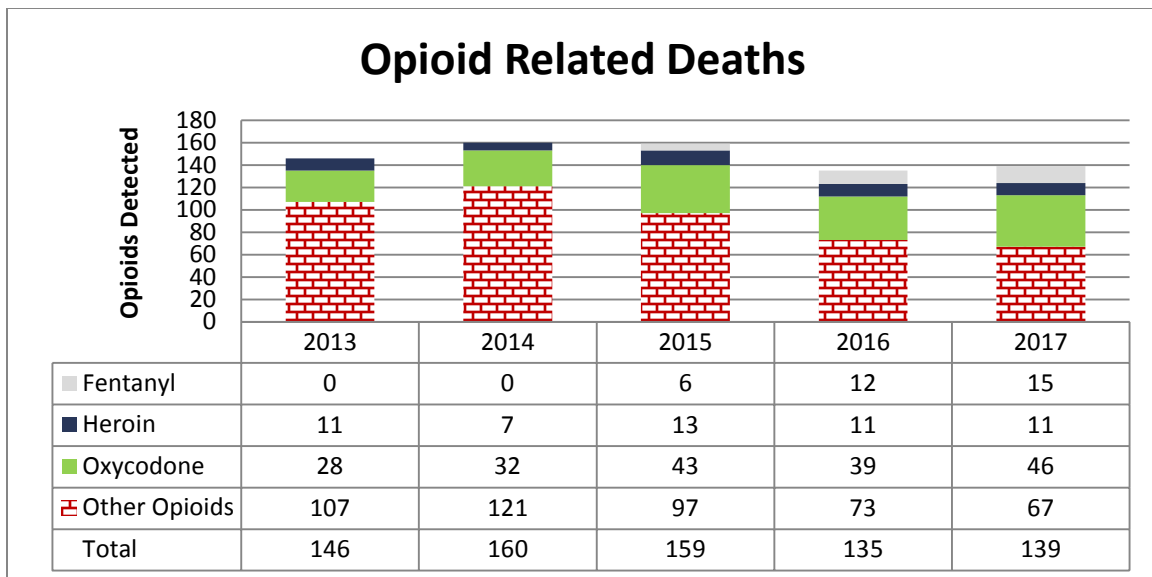


Figure 25: Opioid related death count detected in Postmortem Toxicology cases over the last five years.

Table 3 below illustrates the number of cases that each opioid was detected in postmortem toxicology specimens.

Opioids Detected In Postmortem Specimens	2013	2014	2015	2016	2017
6-Monoacetylmorphine / 6-Acetylmorphine	11	9	13	11	13
Buprenorphine	-	-	0	1	0
Codeine	56	41	14	7	5
Despropionylfentanyl	-	-	0	1	0
Dihydrocodeine	-	-	0	1	0
EDDP	-	-	2	3	2
Fentanyl	10	12	6	12	15
Furanyl-fentanyl	-	-	0	1	0
Hydrocodone	80	60	35	31	37
Hydromorphone	-	-	13	10	5
Loperamide	-	-	0	3	0
Methadone	46	46	29	15	21
Morphine	-	-	48	40	27
n-Didesmethyltramadol	-	-	-	-	4
n,o-Didesmethyltramadol	-	-	1	0	1
Norbuprenorphine	-	-	0	1	0
o-Desmethyltramadol	-	-	4	4	9
Oxycodone	27	32	43	44	48
Oxymorphone	-	-	14	18	9
Propofol	-	-	0	3	0
Tramadol	10	12	8	13	9
U-47700	-	-	0	1	0

Table 3 Opioids detected in death cases over the last 5 years. Previous to 2015, data was captured in categories for Codeine / Morphine, Hydrocodone / Hydromorphone / Dihydrocodeine, Methadone / Normethadone / EDDP / EMDP, Oxycodone / Oxymorphone, and Tramadol / n-Desmethyltramadol / o-Desmethyltramadol instead of individually.

Aside from alcohol, tetrahydrocannabinol (THC) / carboxytetrahydrocannabinol (THCA) [**THC: psychoactive ingredient found in marijuana**] is the most commonly found drug in post-mortem 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 the 10 most common drug findings in post-mortem toxicology cases [excluding ethyl alcohol] for 2017 cases.

Alprazolam / a-Hydroxyalprazolam
Amphetamine / Methamphetamine
Cocaine / Benzoylecgonine / Cocaethylene
Diphenhydramine
Gabapentin
Hydrocodone / Hydromorphone
Methadone
Morphine / Codeine
Oxycodone / Oxymorphone
Tetrahydrocannabinol / Carboxytetrahydrocannabinol

Table 4: The 10 most commonly detected drugs / metabolites (Post Mortem) detected in 2017 listed alphabetically.

Alcohol Positive Drivers

Alcohol plays a significant role in driving under the influence cases. For cases submitted in 2017, 51% of the tested samples in DUI and DUID cases were negative for the presence of alcohol. **Figure 26** shows that approximately 83% of alcohol positive drivers were at or above “per se” limit of 0.08 gm%.

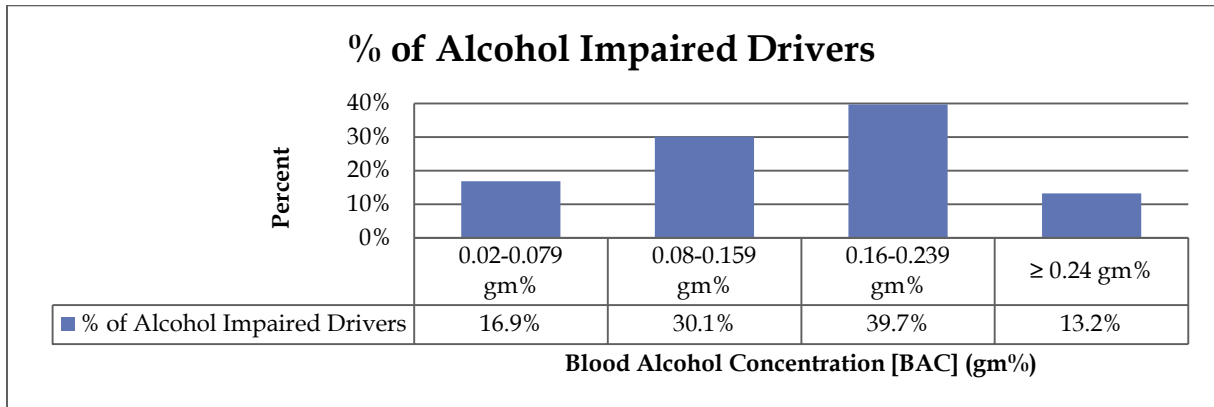


Figure 26 Alcohol test result ranges (gm%) of positively tested samples submitted for DUI and/or DUID analysis.

As illustrated in **Figure 27**, the vast majority (82.5%) of samples submitted in Driving-Under-the-Influence [DUI] cases were found to have alcohol concentrations at or above the legal limit of 0.08 gm%.

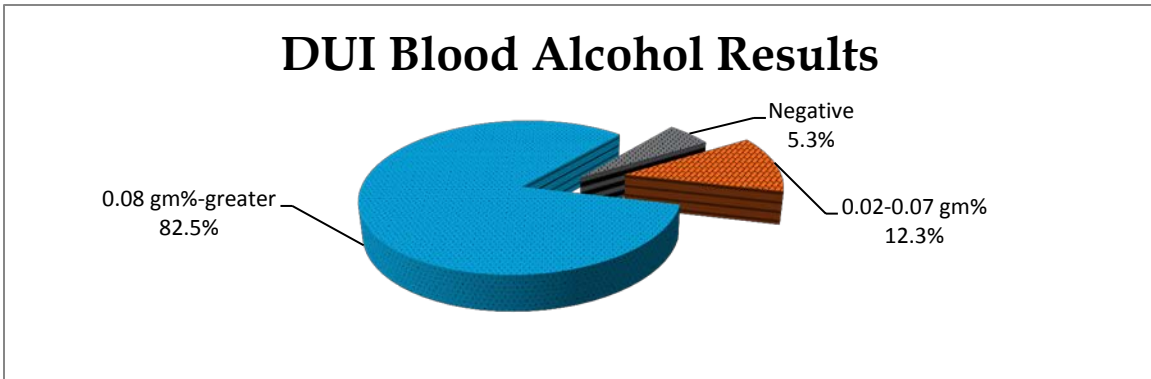


Figure 27 DUI blood alcohol results.

Alcohol Positive Drivers – Under the Age of 21

The legal age for possession of alcohol is 21 years of age. In 2017, approximately 9% of all motor vehicle drivers testing positive for alcohol were under the age of 21. **Figure 28** 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 over 21 years old, approximately 41% had alcohol concentrations ≥ 0.08 gm%.

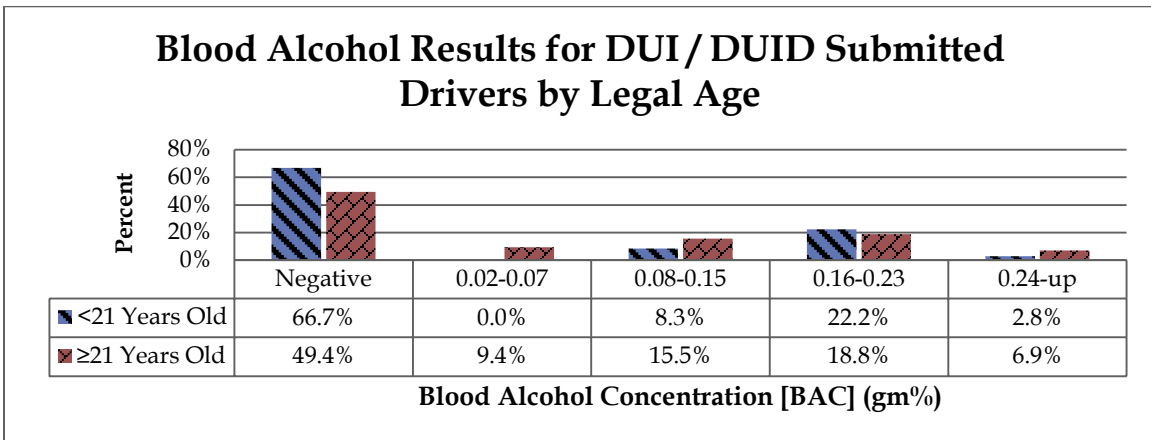


Figure 28 DUI and DUID results sorted by age (minors vs. 21 years and older).

Drugs and Driving

Many driving cases involve drivers that are under the influence of tetrahydrocannabinol (THC). **Figure 29** provides the number of positive THC results from the 225 DUID [Driving Under the Influence of Drugs] cases submitted in 2017. There was measureable THC detected in 62, or 27.5%, of the 2017 submitted cases. This percentage is an underestimation of the true number of drivers with THC in his/her system, since if the blood alcohol level detected is ≥ 0.100 gm% the laboratory does not routinely test for other drugs.

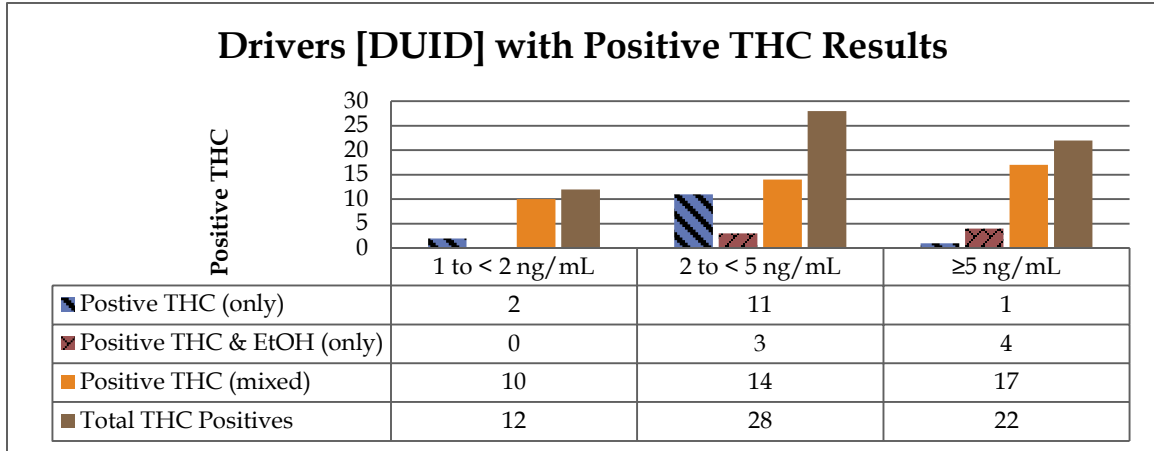


Figure 29 The number of positive tetrahydrocannabinol (THC) specimens analyzed from DUID cases submitted in 2017. The table compares the number of drivers that tested positive for THC only and drivers that tested positive for THC mixed with any other drugs, including alcohol.

Approximately 63% of DUID cases were found to be negative for alcohol upon pre-screening, 7.1% were cases involving blood alcohol levels below the legal limit and 29.3% of the cases were at or above the legal limit (0.08 gm% and up) [**Figure 30**].

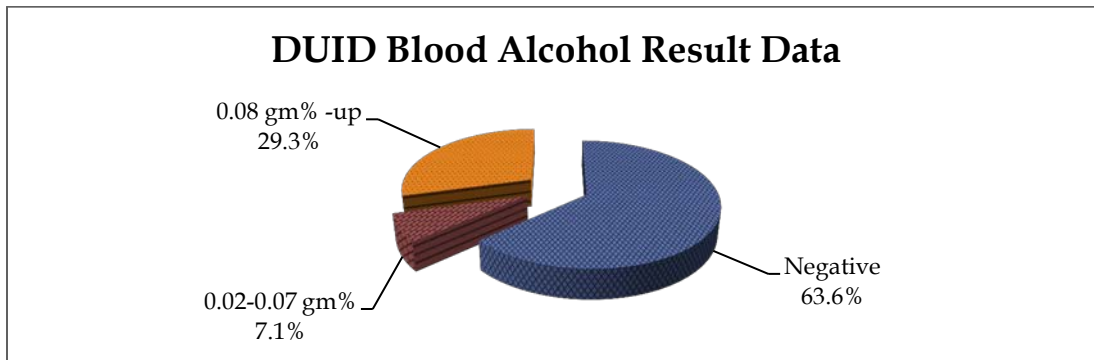


Figure 30 General alcohol testing result ranges for DUID submitted cases.

Drugs play a significant role in driving under the influence cases and can cause different levels of impairment. As depicted in **Figure 31**, the majority (79.5%) of DUI cases tested in 2017 were found to be positive for the presence of drugs.

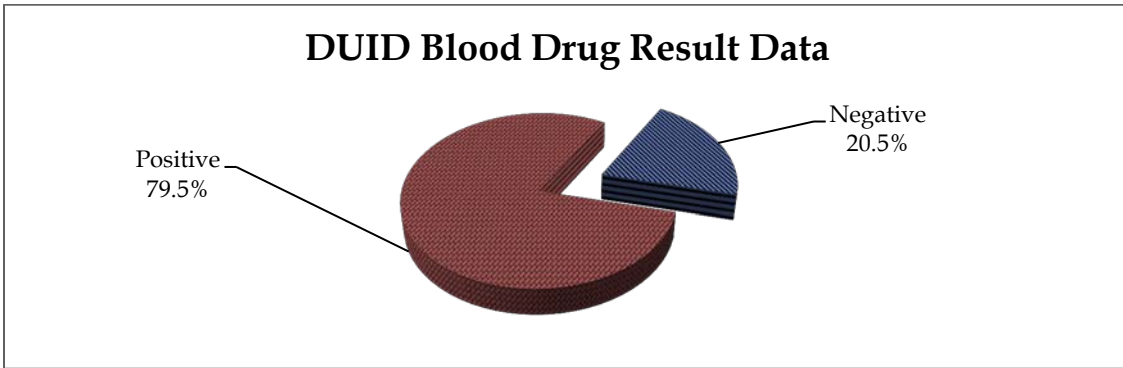


Figure 31 DUID blood drug results.

Driver Drug Usage

In DUI cases where drugs were detected, approximately 76% were prescription drugs and 24% were illicit [**Figure 32**]. Although drugs are classified as prescription drugs, they can also be considered illicit in use. Prescription drugs can be abused by individuals with or without a prescription for the drug. The most commonly abused prescription drugs are Opioids and Benzodiazepines.

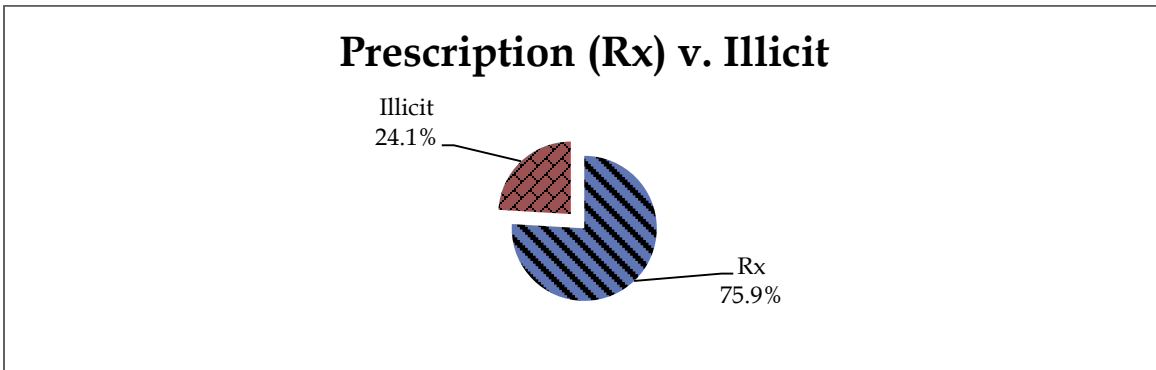


Figure 32 Percentage of prescription (Rx), and Illicit drugs detected in DUI.

Table 5 depicts the 10 most common drugs detected in driving-under-the-influence-of-drugs [DUI] toxicology cases [excluding ethyl alcohol] in 2017.

Alprazolam / a-Hydroxyalprazolam
Amphetamine / Methamphetamine
Carisoprodol / Meprobamate
Cocaine / Benzoyllecgonine
Diazepam / Nordiazepam
Hydrocodone / Hydromorphone
Methadone
Phencyclidine
Tetrahydrocannabinol / Carboxytetrahydrocannabinol
Zolpidem

Table 5: The ten (10) most commonly detected drugs / metabolites detected in DUI cases in 2017 listed alphabetically.

Drug-Facilitated Sexual Assaults

Drug-Facilitated Sexual Assaults [DFSA] continue to be difficult forensic investigations. The cases often involve a perpetrator who will surreptitiously administer a drug to a victim to render them unconscious and sexually assault them. In 2017, the Toxicology Laboratory completed eighteen (18) DFSA cases [Table 6]. Ethanol was detected in four (4) of the completed DFSA cases.

Case Completion Year	Cases Completed
2015	8
2016	4
2017	18

Table 6: DFSA cases completed each year since 2015.