HOME DEPARTMENT
GOVERNMENT OF THE PUNJAB

PUNJAB FORENSIC SCIENCE AGENCY

ANNUAL PERFORMANCE REPORT 2022

"Forensic science is the silent witness that speaks the truth in court."

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SUMMARY

The Punjab Forensic Science Agency (PFSA) is adhering to Section 15 of the Punjab Forensic Science Agency Act of 2007 by providing a comprehensive overview of its performance in terms of submitted cases, generated reports, and existing case backlog across its laboratories. Measures and strategies are actively being implemented to effectively reduce the backlog.

Brief introduction of following forensic disciplines is provided;

- Audio Visual Analysis Department
- Computer Forensics Department
- Crime Scene Investigation / Death Scene Investigation Department
- DNA & Serology Department
- Firearms & Tool Marks Department
- Forensic Photography Department
- Latent Fingerprints Department
- Narcotics Department
- Polygraph Examination Department
- Questioned Documents Department
- Forensic Toxicology Department
- Forensic Pathology & Histology Department
- Trace Chemistry Department

PREFACE

Forensic science involves the utilization of scientific methods in relation to criminal and civil laws; primarily focused on analysing diverse forms of evidence found at crime scenes and establishing connections between the evidence and the crime. The domain of forensic science is vast and encompasses numerous specialized fields within it.

As second largest state-of-the-art laboratory globally, Punjab Forensic Science Agency offers forensic evidence analysis services in 14 disciplines, alongside expert testimony in the court of law whenever required.

Punjab Forensic Science Agency (PFSA) aims to deliver precise, accurate and prompt analysis and results to contribute to the administration of justice. To achieve this objective, the laboratories of PFSA adhere to the ISO/IEC 17025:2017 International Standard for their testing activities, utilizing validated methods whether standardized or developed within the laboratory.

The ISO/IEC 17025:2017 standard establishes requirements of competence to conduct testing, calibration, and sampling; and is widely adopted by forensic laboratories worldwide. Upholding quality laboratory results necessitates adhering to minimum standards of care and attention throughout the entire process; from procurement of evidence to collection method, timing, storage, transport, and handling of collected evidence, as well as the testing of evidence samples and report generation.

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MISSION STATEMENT

To receive physical evidence from Law Enforcement Agencies (LEA) in criminal as well as civil matters, analyse these and provide accurate results of forensic analysis well in time (on first come first served basis) and testify in COURTS OF LAW on analytical findings for the people of Punjab when required.

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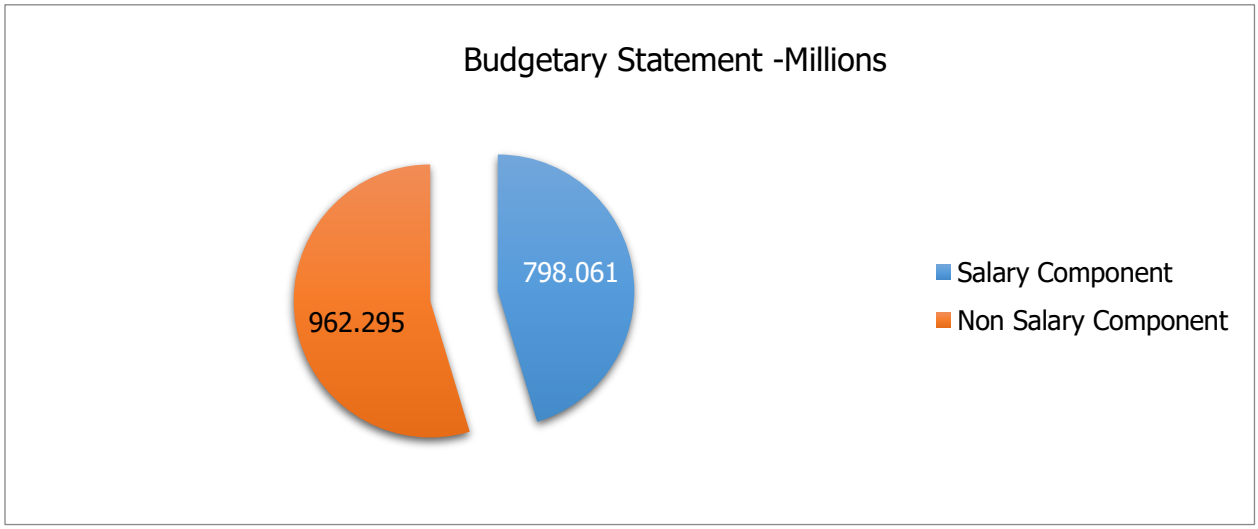
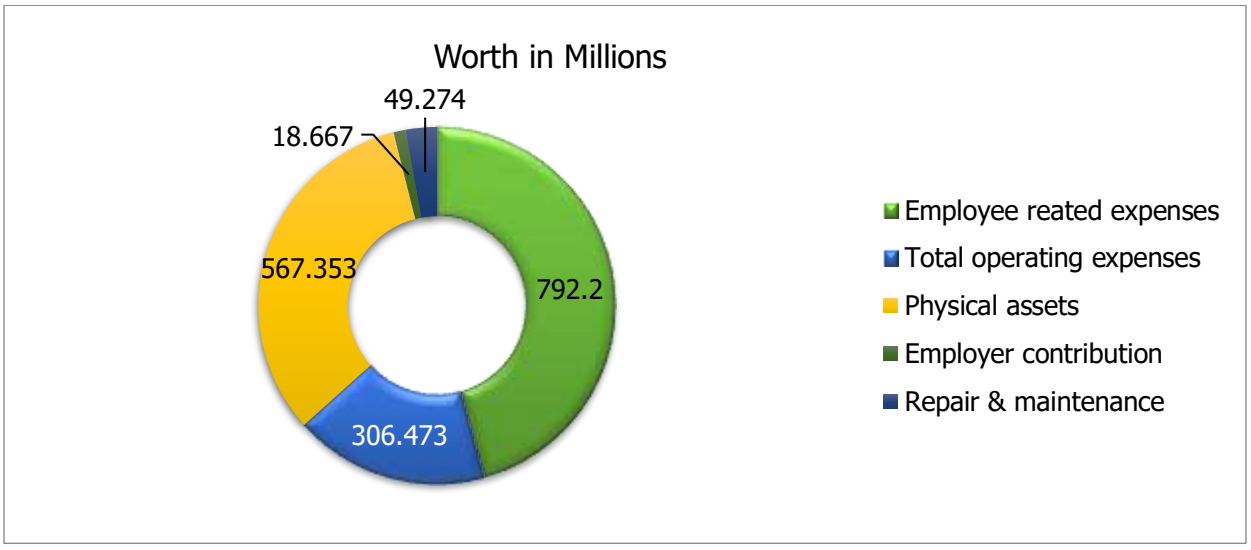
FINANCIAL REVIEW



Major expenses are as under:



The profitability of any business relies on the product's cost, and the Punjab Forensic Science Agency (PFSA) is no exception. Although forensic analysis is conducted free of charge for all law enforcement agencies, the government of Punjab provides necessary budget funds. These funds cover expenses such as purchasing chemicals, equipment, and instruments. The evidence items involved in a specific case undergo forensic analysis, and the end result is a laboratory examination report. To determine the cost,

the total number of items processed for forensic analysis across all 14 disciplines is calculated. This cost represents the amount of money that would have been spent if these items had been outsourced to a vendor laboratory for analysis. It is common for vendor forensic laboratories to charge an analysis fee based on the urgency of the request, with up to three times the regular cost for expedited analysis. The table below illustrates that in 2022, PFSA generated laboratory reports containing analysis valued at Rs 6.5 billion. According to the table, if forensic analysis had been outsourced to a foreign vendor forensic laboratory, government of Punjab would have incurred a cost of Rs. 26.3 billion.

Section	Total cases	Total no of items	PFSA analyses (PKR-millions)	Analysis cost if evidence items out-sourced to foreign vendor laboratory (PKR - millions)
AV	1604	3134	21.4	1383.6
CF	673	2644	21.0	1249.4
NAR	52840	86496	313.2	325.3
PGR	114	265	3.0	23.3
QD	668	2979	31.0	1277.4
PATH	2939	11593	30.8	47.4
TC	845	2970	61.5	29.3
TOX	4221	6415	271.5	317.0
DNA	9971	45722	5,117.3	14,127.2
FTM	31189	52606	24.4	974.0
LFP	3260	15048	76.3	5836.8
CSI	15181		564.0	712.3
Total	**123,505**	**229,872**	**6,535**	**26,303.0**

Another aspect of the benefits derived from the efforts of the Punjab Forensic Science Agency (PFSA) is the acquisition of foreign donations facilitated by the Director-General of PFSA.

HUMAN RESOURCE DEVELOPMENT

➢ Continuing Education

1. Human Resource Development: Continuing Professional Development.

2. In 2022, more than 100 scientists participated in one or more of the following international conferences, symposiums, and trainings, emphasizing the importance of continuing professional development:

(i) CSI Korea Conference – Korean Police Department

(ii) Safe Handling of Synthetic Opioids – A training by UNODC in Vienna (Austria).

(iii) The 2022 Forensic Symposium on Current Trends in Seized Drug Analysis, hosted by The Center for Forensic Science Research & Education in the USA.

(iv) Training on the UNODC Toolkit for Identification of New Psychoactive Substances.

(v) The 2022 Forensic Symposium on Current Trends in Forensic Trace Analysis, organized by The Center for Forensic Science Research & Education in the USA.

(vi) Annual Scientific Meeting of the American Academy of Forensic Sciences.

(vii) HID future trends in Forensic DNA technology

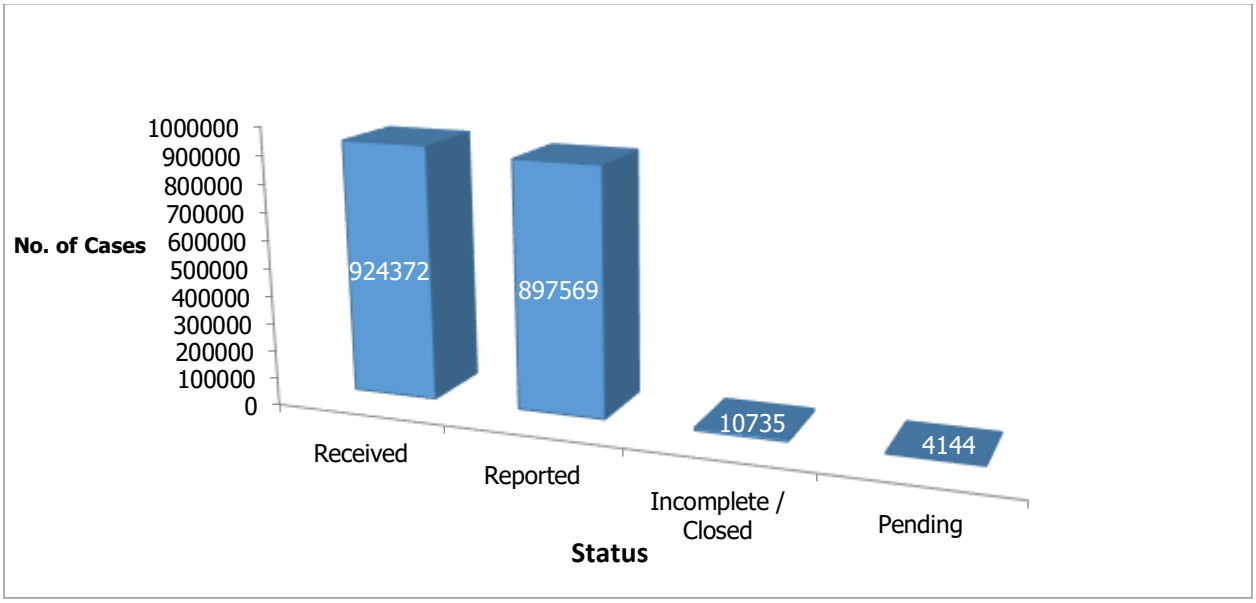
These events offer scientists valuable opportunities to enhance their knowledge, skills, and professional growth in the field of forensic science.

Positions	Sanctioned	Filled	Vacant
Forensic Scientists	177	133	44
Junior Forensic Scientists	285	209	76
Administrative/Technical/Support Staff	593	494	99
Total	1055	836	219
PFSA is currently working with **79.2%** human resource strength.			

PFSA CASE LOG
(SINCE INAUGURATION TO 31/12/2022)

PFSA, since its establishment in 2011, has recorded a total of 924,372 cases, out of which 897,569 cases have been reported. The backlog or pendency rate stands at 0.44%, which is significantly lower than the case backlog observed in other international laboratories. PFSA is actively working towards resolving this minimal number of pending cases, amounting to 0.44%, by the end of 2023.

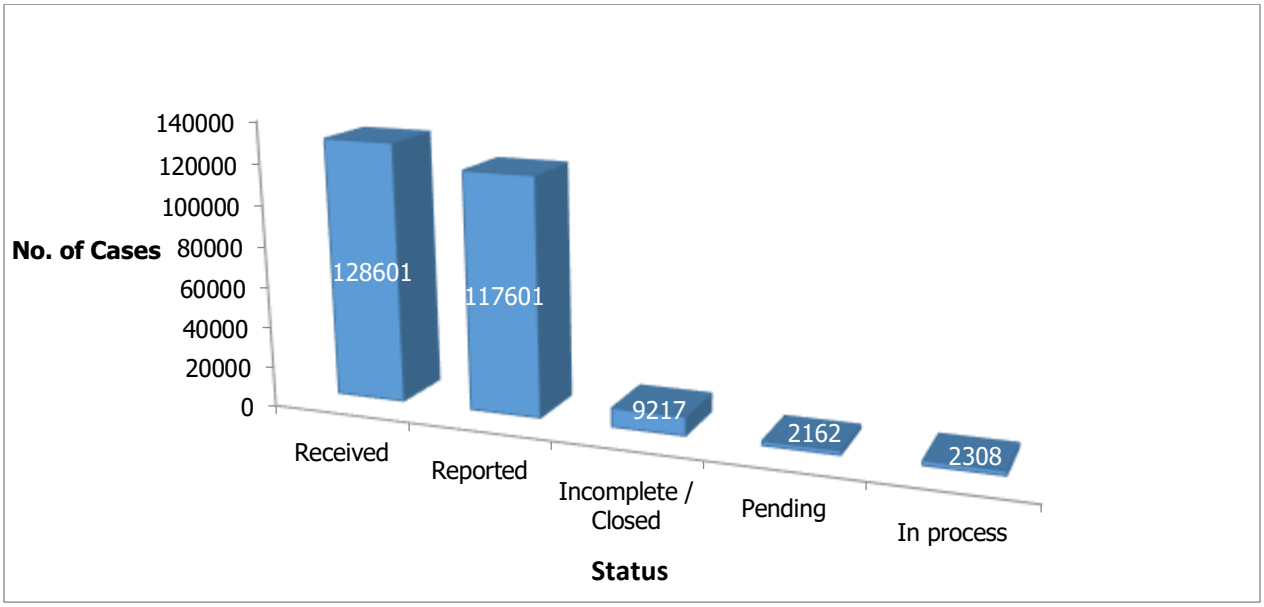
A survey conducted by the National Institute of Justice, USA, sponsored by the United States Department of Justice, examined 187 forensic laboratories in the years 2005, 2007, 2008, and 2009. The survey revealed that the year-end case backlogs for those years were 42%, 32%, 40%, and 35% respectively, indicating higher levels of pending cases compared to PFSA's current backlog rate.



The presence of a case backlog is attributed to the continuous rise in the number of cases submitted each year, indicating that the backlog is likely to persist, albeit at a relatively smaller percentage.

PFSA PROGRESS REVIEW (2022)

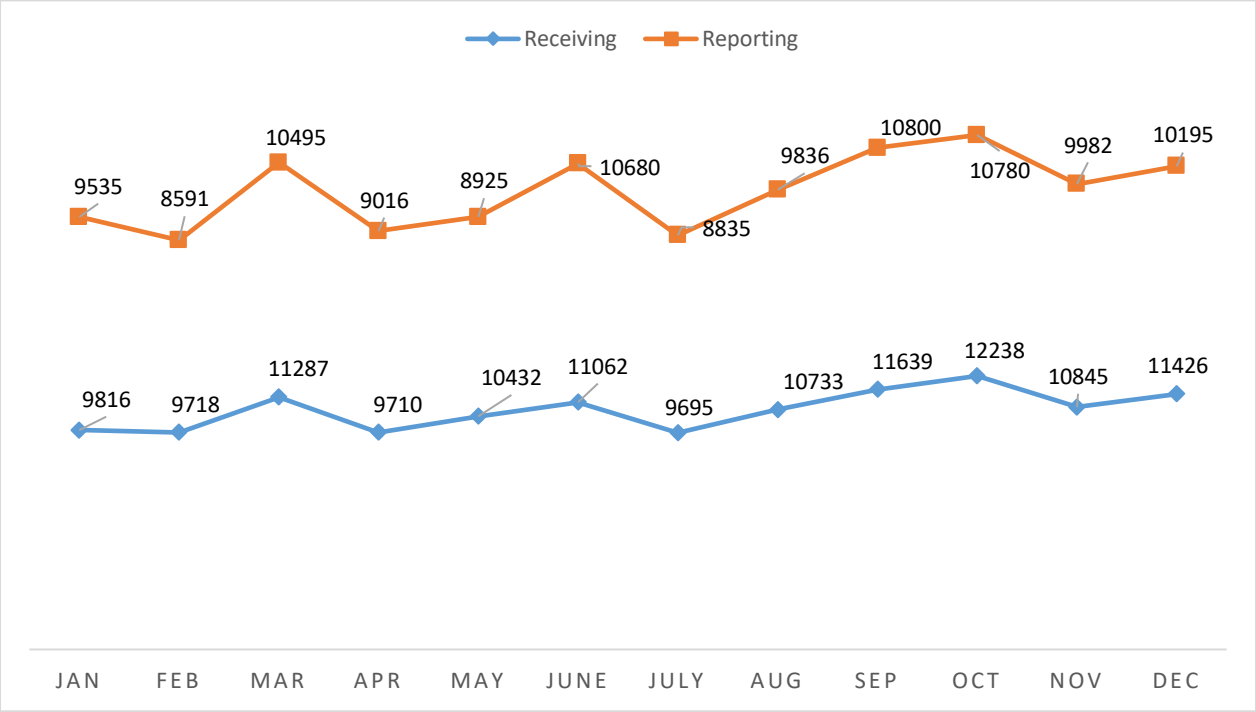
In the year 2022, PFSA recorded a total of 128,601 cases. The backlog or pendency rate for the same year stands at approximately 1.68%. The graph below illustrates the total number of cases received and reported by PFSA in the year 2022:



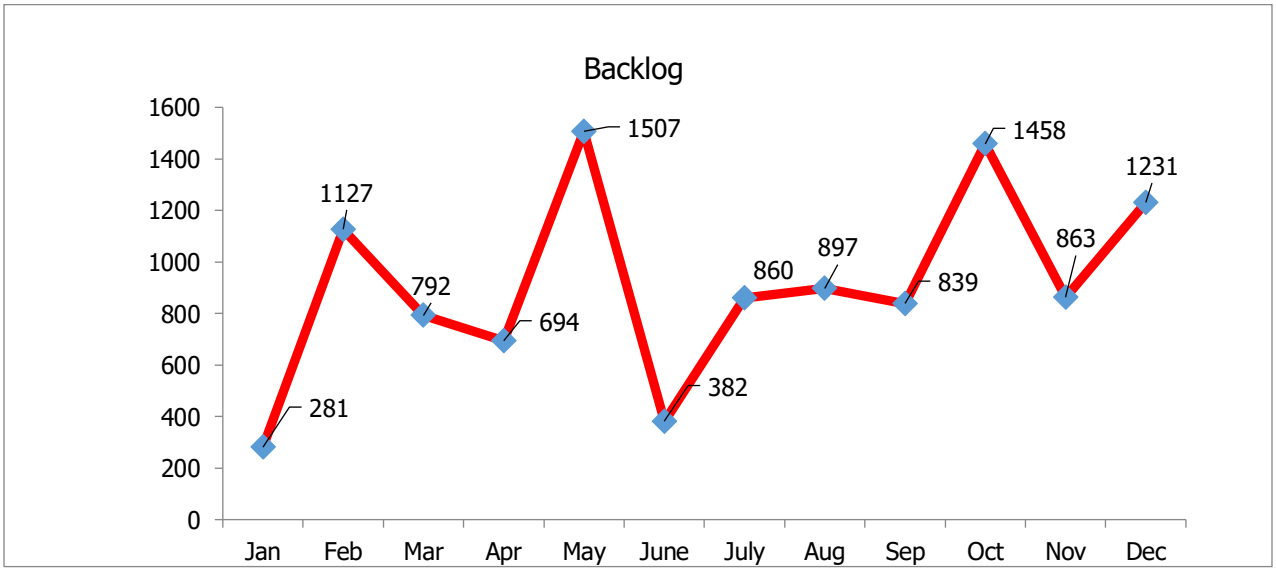
During the year 2022, PFSA reported a total of 117,670 cases out of the 128,601 cases received.

Out of the cases received in 2022, 9,217 were incomplete due to non-submission of reference samples/standards or were closed due to discrepancies. By the end of the year 2022, there were 2,162 cases pending analysis, which accounted for only 1.68% of the total cases received in that year.

Month wise (January 2022 to December 2022) graph of cases received and reported in PFSA:



The line graph depicts a parallel trend between the number of cases received and the reports generated, with noticeable spikes observed throughout the year.



A comparison of influx of cases during year 2021 and year 2022 is given as follows;

Month	Cases Received in Year 2021	Cases Received in Year 2022	% age Increase in Incoming Cases
January	10043	9816	-2.2% (decreased)
February	9202	9718	5.6%
March	11375	11287	-0.7% (decreased)
April	8700	9710	11.6%
May	9567	10432	9.04%
June	11216	11062	-1.3% (decreased)
July	10178	9695	-4.7% (decreased)
August	9282	10733	15.6%
September	10064	11639	15.6%
October	9150	12238	33.7%
November	9787	10845	10.8%
December	10707	11426	6.7%
Total	119271	128601	4.56%
OVERALL % age Increase/Decrease in Incoming case			**7.8%**

Despite an increased influx of cases, the PFSA effectively managed the submitted cases, as evident by an overall backlog of only 1.68% by the end of 2022, showing efficiency of the PFSA staff in processing these cases.

➢ *Reasons for Backlog:*

Forensic case backlog is not unique to Pakistan; even western countries, like USA, face this problem despite having ample resources. Nevertheless, PFSA has managed to maintain an overall backlog of only 1.68% (including pending cases from the previous year), which is favourable than the best forensic facilities worldwide. Several factors have contributed to this backlog;

(i) Continuous increase in case submissions (7.8% rise in 2022) due to public confidence and awareness in forensic evidence analysis.

(ii) Insufficient cooperation and coordination among the prosecution, police, judiciary and the forensic agency.

(iii) Inadequate education about forensic techniques among the police, prosecution and judiciary.

(iv) Shortage of human resources (as PFSA is currently operating at 79.2% staff capacity).

(v) Submission of non-probative evidence.

(vi) Submission of unnecessary evidence.

To address this backlog, following general steps have been taken;

(i) Implementation of a case-return-policy in case of discrepancies.

(ii) Completion of the recruitment process to fill remaining 20.8 % of vacant positions; thereby increasing efficiency.

(iii) Implementation of an evidence rejection policy.

(iv) Performance evaluation measures.

(v) Streamlining processes to simplify them.

(vi) Utilizing support staff in technical departments to optimize staff utilization.

(vii) Hiring of technical expertise in pathology.

(viii) Providing technical training to staff.

(ix) Conducting training programs for the judiciary.

(x) Conducting training programs for the prosecution.

(xi) Conducting training programs for law enforcement agencies

PFSA CASE RECEIVING (DIVISION WISE)

(Jan 2022 to Dec 2022)

Division	Cases Received	Cases Reported	%age Cases Reported
Lahore	22684	20752	91.5%
Gujranwala	22724	20841	91.7%
Faisalabad	16227	14403	88.8%
Sahiwal	8649	7742	89.5%
Multan	14297	13159	92.0%
Rawalpindi	11790	10847	92.0%
Bahawalpur	10679	10037	94.0%
Sargodha	9745	8990	92.3%
DG Khan	9968	9012	90.4%

Lahore Division:

District	Cases Received	Cases Reported
Lahore	16634	13570
Sheikhupura	2859	2506
Kasur	3003	2580
Nankana Sahib	2188	2096
Total	22684	20752

➢ *Gujranwala Division:*

District	Cases Received	Cases Reported
Gujranwala	7569	7006
Sialkot	5925	5489
Gujrat	3291	2894
Hafizabad	2070	1863
Narowal	1900	1796
Mandi Bahauddin	1969	1793
Total	22724	20841

➢ *Faisalabad Division:*

District	Cases Received	Cases Reported
Faisalabad	9689	8528
Jhang	2335	2015
Toba Tek Singh	2245	2045
Chiniot	1958	1815
Total	16227	14403

➢ *Sahiwal Division:*

District	Cases Received	Cases Reported
Okara	3195	2724
Sahiwal	3008	2849
Pakpattan	2446	2169
Total	8649	7742

➢ *Multan Division:*

District	Cases Received	Cases Reported
Vehari	3478	3126
Multan	5582	5204
Lodhran	2277	2107
Khanewal	2960	2722
Total	14297	13159

➢ *Rawalpindi Division:*

District	Cases Received	Cases Reported
Rawalpindi	6489	5864
Attock	2148	2004
Jhelum	1767	1709
Chakwal	1386	1270
Total	11790	10847

➢ *Bahawalpur Division:*

District	Cases Received	Cases Reported
Rahim Yar Khan	3560	3218
Bahawalnagar	3038	2749
Bahawalpur	4081	4070
Total	10679	10037

➢ *Sargodha Division:*

District	Cases Received	Cases Reported
Sargodha	5814	5293
Mianwali	1487	1373
Khushab	1393	1352
Bhakkar	1051	972
Total	9745	8990

➢ *D.G Khan Division:*

District	Cases Received	Cases Reported
Rajanpur	1356	1172
Muzaffargarh	5294	4876
DG Khan	1880	1641
Layyah	1438	1323
Total	9968	9012

AUDIO VISUAL ANALYSIS (AV)

Audio Visual Analysis Department specializes in the scientific examination, comparison, and evaluation of audio and video evidences in legal matters. Equipped with state-of-the-art forensic tools for audio and video analysis, these tools are utilized by the global forensic community and have received approval from LEVA International Inc. (Law Enforcement/Emergency Services Video Association).

Our department offers following services;

(i) Enhancing and improving the intelligibility of audio signals recorded in digital media or video recordings, while also removing unwanted noise from audio recordings.

(ii) Authenticating video evidence and detecting any signs of tampering or editing within videos.

(iii) Analysing images extracted from video evidence using forensic enhancement and clarification tools.

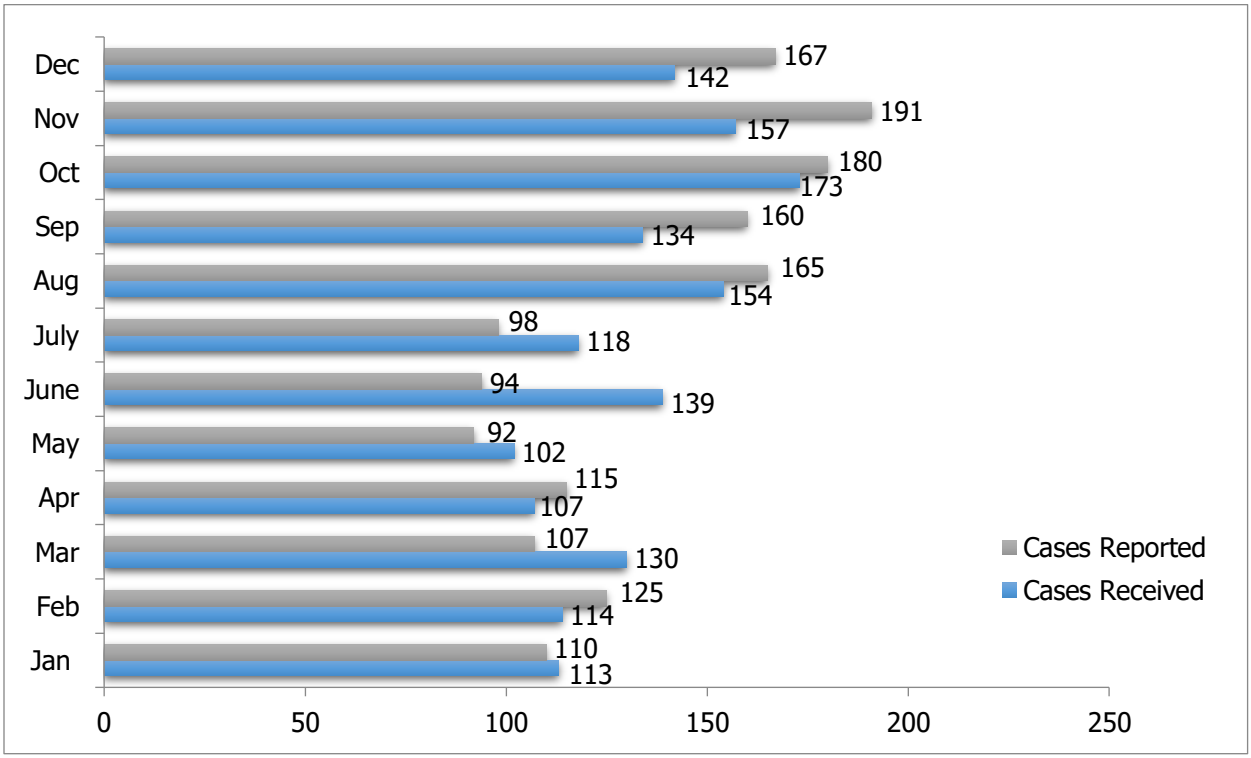
(iv) Comparing individuals and objects observed in videos with suspected persons and objects.

(v) Enhancing video evidence to aid in the identification and association of various events, individuals, and objects captured by video surveillance systems and other video sources.

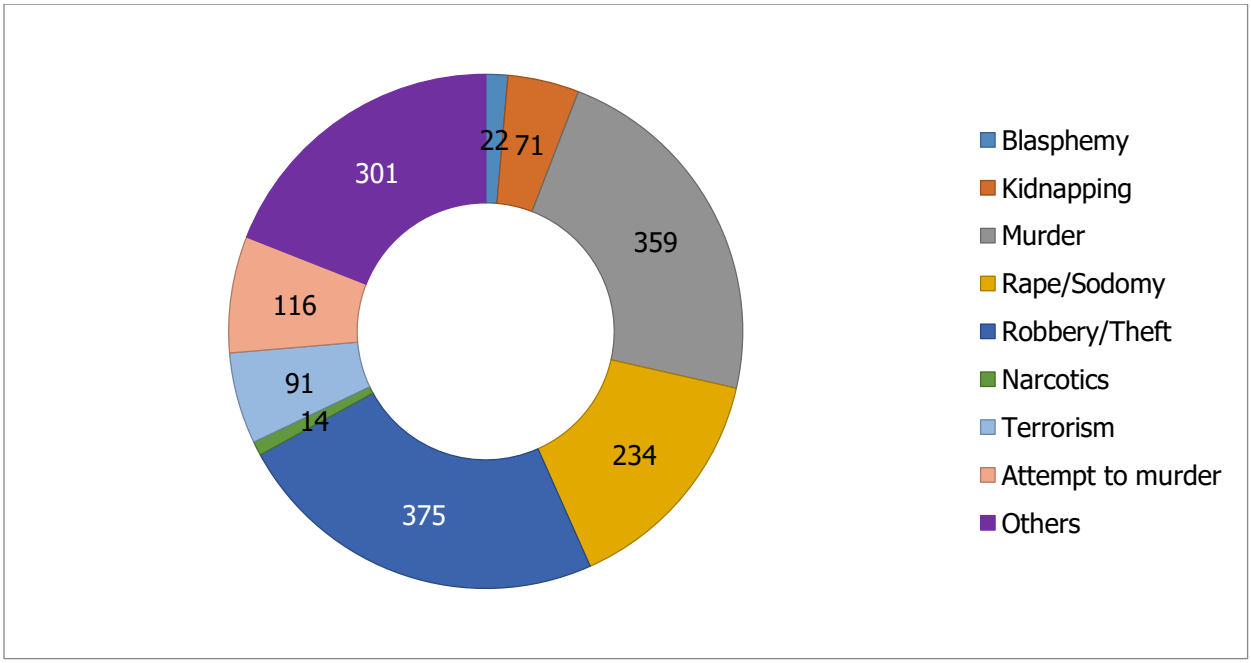
Case Log of AV is as follows (January 2022 to December 2022):

Total No. of Cases received at PFSA in 2022	**1583**
Reports Issued (January To December 2022)	**1604**
Incomplete / Closed	**31**
Pending	142
In process	**16**
NOTE: 210 extra cases were reported from the backlog of previous period 2021	

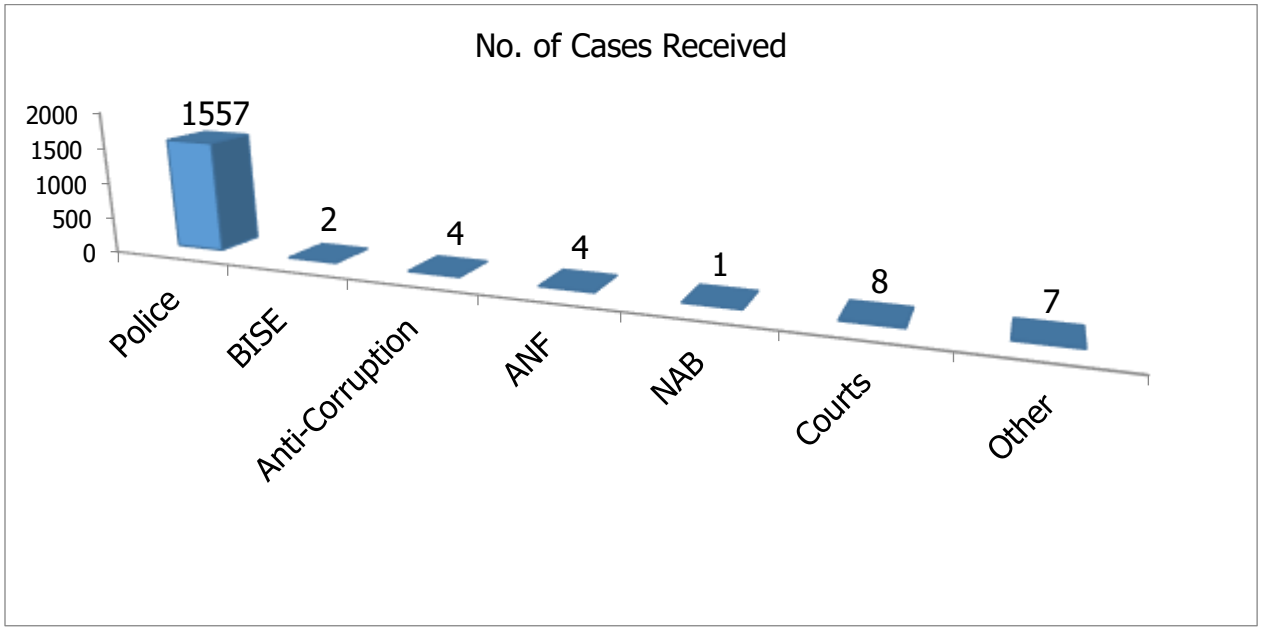
Month wise data of cases received vs reports generated during the year 2022 is shown by the following bar diagram:



Case classification can be seen as under:



AV received audio, video or image analysis cases from various agencies as shown below:



COMPUTER FORENSICS (CF)

Computer forensics involves the application of investigation and analysis techniques to collect and preserve evidence from specific computing devices in a manner suitable for presentation in a court of law. The increasing prevalence of mobile phones and other digital devices necessitates the examination of the data contained within them. Digital devices and storage media may hold valuable information such as call logs, pictures, SMS, chats, videos, audio, documents, and more, which are instrumental in solving criminal cases.

The Computer Forensics Unit operates within the following scope:

(i) Conducting scientific examinations and analyses of digital storage media, including hard disk drives, USBs, mobile phones, SIM cards, memory cards, CD/DVDs, and others.

(ii) Recovering deleted digital data.

(iii) Deciphering passwords or bypassing security measures on submitted digital media.

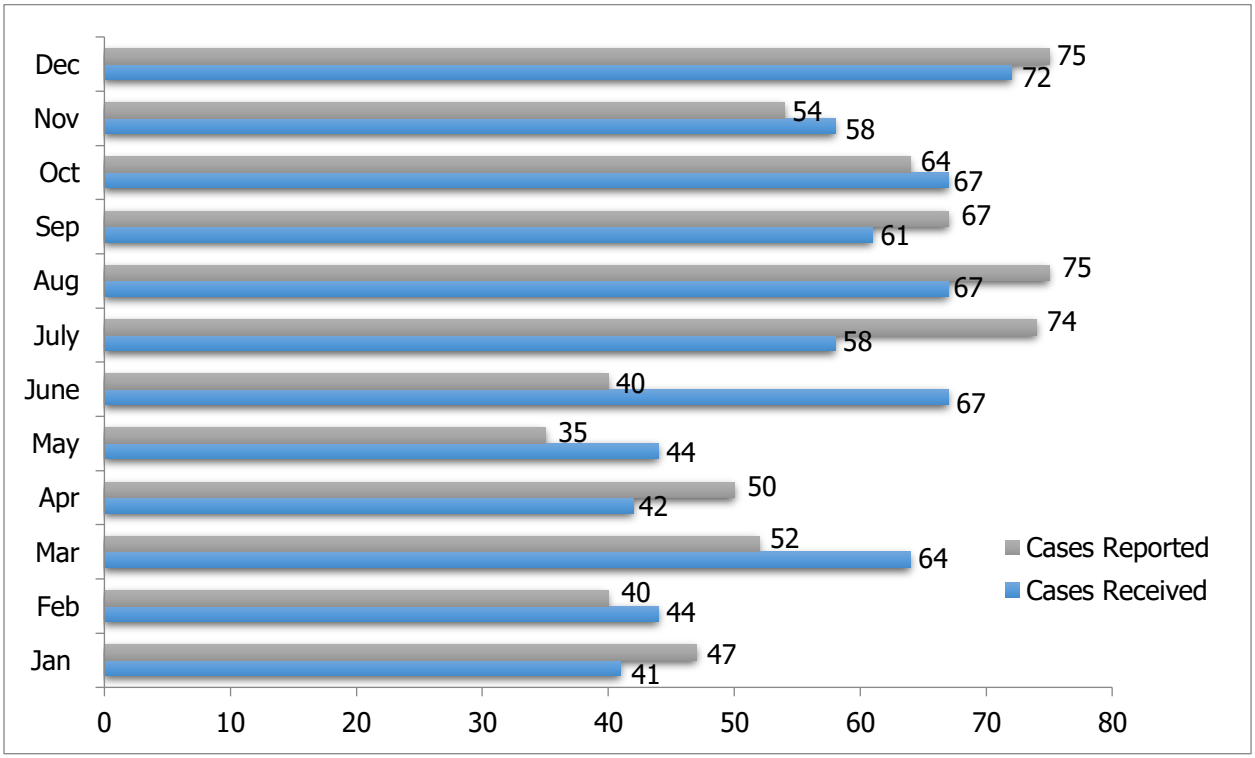
(iv) Retrieving and acquiring evidence from digital media.

(v) Providing expert testimony and presenting case reports in a court of law.

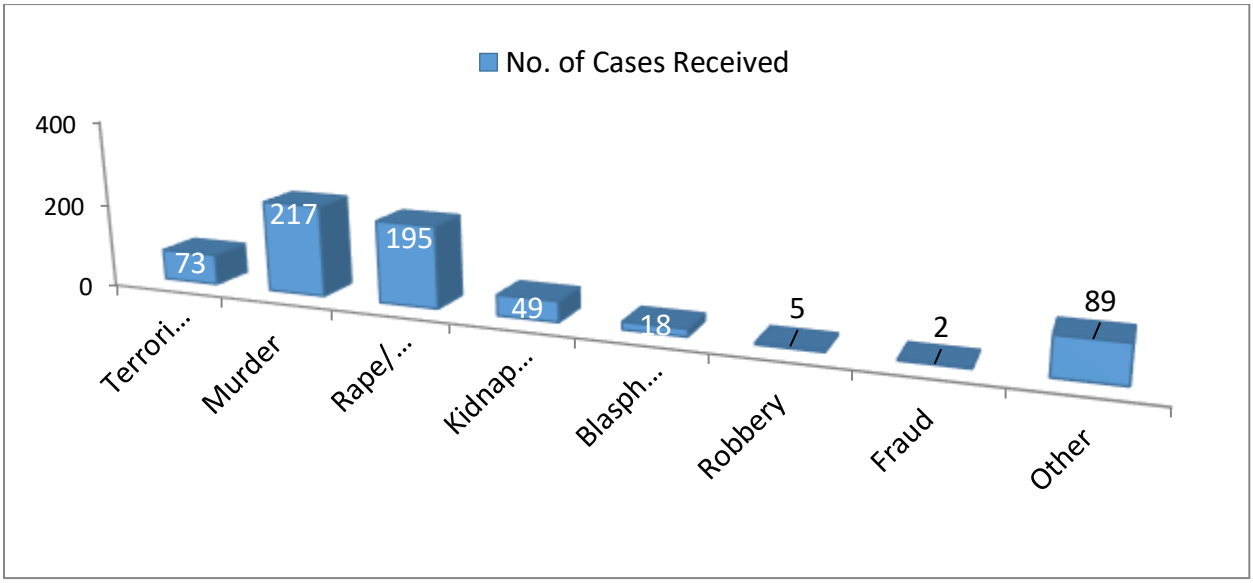
Case log of CF is as follows (January 2022 to December 2022):

Total No. of Cases received at PFSA in 2022	**685**
Reports Issued	**673**
In Process	**40**
Incomplete / Closed	**3**
Pending	76
NOTE: 87 extra cases were reported from the backlog of previous period 2021	

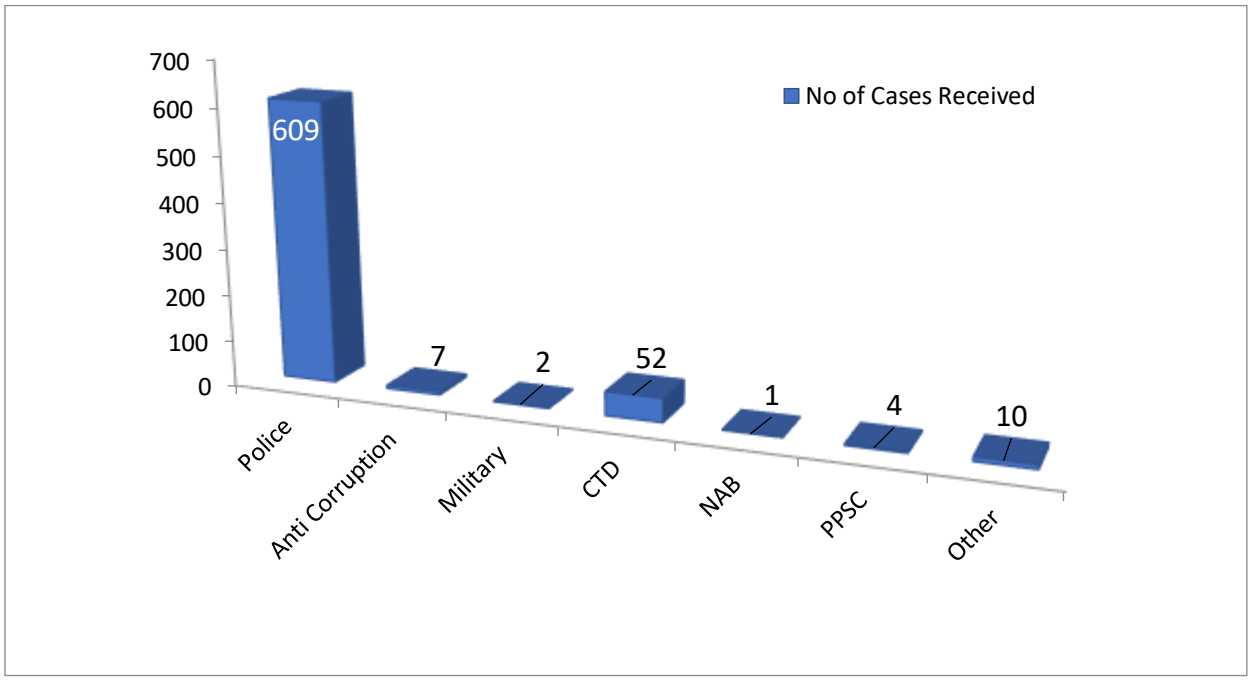
Month wise data of cases received and reports generated during the year 2022 is shown by the following bar diagram;



Case classification according to the crime type:



CF cases submitted agency wise:



CRIME SCENE INVESTIGATION (CSI)

Crime scene refers to any physical location where potential evidence can be found to be investigated by an investigator. This includes various places such as buildings, vehicles, outdoor areas, objects, and even a person's body.

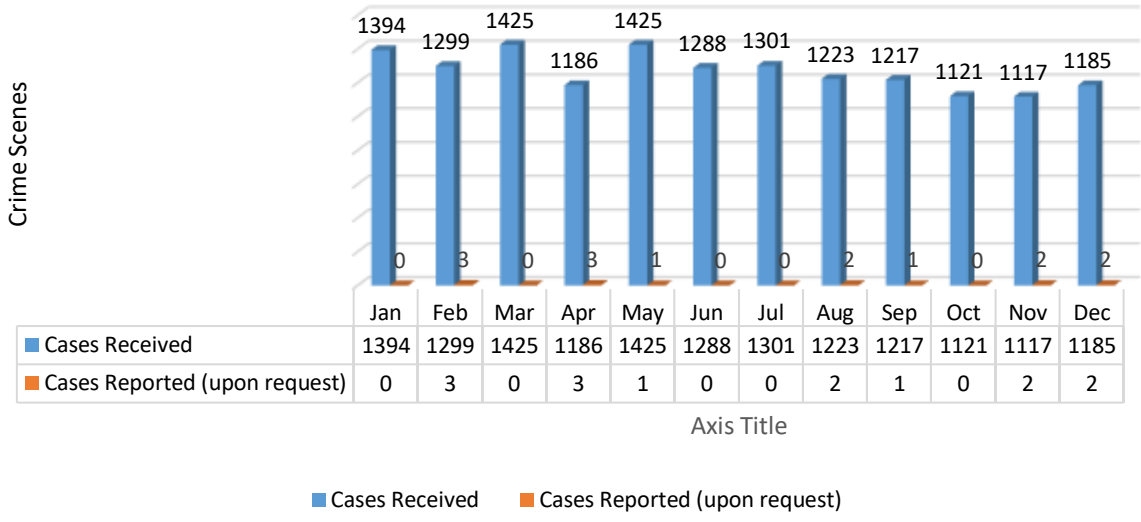
Crime Scene Investigation Unit (CSU) of the PFSA is a professional unit that operates 24/7 in all divisional headquarters of Punjab. The responsibilities of the CSU include ensuring proper identification, preservation, collection, and establishing a chain of custody to maintain the integrity of the evidence.

Crime scene investigators (CSIs) collaborate as a team at the crime scene. Their tasks involve defining and securing areas that could contain evidence, examining and documenting the scene, collecting physical evidence, and preserving, packaging, and submitting the evidence to the laboratory for analysis. By utilizing these crucial pieces of evidence, investigators can reconstruct the elements of the crime.

Table-1: Crime Scene Coverage during 2022

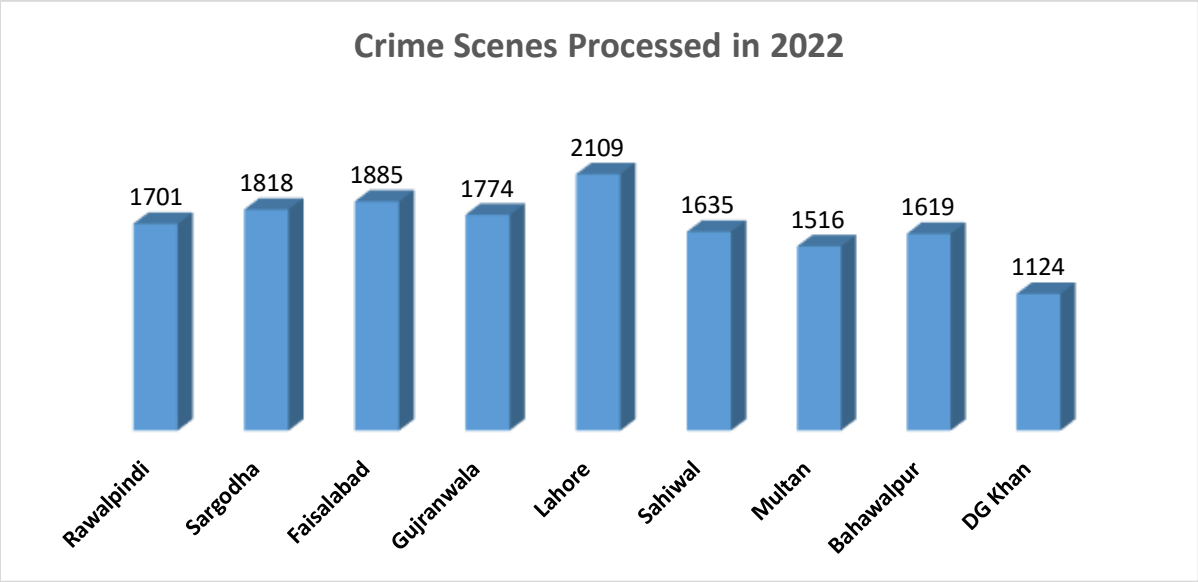
Total No. of Cases received at PFSA in 2022	**15181**
Cases processed	**15181**

Month wise data of cases received and processed during 2022 is shown as follows;

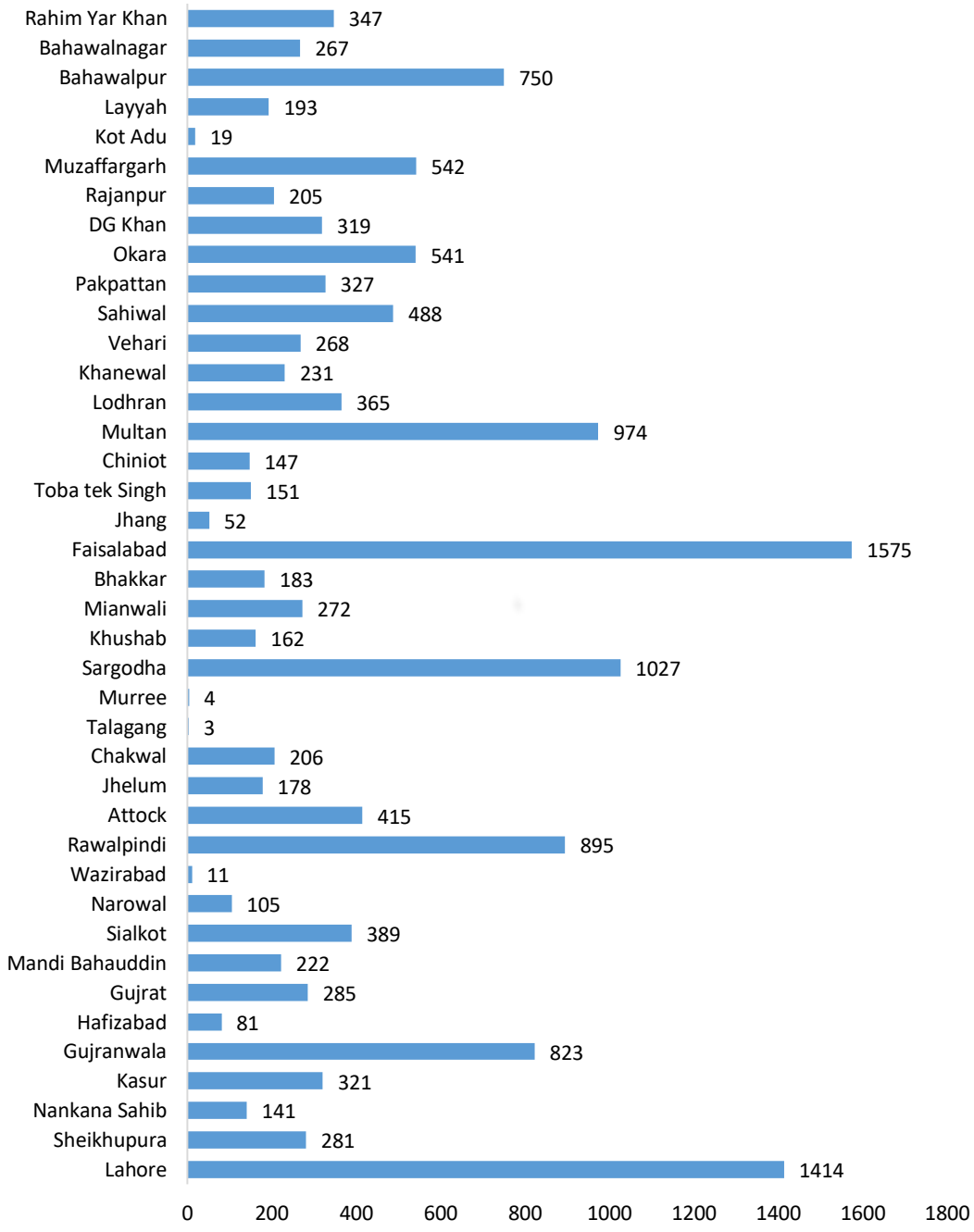


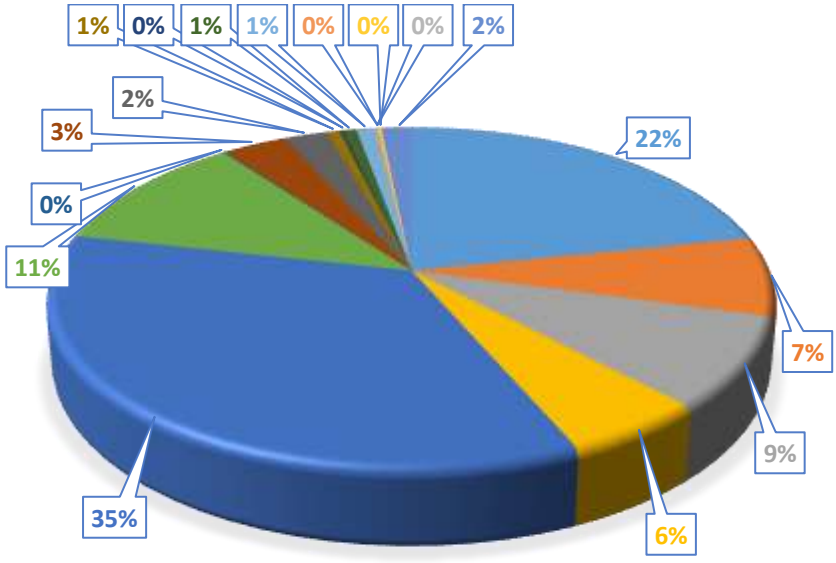
SATELLITE STATIONS OF CRIME SCENE INVESTIGATION UNIT

Since 2016, Satellite Stations of Crime Scene Investigation Unit are operational in all divisional headquarters of Punjab. Distribution of crime scene coverage During 2022 with respect to satellite stations is as follows;



District wise crime scene coverage during 2022;





Crime Scenes Processed in 2022

DNA & SEROLOGY (DNA)

DNA & Serology analysis involves identifying body fluids present on submitted evidence items and developing DNA profiles from relevant fluid stains. These DNA profiles are then compared with standard reference samples to determine possible contributors to the DNA profile. The analytical findings are documented in a laboratory examination report and presented to law enforcement agencies and courts of law to facilitate administration of justice.

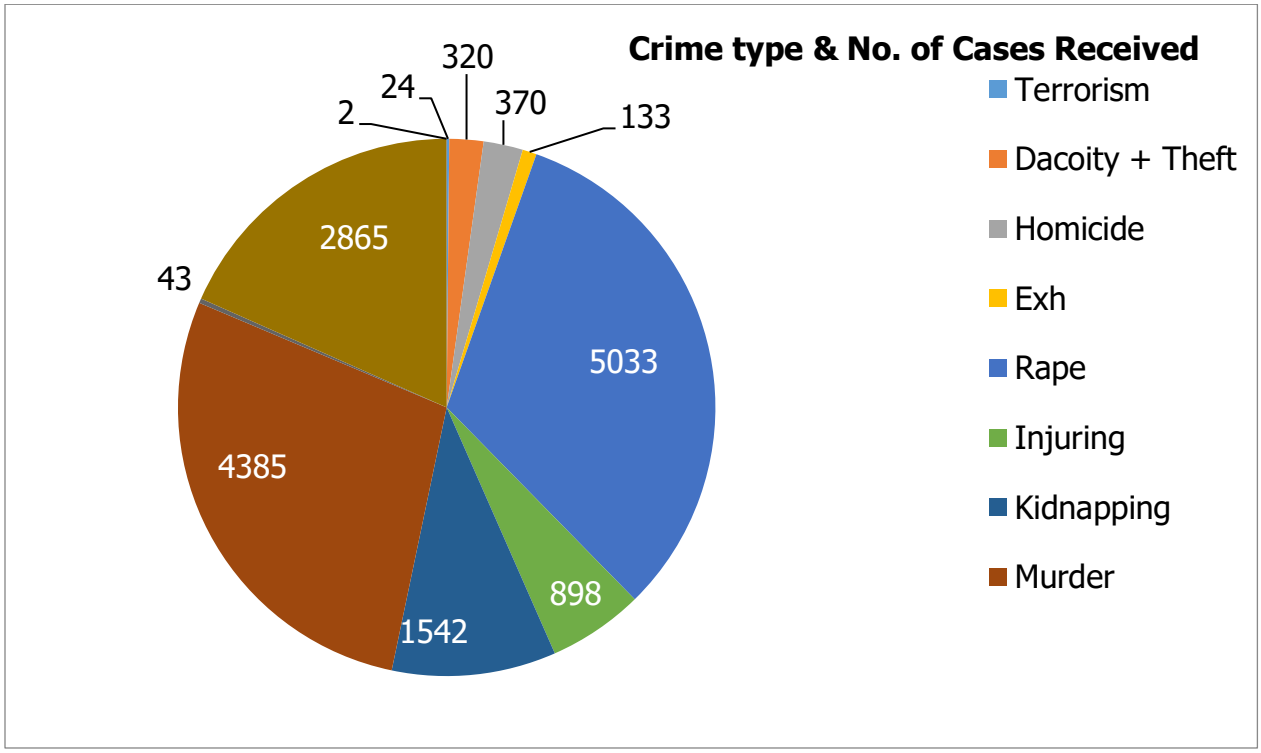
The department receives cases not only from Punjab but from all over Pakistan, resulting in a high influx of cases. These cases primarily involve terrorism, murder, and sexual assault; which are considered highly egregious crimes in society. In the year 2021 alone, DNA section received a significant workload, handling 15,300 cases.

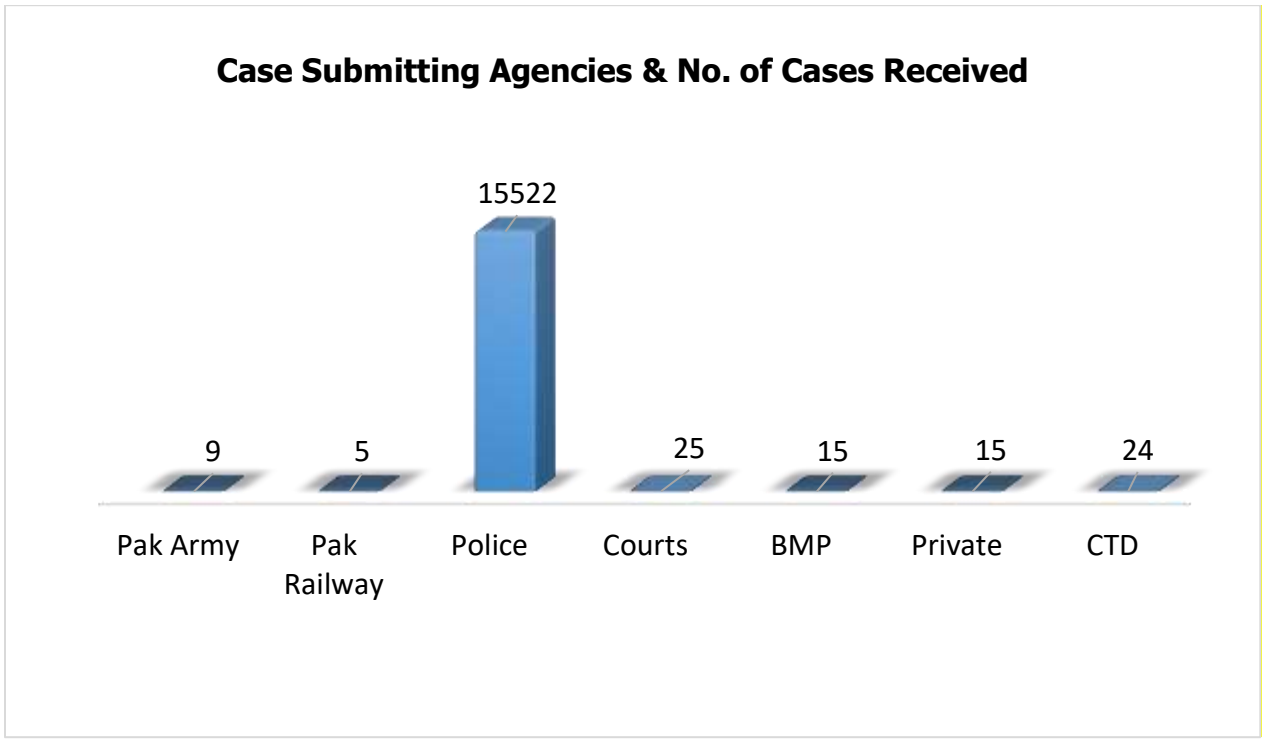
Over the past decade, DNA section's efforts have significantly elevated the importance of DNA evidence in court decisions throughout Pakistan. Courts now rely on DNA results as crucial and substantial evidence in heinous crimes, enabling them to reach conclusions and deliver justice. This achievement has garnered appreciation from the country's superior courts. Additionally, DNA section successfully solved several high-profile cases that created national exigencies.

PFSA is dedicated to maintaining the highest standards of quality assurance. A significant milestone was reached in 2021 with the accreditation of the DNA & Serology section according to ISO/IEC 17025:2017 by the Pakistan National Accreditation Council. DNA section remains committed to delivering quality services for the administration of justice and the betterment of Pakistani society, serving all citizens of the country. Notably, the department received over a thousand cases per month during 2021.

Case Log of DNA & Serology (January 2022 to December 2022):

Total No. of Cases received at PFSA in 2022	**15615**
Reports Issued	**9971**
In Process	**342**
Adjudicated cases	**21**
Pending Owing to Incomplete Submission **(Either reference samples not submitted by police or analysis request by competent authorities is awaited)**	**7907**
NOTE: 2626 extra cases were reported from the backlog of previous years.	


Crime type & No. of Cases Received
320
24
2
370
133
2865
43
5033
4385
898
1542
Terrorism
Dacoity + Theft
Homicide
Exh
Rape
Injuring
Kidnapping
Murder


Case Submitting Agencies & No. of Cases Received
15522
9
5
25
15
15
24
Pak Army
Pak Railway
Police
Courts
BMP
Private
CTD

FIREARMS & TOOLMARKS UNIT (FTM)

The discipline of Firearms and Tool Marks is a prominent field within forensic science. One of the primary examinations conducted in the firearms and tool marks section is firearms identification, which involves analysing firearms and ammunition components to establish their connection to specific firearms or crime scenes.

Firearm examiners utilize various equipment, including comparison microscopes, to examine fired bullets, cartridge cases, and shotgun shells. These examinations often involve comparing individual characteristics, such as rifling patterns on bullets or firing pin impressions on cartridge cases, to establish links between the recovered components and a particular firearm.

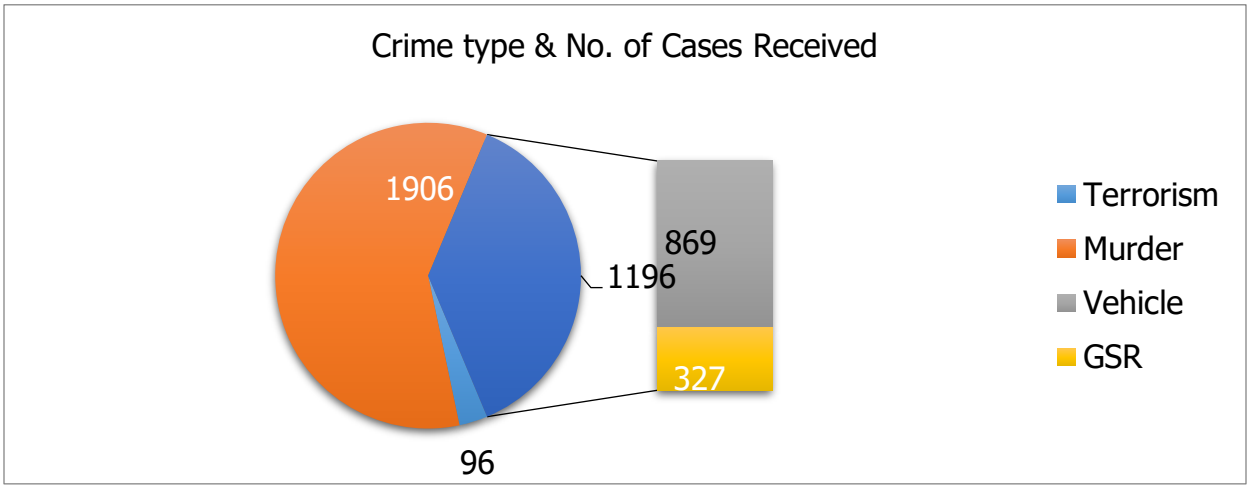
Firearm identification plays a critical role in criminal investigations as it provides valuable information to law enforcement agencies. It aids in establishing connections between firearms, suspects, and crime scenes, assisting in perpetrator identification, event reconstruction, and determination of type of weapon used.

The Firearms and Tool Marks section offers the following services:

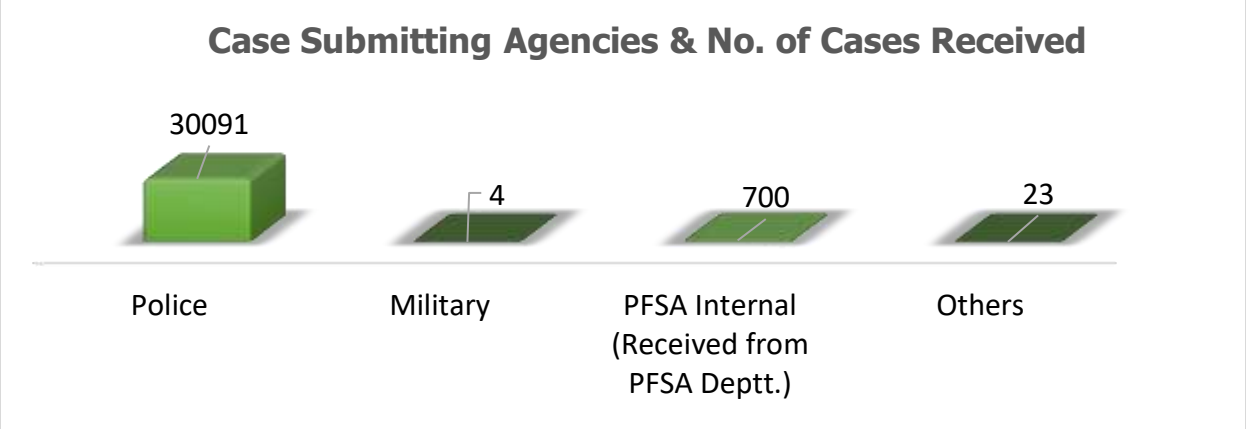
- Examination of submitted firearms to determine their model, caliber, serial number, and functionality.
- Examination of evidence bullets and cartridge cases to determine if they were fired from the submitted firearms, and their entry in the Automated Ballistic Identification System.
- Examination of evidence ammunition to determine the type of bullet used.
- Examination of submitted tools in conjunction with evidence tool marks or silicone casts to determine if the tool was used to create the marks.
- Restoration of altered, modified, or obliterated serial numbers.
- Analysis of gunpowder patterns on various evidence items using submitted firearms and ammunition to determine the distance between the muzzle and the point of impact.
- Shooting scene reconstruction using trajectory analysis to determine the sequence of events in a particular incident based on information derived from the physical evidence.
- Shotgun Shot Pattern Analysis to determine the distance between the shooter and the target.

Case Log of FTM Unit (January 2022 to December 2022):

Total No. of Cases received at PFSA in 2022	**30818**
Cases processed	**26492**
In Process	**618**
Incomplete Cases	**2819**
Pending Cases	**1778**
Note: 889 cases were reported from the backlog of previous year 2021	



- ***Reasons of Incomplete/Closed Cases***
  - (i) There is a lack of effective cooperation from Submitting Agencies in submitting complete evidence.
  - (ii) In majority of cases, weapon of offense is neither recovered nor submitted by the case submitting agencies.



LATENT FINGERPRINTS DEPARTMENT (LFP)

Latent Fingerprint Department is a laboratory that holds an ISO17025 accreditation and provides standard fingerprint examination services. Fingerprint Identification is a method of identification that utilizes the impressions created by the intricate ridge formations or patterns on fingertips. Fingerprint analysis is highly effective and widely used as forensic evidence in recent times. Each person has unique fingerprints, and these patterns remain unchanged throughout their entire life. As a result, fingerprints serve as an excellent means of identification and greatly assist law enforcement agencies in various areas, contributing to crime control.

At PFSA, an Automated Fingerprint Identification System (AFIS) is installed, connected through a VPN to 31 prisons in Punjab, 08 CSI Satellite Stations, and the PFSA headquarters. This system enables real-time submission of criminal data, including fingerprints, palm prints, and mug shots. **AFIS has successfully solved 125 blind cases to date using fingerprint evidence. Furthermore, in 2022, a new method utilizing Indandione was developed for the enhancement of latent prints on thermal papers.**

The lab offers a range of high-quality scientific services, including:

(i) Scientific examination and comparison of latent fingerprints, palm prints, and footprints through friction ridge analysis.

(ii) Comparison of thumb impressions in property cases, such as mutations, affidavits, and agreements.

(iii) Examination of forged and fabricated thumb impressions.

(iv) Development and processing of latent prints.

(v) Preparation of detailed reports on findings and expert testimony for legal proceedings.

(vi) Establishment of the identity of unknown deceased individuals.

(vii) Recording legible fingerprints in immigration cases for criminal history verification.

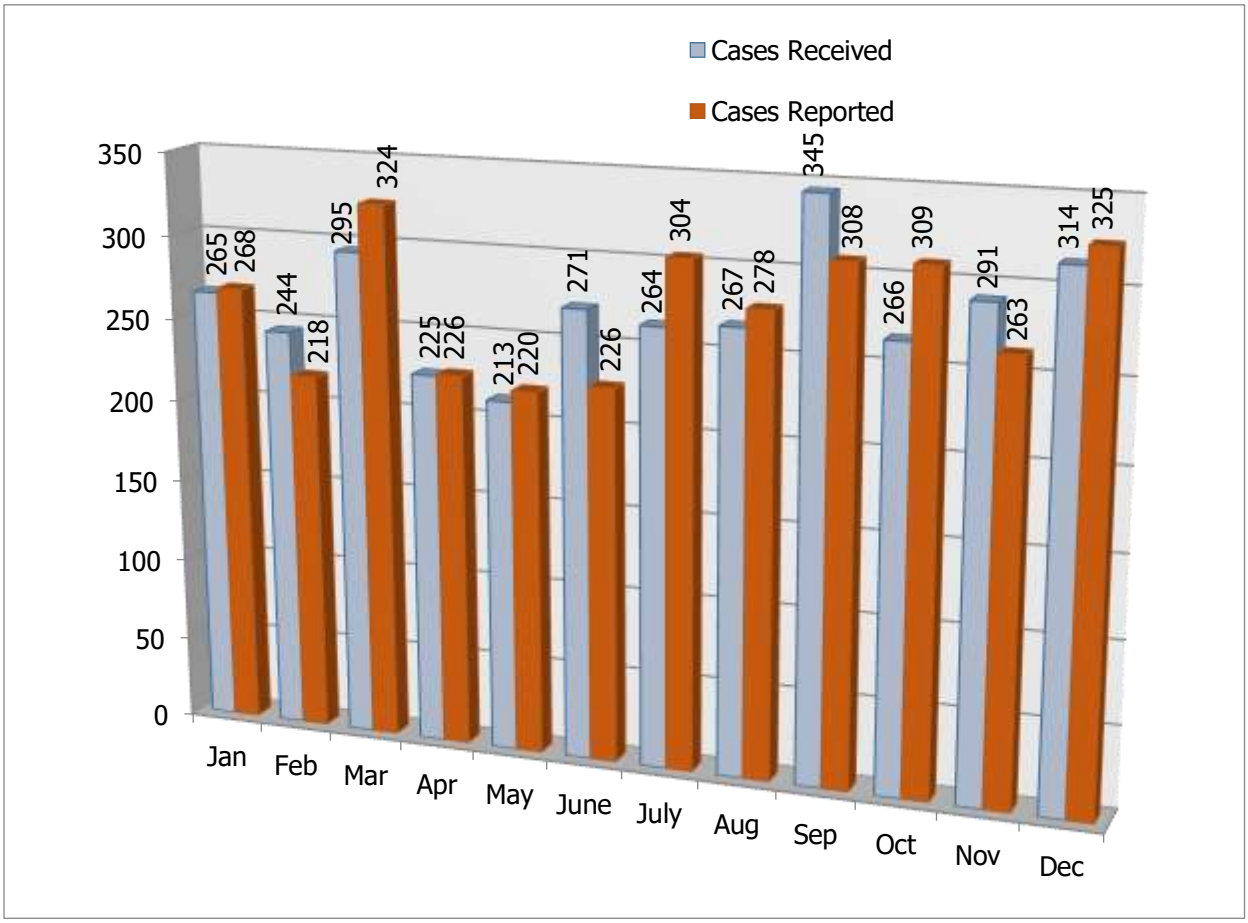
(viii) Provision of training and forensic field support to the law enforcement community.

(ix) Conducting questioned fingerprint searches through the Automated Fingerprint Identification System.

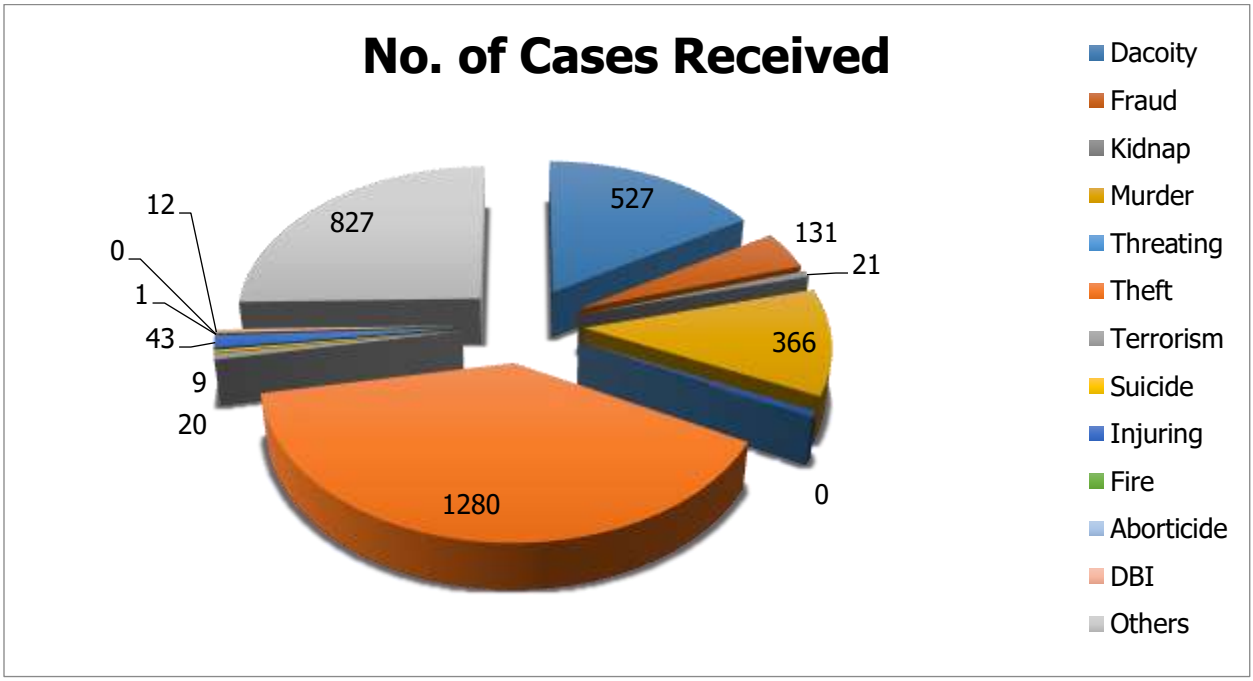
Case Log of LFP is as follows (January 2022 to December 2022):

Total No. of Cases received at PFSA in 2022	**3260**
Report Issued/Closed	**3269**
In Process	**94**
Incomplete Cases	**10**
Note: 113 cases were reported from the backlog of previous year 2021	

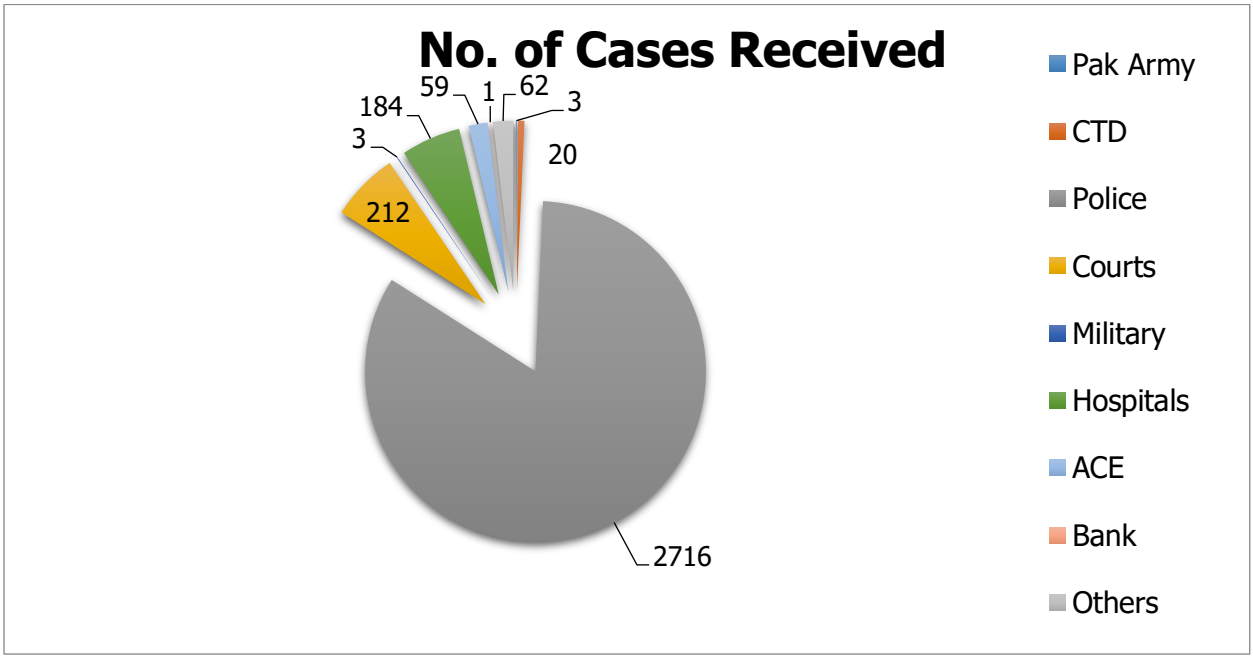
Month wise data of cases received and reports generated during the reported year 2022 is shown by the following bar diagram;



LFP has zero backlog. Case classification is shown as follows;



Agencies submitting LFP cases are as following:



NARCOTICS DEPARTMENT (NAR)

Narcotics Unit of Punjab Forensic Science Agency is equipped with highly advanced and efficient equipment that are considered the gold standard for the analysis of controlled substances worldwide. This unit is responsible for examining suspected Narcotic & Psychotropic substances in accordance with the requirements of the Control of Narcotic Substances Act 1997, Pakistan.

Narcotics Unit is an ISO/IEC 17025:2017 accredited laboratory that adheres to international guidelines for the analysis of seized drugs. The analysis procedures and protocols of the Narcotics Unit fully comply with internationally recommended guidelines, including:

- SWGDRUG Recommendations
- UNODC procedures
- ISO/IEC 17025:2017 recommendations

Scope of Analysis: Narcotics Unit has the capability to qualitatively identify controlled substances listed in Section 2 of the Control of Narcotic Substance Act (CNSA) 1997, as well as internationally contraband substances.

Case Submitting Agencies: Samples of seized materials are submitted for analysis from various law enforcement agencies, including:

- Punjab Police
- Anti Narcotics Force
- Pakistan Rangers
- Pakistan Army
- Pakistan Railways
- Counter Terrorism Department
- Border Military Police
- Customs department
- Law enforcement agencies of other provinces, Islamabad Capital Territory, and Kashmir.

Types of Samples Received: Narcotics Unit receives samples of various seized materials for analysis, including:

- Cannabis (Bhang, Charas, and Cannabis plant)
- Opium (Afyun, Poast, Bhukki, Poppy plant)
- Heroin
- Cocaine
- Ketamine
- Methamphetamine (ICE)
- MDMA (Ecstasy Tablet)
- Ephedrine and Pseudoephedrine
- Acetic Anhydride
- Suspected Narcotics Injection (Ativan, Clonazepam, Lorazepam, etc.)
- Items soaked in Narcotic substances (e.g., clothes)
- New Psychoactive Substances used worldwide (Synthetic Cannabinoids)
- Alcohol

Analytical Techniques: The available equipment for testing includes:

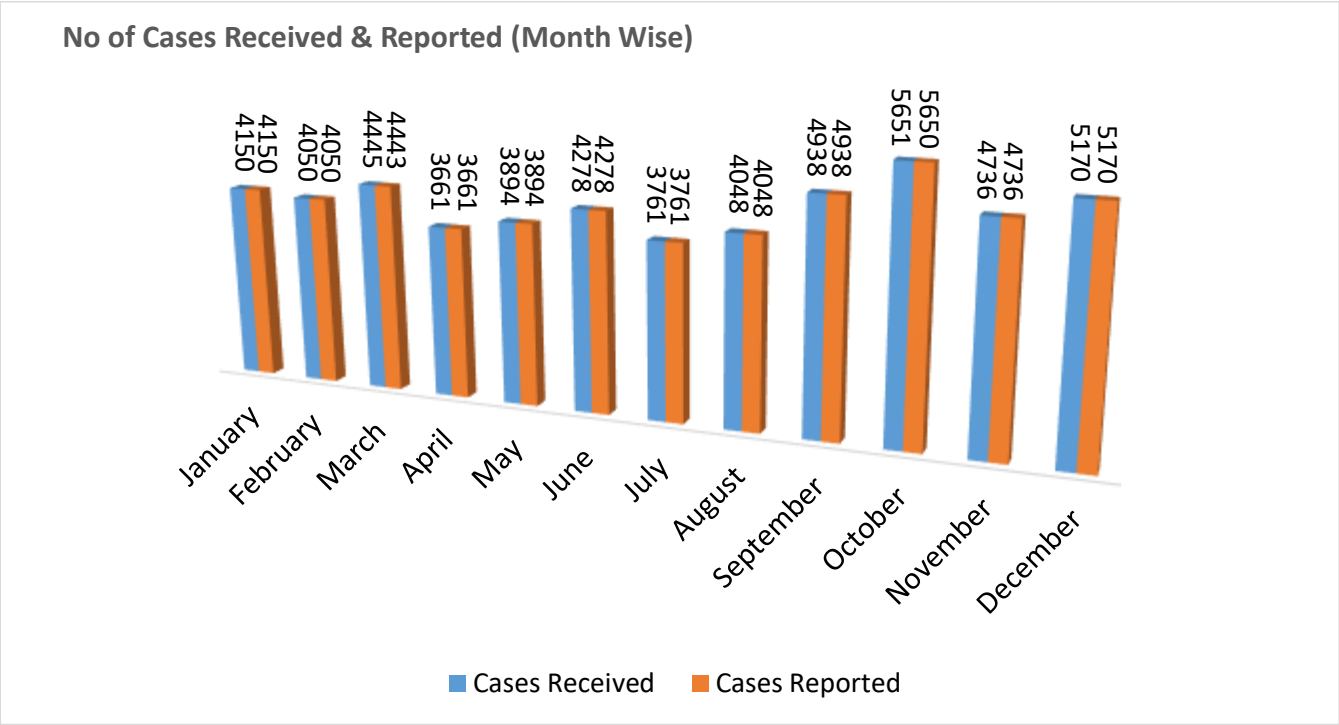
- Chemical Spot Tests (Color tests)
- Fourier Transform Infra-Red Spectrometer
- Gas Chromatograph-Mass Spectrometer
- LC/MSMS
- Raman Spectrophotometer
- Stereomicroscope
- Polarimeter
- UV/Visible Spectrophotometer

Submitted seized materials are initially identified using presumptive testing, such as color tests, and then confirmed using confirmatory techniques, such as GC-MS. The Gas Chromatograph/Mass Spectrometer (GC-MS) operates based on the chemical fingerprinting of drug molecules. The detailed molecular structure of pure substances can be confirmed using the Fourier Transform Infrared Spectrometer (FTIR).

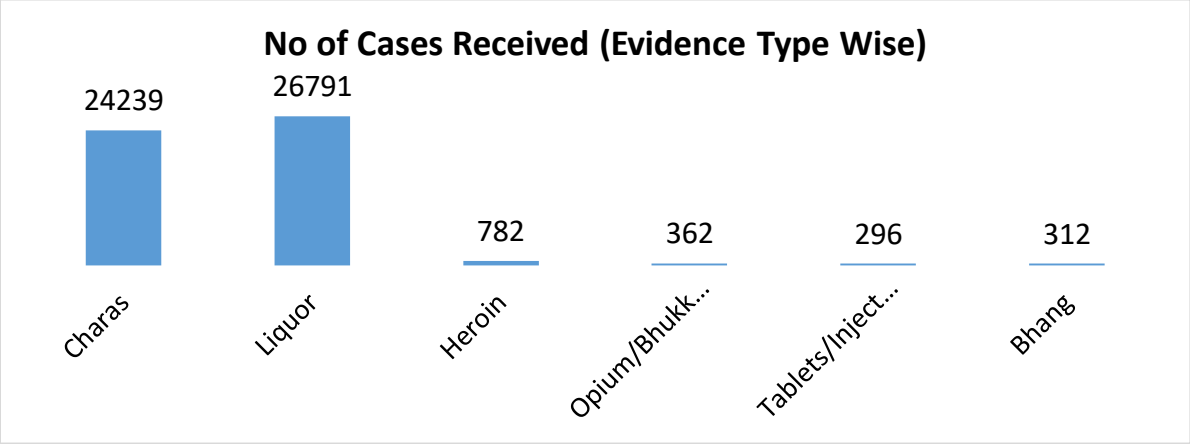
Case Log of Narcotics (January 2022 to December 2022):

Total No. of Cases received at PFSA in 2022	**52782**
Reports Issued	**52779**
Pending	**03**
Incomplete / Closed	**0**

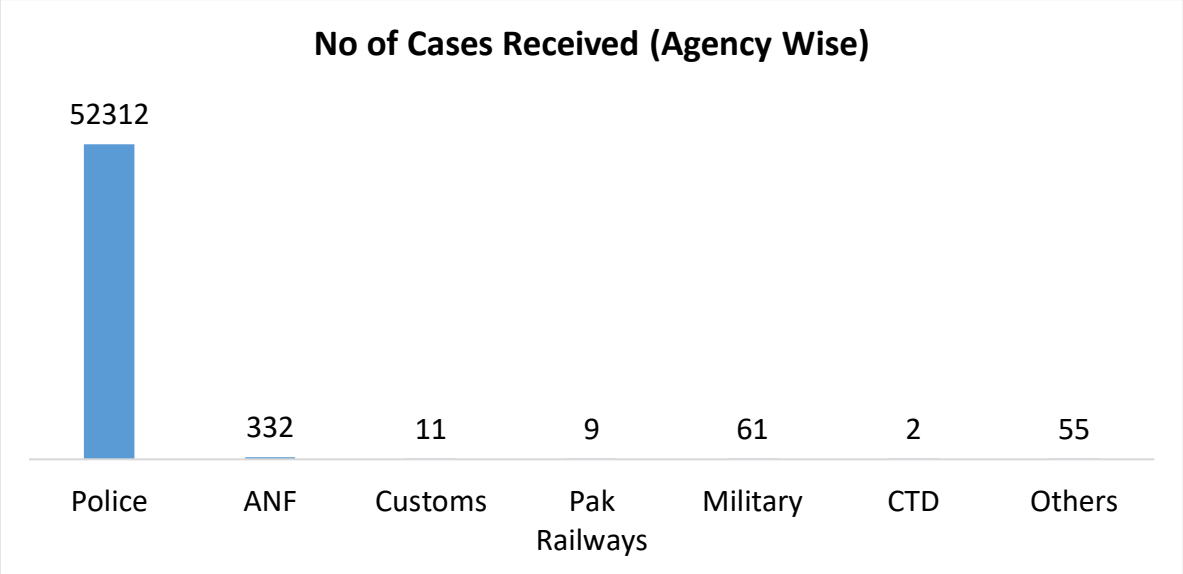
Month wise data of cases received and reports generated during 2022 is shown in the following bar chart;



Classification of cases according to the type of evidence submitted is as under:



Classification of cases according to the case submitting agency is as under:



FORENSIC PATHOLOGY & HISTOLOGY (PATH)

Forensic pathology serves as the fundamental discipline in medico-legal investigations. It involves the application of forensic scientific and pathological techniques to determine the cause and manner of death, distinguish between suicides and homicides, assess the nature of injuries such as burns, fractures, electric shocks, and drowning, whether they occurred before or after death. The field of forensic pathology also plays a crucial role in determining the cause of death for unidentified bodies and individuals who died while under police or law enforcement custody. Additionally, it deals with cases related to sexual assaults, abortions, fetal age, and violence against women, demonstrating a high level of expertise.

Forensic pathology primarily focuses on investigating sudden, violent, suspicious, and unexpected deaths.

Services provided by the Department of Forensic Pathology include:

(i) The Department of Forensic Pathology offers a comprehensive autopsy service.

(ii) A well-equipped and advanced autopsy hall is available for conducting post-mortem examinations.

(iii) Fixed and mobile X-ray units are accessible for capturing x-rays of specific parts of the deceased body.

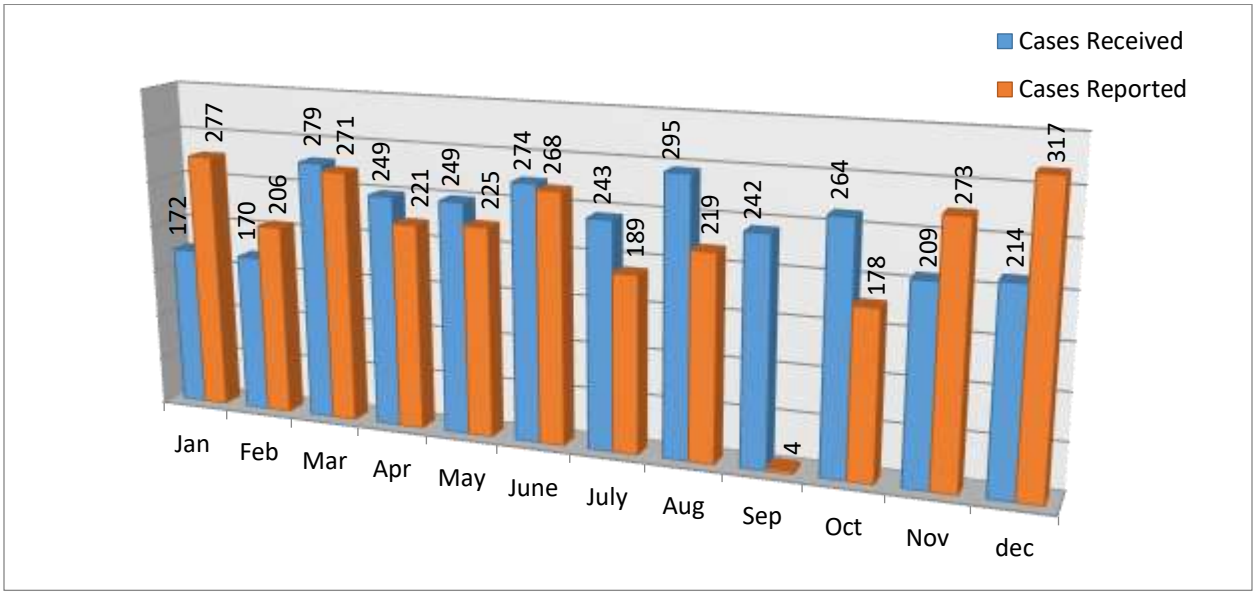
(iv) Histopathology laboratory is equipped with the latest instruments and provides microscopic analysis of tissue specimens obtained during autopsies or received from various locations across the country.

(v) Forensic Pathology department has two body storage refrigerator rooms and two body storage freezers for temporary preservation of deceased bodies.

Case log of PATH is as follows (January 2022 to December 2022):

Total No. of Cases received at PFSA in 2022	2860
Reports Issued	2648
In Process	1672
Incomplete / Closed	2
Pending	0
NOTE: 1462 cases were reported from the backlog of previous period 2021.	

The bar chart provides a month-wise overview of case receiving and reporting activities throughout the year 2022. The implementation of effective solutions to improve quality resulted in an increased reporting rate, which also helped to resolve the backlog in this department.



All cases for pathological analysis were submitted by police

POLYGRAPH EXAMINATION (PGR)

Polygraph examination is a scientific method used to assess the accuracy of an individual's statements. The process of conducting a polygraph examination involves several steps, including an interview, pre-test discussion, data collection, and data analysis. By utilizing a polygraph instrument, physical data from the examinee is collected and objectively analyzed to determine the results. The examination includes the use of foot sensors and activity sensors to ensure the integrity of the responses. Examinees are asked a series of questions to which they respond with either a "yes" or "no."

➢ ***Polygraph testing can be successfully employed:***

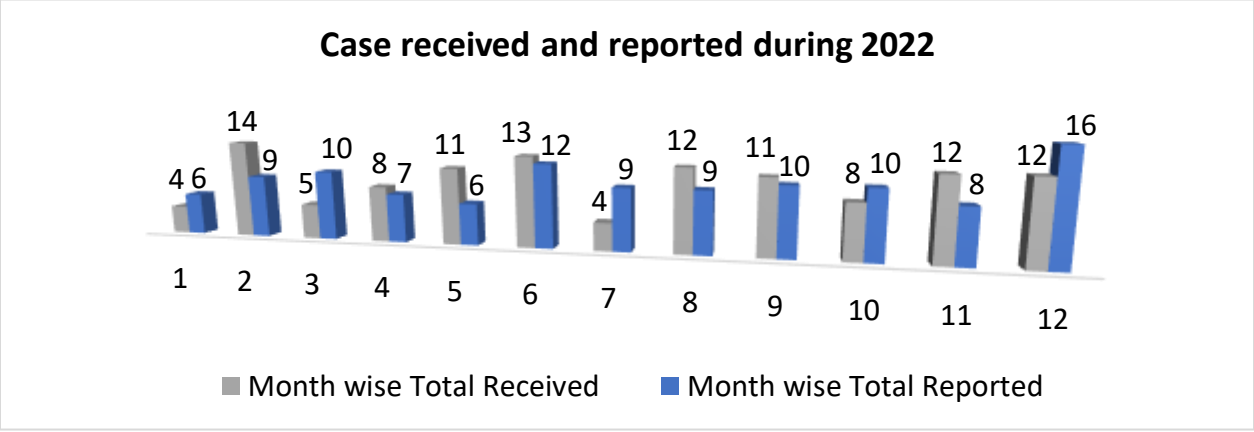
(i) Criminal Investigation (ii) Civil cases
(ii) Intelligence and Counter-Intelligence (iv) Pre-employment Testing

Available research suggests that polygraph is 90% reliable instrument. *Level of skill and experience of the examiner plays an important part in the accuracy of the examination*. Comparative studies have shown that polygraph tests yield an accuracy that equals or exceeds that of many other forms of evidence.

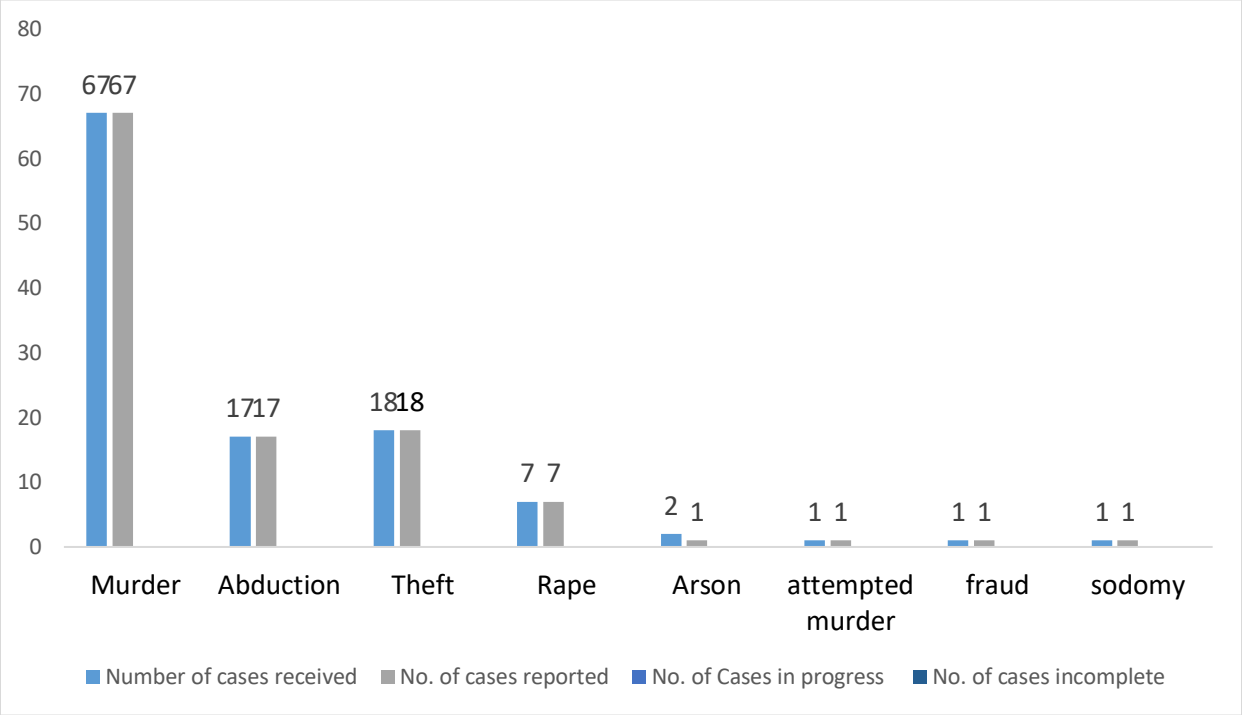
Case log of PGR is as follows (January 2022 to December 2022):

Total No. of Cases received at PFSA in 2022	114
Reports Issued	112
In Process	02
Incomplete / Closed	0
Pending	0

Month wise data of cases received and reported during 2022 is shown by the following bar diagram;



Case classification is shown below according to the evidence submitted:



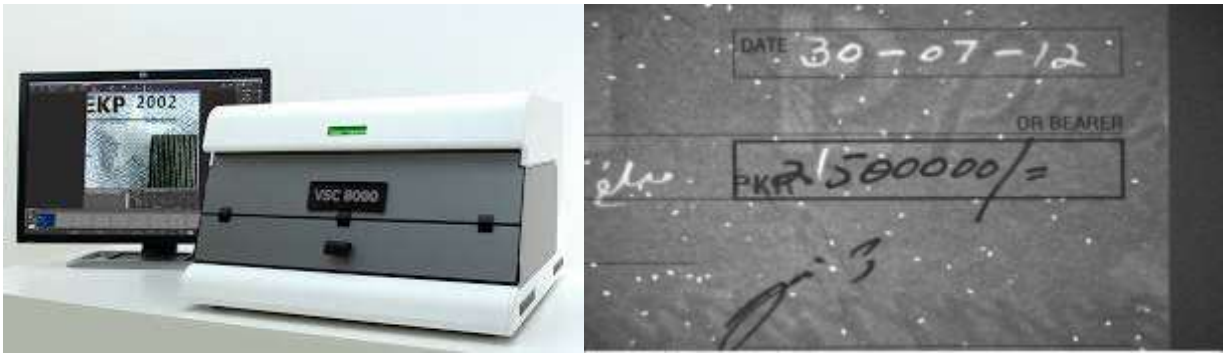
All cases were submitted by police.

QUESTIONED DOCUMENTS (QD)

Questioned Documents Examination is a field within Forensic Science that focuses on analysing disputed documents for potential legal disputes. The Questioned Documents Section at the Punjab Forensic Science Agency in Lahore is responsible for examining any document that has raised concerns regarding its authenticity in a court of law. These examinations encompass various types, such as handwriting and signature analysis to determine the authorship, typewriting examination, scrutiny of altered documents, indentations on paper, non-destructive ink analysis, and other types of examinations.

Handwriting examinations involve comparing known writing samples from one or more individuals with the questioned writing. The questioned writing may appear on cheques, anonymous or threatening letters, bank hold-up notes, wills, mutations, and so on.

Altered documents can take different forms, including erasures that can be detected using appropriate lighting techniques. However, identifying the original information may not always be possible. Obliterations can manifest in various ways, such as the use of opaque materials, marker pens, or simply marking over previous writing with a ballpoint pen. Special lighting, magnification techniques, and tools like the Video Spectral Comparator (VSC) are often employed to reveal hidden information beneath the obliteration. For example, on bank cheques, the amount may have been altered, and the VSC can unveil the presence of different inks in the amount area



Video Spectral Comparator (VSC-8000)

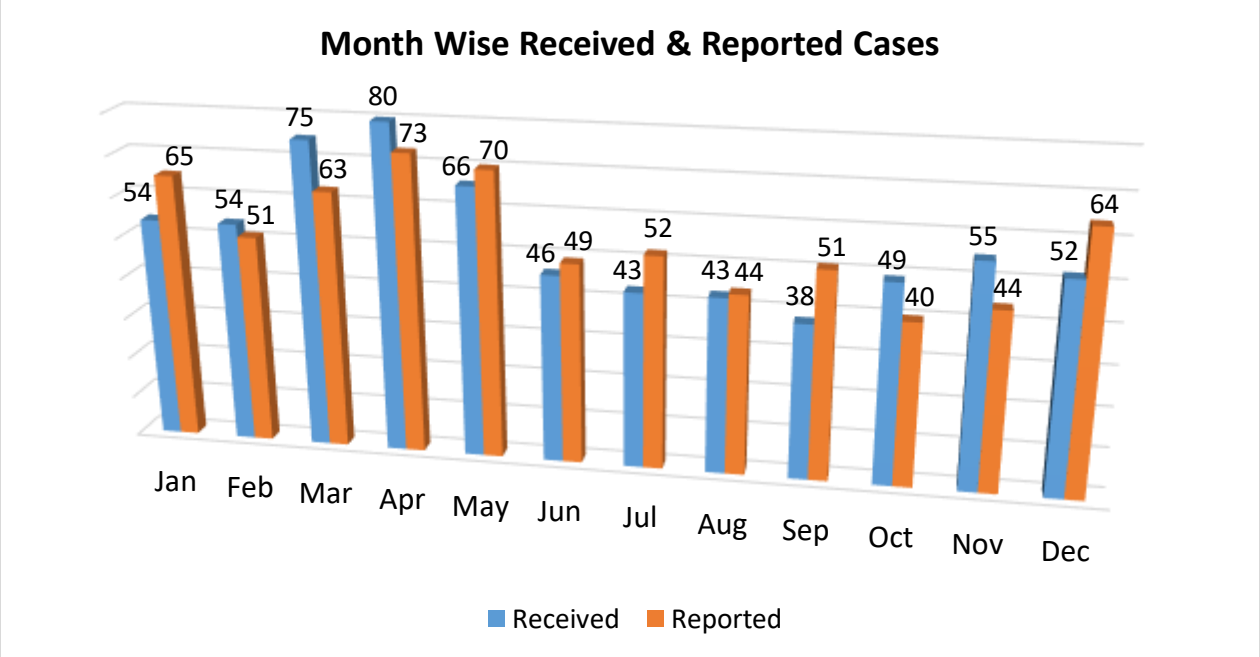
Handwriting indentations occur when an individual writes on the uppermost sheet of a notepad or stack of paper, resulting in impressions of the original writing on the pages below. The Electrostatic Detection Apparatus (ESDA) is a non-destructive technique utilized to enhance and retain these indentations.

Electrostatic Detection Apparatus (ESDA²)

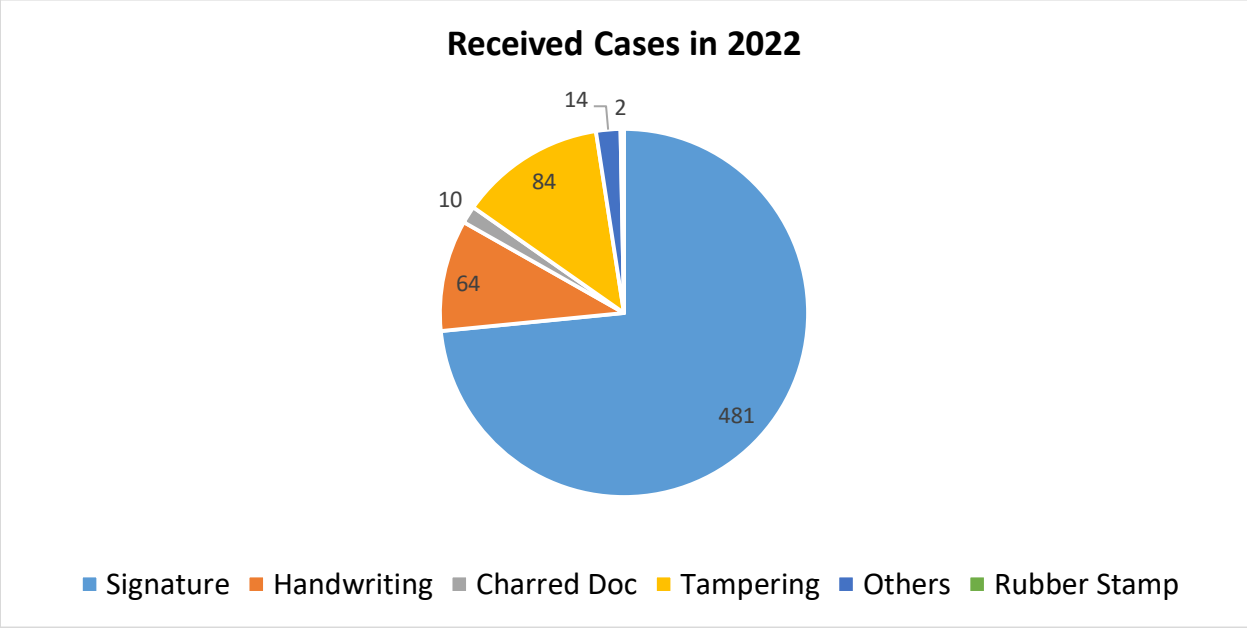
Case detail of Questioned Documents Section for the year 2022 (January 2022 to December 2022) is as follows:

Total No. of Cases received at PFSA in 2022	**655**
Reports Issued	**666**
In Process	**0**
Incomplete / Closed Cases	**0**
Pending	**0**
NOTE: 11 cases were reported from the backlog of previous period 2021.	

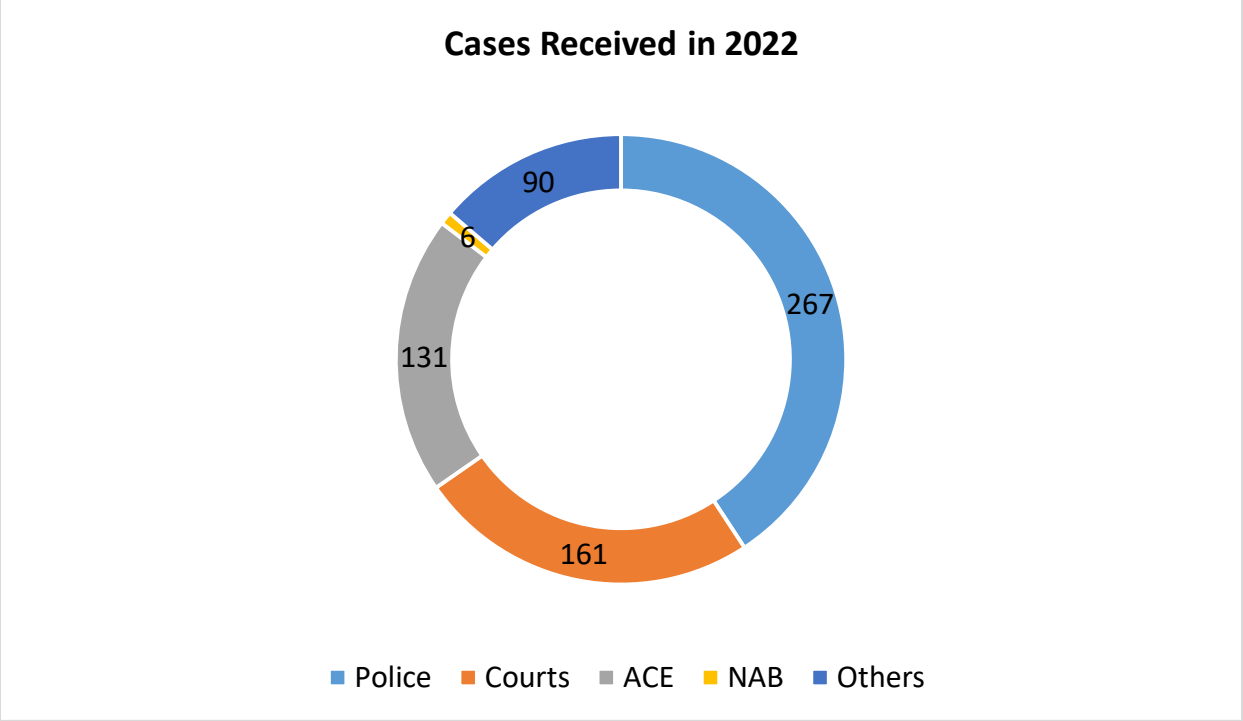
Month wise data of cases received and reported during the year 2022 is shown by the following bar diagram;



Number of cases received based on case type can be seen as under:



Detail of cases received based on submitting agency is as under:



FORENSIC TOXICOLOGY (TOX)

Forensic toxicology is a specialized field within forensic science that focuses on the examination and analysis of drugs, poisons, and other chemicals in both biological and non-biological specimens. Its primary objective is to determine the presence, concentration, and potential effects of these substances on individuals. By combining principles from analytical chemistry, pharmacology, and toxicology, forensic toxicologists provide crucial evidence and expert opinions in cases involving drug overdoses, driving under the influence incidents, workplace accidents, suicides, and homicides. They employ specialized techniques and state-of-the-art instrumentation to identify substances in body fluids, tissues, hair, and various other samples obtained from both living and deceased individuals. Additionally, forensic toxicologists interpret the results of their analyses and present their findings in legal proceedings, including courtrooms.

The Forensic Toxicology Department at the PFSA (Punjab Forensic Science Agency) is an exceptional laboratory that has obtained ISO-17025 accreditation, ensuring adherence to global standards of excellence in forensic toxicology. With an unwavering commitment to proficiency, this department follows guidelines established by internationally recognized organizations such as The International Association of Forensic Toxicologists (TIAFT), American Board of Forensic Toxicologists (ABFT), Scientific Working Group for Forensic Toxicology (SWGFTOX), and Society of Forensic Toxicologists (SOFT). Through their dedication to maintaining the highest levels of quality, the Forensic Toxicology Department at PFSA provides forensic evidence of utmost reliability, establishing itself as a vital pillar within the criminal justice system.

Collection and Selection of Toxicological Specimens:

When selecting specimens for a specific case, various factors such as specimen availability and case history are considered. The common specimens used for toxicological analysis include blood, urine, and gastric contents. It is crucial to collect blood and urine specimens before significant therapeutic interventions are administered upon admission, as they hold valuable information for toxicological analysis. However, samples obtained after 24 to 48 hours of medical intervention are less useful since drugs or poisons may have been metabolized or eliminated from the body.

Here are the recommended specimens for toxicological analysis and their preservation methods:

- **Blood:** Peripheral blood is preferred over cardiac blood for quantitative analysis (if both are available). However, cardiac blood can be used for qualitative analysis of drugs and certain poisons like carbon monoxide and cyanide. Both samples should be preserved with sodium fluoride and potassium oxalate.
- **Urine:** Urine is the optimal specimen for comprehensive screening of drugs and poisons. The accumulation of substances and their metabolites in urine often results in higher concentrations, facilitating detection. Urine typically does not require any preservatives.
- **Gastric contents:** Since oral ingestion is the most common route of exposure to drugs and poisons, collecting gastric contents is crucial for screening tests. All available samples should be collected without adding preservatives. Undigested pills or tablets, if recovered, should be separated and placed in a plastic jar or tube for analysis.
- **Vitreous humor:** This is the most suitable sample for postmortem alcohol analysis. The anatomical isolation and protection of vitreous humor (located behind the lens of the eye) along with its stability make it less prone to putrefactive changes compared to other postmortem specimens.
- **Tissue samples:** Tissue samples collected during postmortem investigations provide supplemental information to the toxicologist for result interpretation. Tissue samples should be preserved in saturated saline.
    - **Liver:** In cases where blood is unavailable, the liver can be tested for drugs or poisons. The liver is typically the most valuable tissue specimen in postmortem toxicology cases since most substances are metabolized there, leading to high concentrations of both the parent compound and its metabolites.
    - **Bile:** In the absence of urine, bile from the gallbladder can serve as an alternative waste fluid for drug screening.
    - **Spleen:** The spleen, being an organ rich in blood, is useful for analyzing compounds that bind to hemoglobin, such as carbon

monoxide and cyanide. In fire-related deaths with extensive charring, the spleen may be the only useful specimen available for these assays.

- **Other tissues:** Kidney samples can be collected in cases of metal poisoning as heavy metals tend to concentrate in this organ. Lungs often contain high concentrations of drugs and poisons in cases of inhalation. The brain is a valuable specimen, especially for lipophilic substances like halogenated hydrocarbons, narcotics, and antidepressants, as it is the primary site of action for many drugs. In exhumation cases, other soft tissues can be tested for drugs or poisons when the most appropriate specimens are unavailable.

➢ **Hair:** Hair may be used to rule out chronic drug/heavy metal exposure.

➢ **Techniques available in Toxicology Department:**

The analysts working at toxicology laboratory of PFSA, are trained in toxicological analysis, interpretation, court testimony and use of latest instrumentations such as:-

(i) Gas Chromatography-Mass Spectrometry (GC-MS)
(ii) Gas Chromatography- Triple Quadrupole Mass Spectrometry (GC-MSMS)
(iii) Headspace Gas Chromatography-Flame Ionization Detector (HS-GC-FID)
(iv) Gas Chromatography-Nitrogen Phosphorous Detector (GC-NPD)
(v) Tox Analyzer (GC-MS with NPD)
(vi) High Pressure Liquid Chromatography (HPLC)
(vii) Enzyme-linked Immunosorbent Assay (ELISA)
(viii) Liquid chromatography-Quadrupole Time of Flight Mass Spectrometry (LC-QTOF)
(ix) Liquid chromatography-Triple Quadrupole Mass Spectrometry (LC-MSMS)
(x) Atomic Absorption Spectroscopy.
(xi) Conway Diffusion Technique for carbon monoxide determination.

➢ **Scope of Testing:**

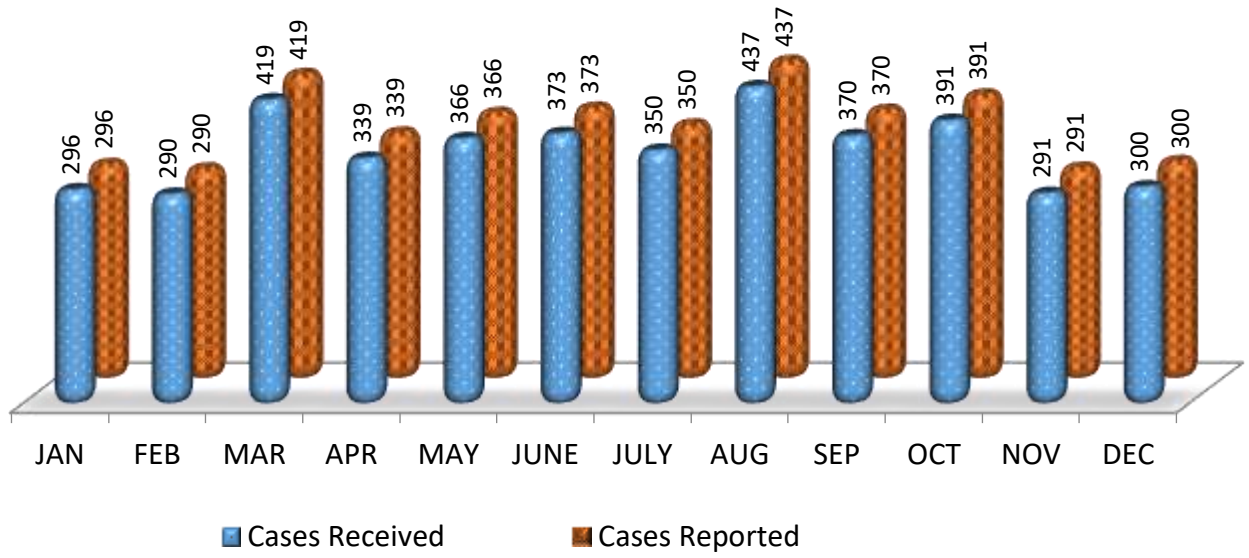
- Alcohol Analysis in blood and urine in ante-mortem cases
- Alcohol Analysis in vitreous humour, blood and urine in post-mortem cases
- Volatile analysis (acetone, isopropanol, methanol, toluene) in biological samples.
- Analysis of drugs of abuse in biological samples (heart blood, urine, gastric lavage/gastric contents, or liver etc.)

- Analysis of drugs used in drug facilitated crimes (alprazolam, lorazepam etc.) in blood and urine
- Analysis of pesticides, blackstone, wheat pills, rat kill pills and cyanide in biological samples
- Analysis of carbon monoxide in blood.
- Quantitative Analysis of drugs in peripheral blood (i.e. femoral blood)

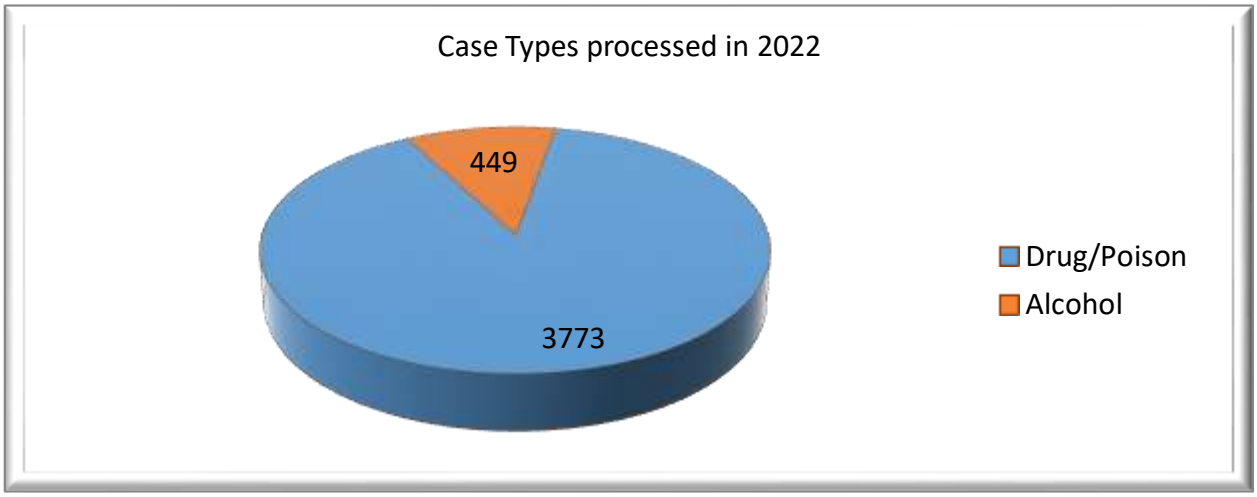
Case Log of Toxicology is as follows (January 2022 to December 2022)

Total No. of Cases received at PFSA in 2022	**4222**
Reports Issued	**4222**
In Process	**0**
Pending	**0**

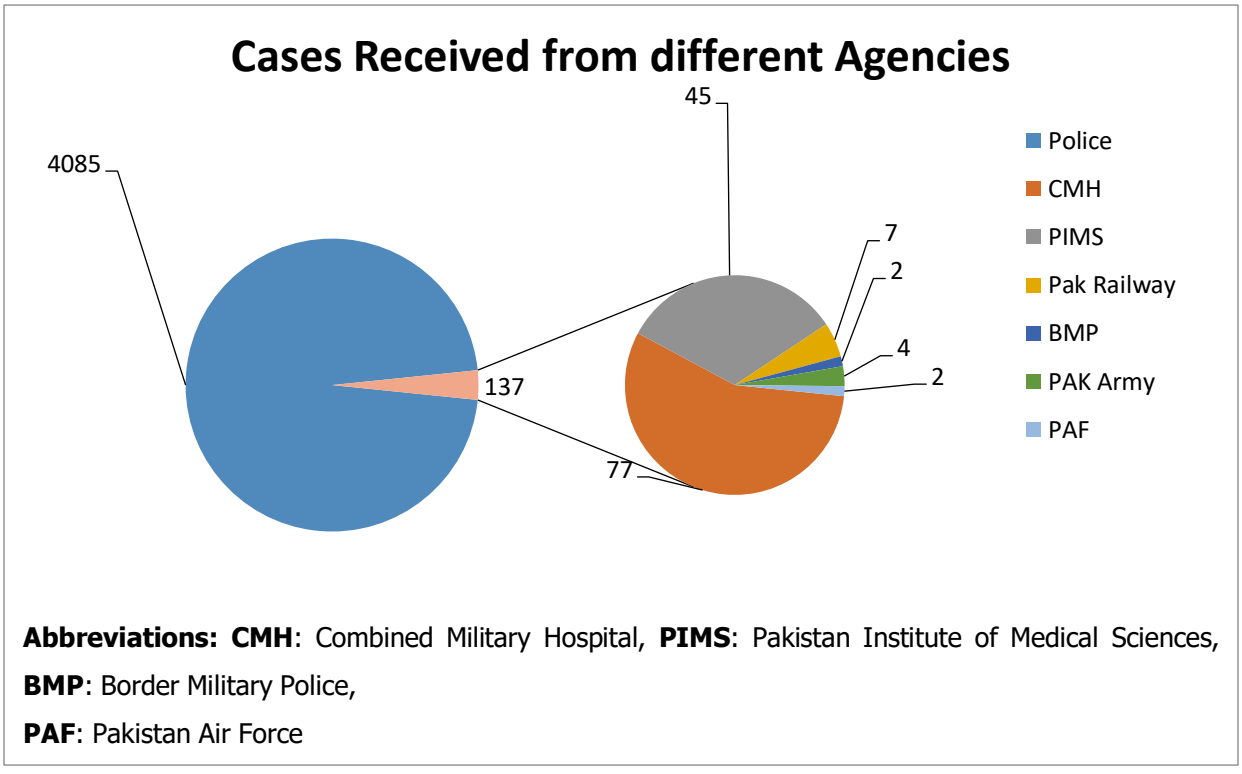
Month wise data of cases received and reported during the year 2022



Case classification can be seen as under;

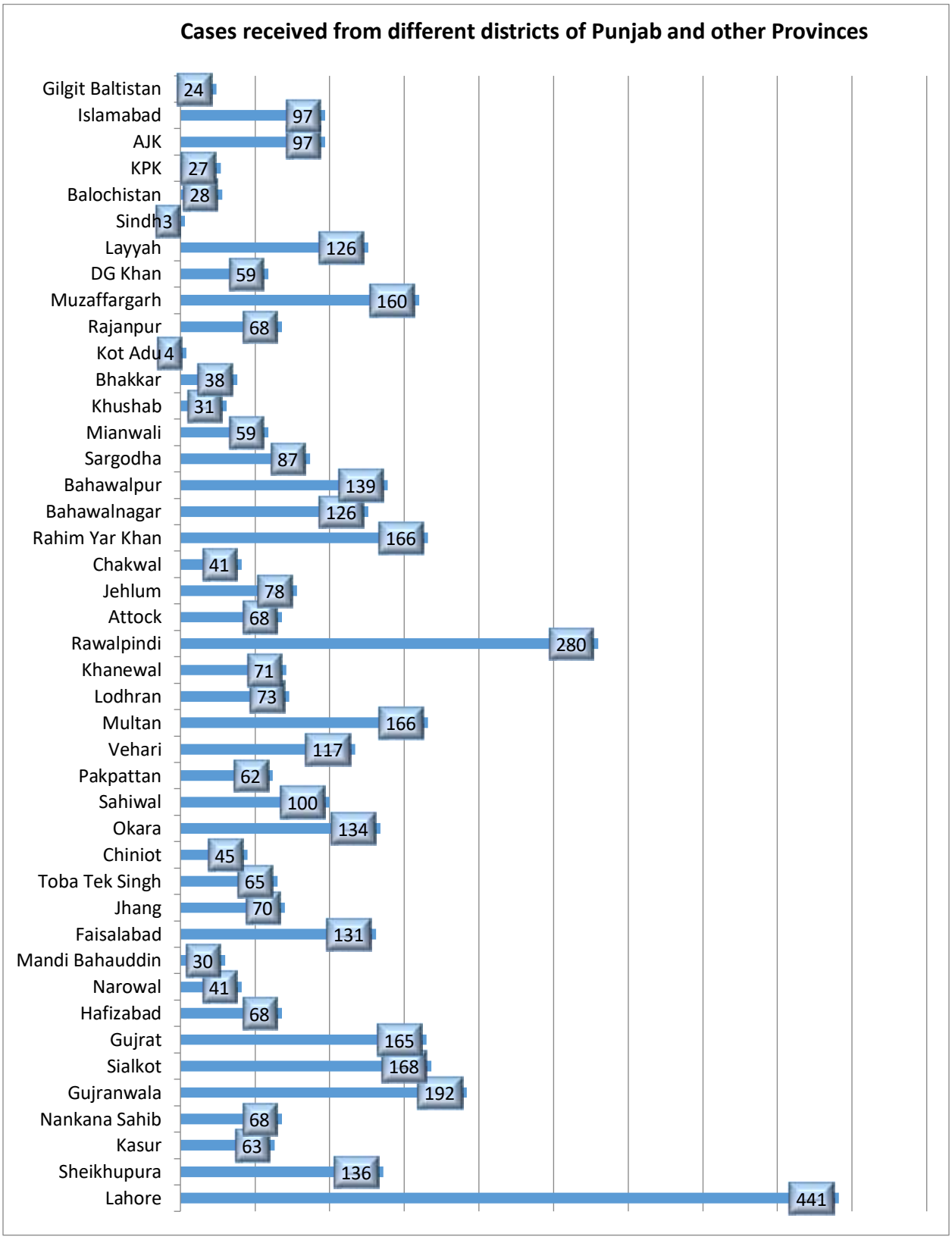


Details of cases received from different submitting agencies



Abbreviations: CMH: Combined Military Hospital, **PIMS**: Pakistan Institute of Medical Sciences, **BMP**: Border Military Police,

PAF: Pakistan Air Force


Cases received from different districts of Punjab and other Provinces
Gilgit Baltistan 24
Islamabad 97
AJK 97
KPK 27
Balochistan 28
Sindh 3
Layyah 126
DG Khan 59
Muzaffargarh 160
Rajanpur 68
Kot Adu 4
Bhakkar 38
Khushab 31
Mianwali 59
Sargodha 87
Bahawalpur 139
Bahawalnagar 126
Rahim Yar Khan 166
Chakwal 41
Jehlum 78
Attock 68
Rawalpindi 280
Khanewal 71
Lodhran 73
Multan 166
Vehari 117
Pakpattan 62
Sahiwal 100
Okara 134
Chiniot 45
Toba Tek Singh 65
Jhang 70
Faisalabad 131
Mandi Bahauddin 30
Narowal 41
Hafizabad 68
Gujrat 165
Sialkot 168
Gujranwala 192
Nankana Sahib 68
Kasur 63
Sheikhupura 136
Lahore 441

TRACE CHEMISTRY (TC)

Crime scenes often contain minuscule fragments of physical evidence, such as hairs, fibres from clothing or carpets, accelerant residues from arson, and explosive residues from bomb-blast scenes. These fragments play a crucial role in uncovering the events that transpired. The field of trace chemistry involves analysing non-biological materials discovered at crime scenes to establish their connection to the perpetrator.

Trace Chemistry Scientists conduct various tests based on the nature of the material to determine its origin. Trace evidence serves as a potential link among the victim, suspect, and the crime scene, forming a triangle of crucial information. Physical and chemical examinations are conducted by Trace Chemistry Scientists, encompassing a wide range of forensic analysis areas.

Trace chemistry covers diverse domains within forensic science, including Explosives Examination, Primer Gunshot Residue Examination, Ignitable Liquids & Fire Debris Examination, Acid Examination, Impression Evidence Examination, Physical Match Examination, Glass Examination, Hair Examination, Fibre and Cordage Examination, Tape Examination, Paint Examination, and Trace Metal Detection Test.

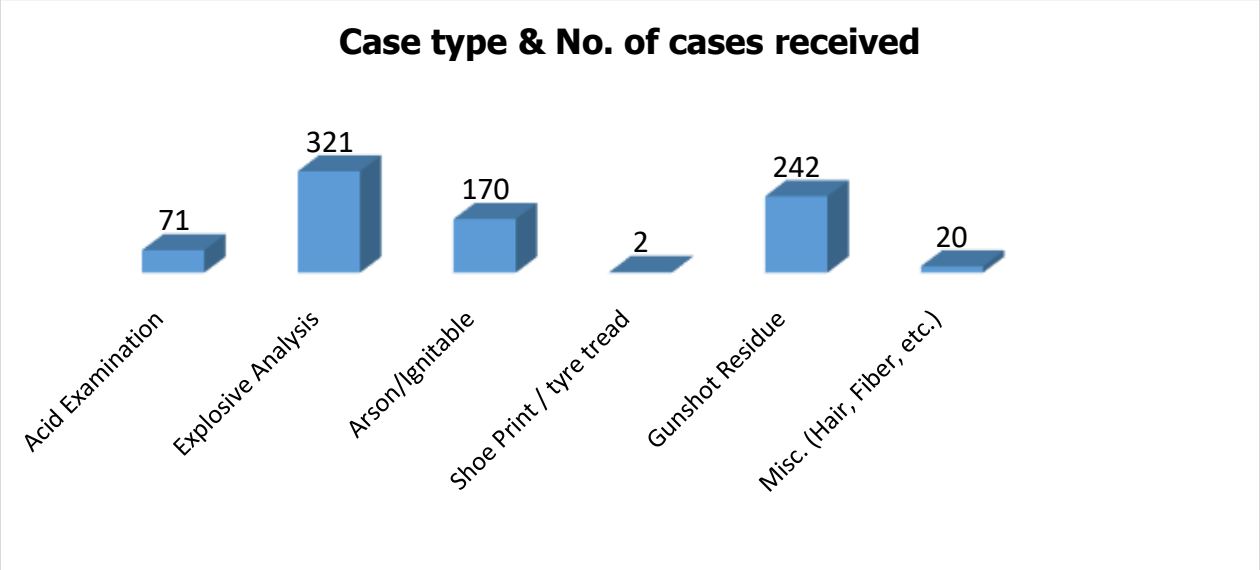
Analyzing GSR (Gunshot residue) using Scanning Electron Microscopy and Energy Dispersive X-ray (EDX) allows the detection and analysis of primer particles containing lead, antimony, and barium. This analysis is a standard method to determine if a firearm has been discharged by an individual.

Proper collection, packaging, and transportation of trace evidence are vital, as they can provide valuable insights into the incident and aid law enforcement agencies and the judiciary in solving a case.

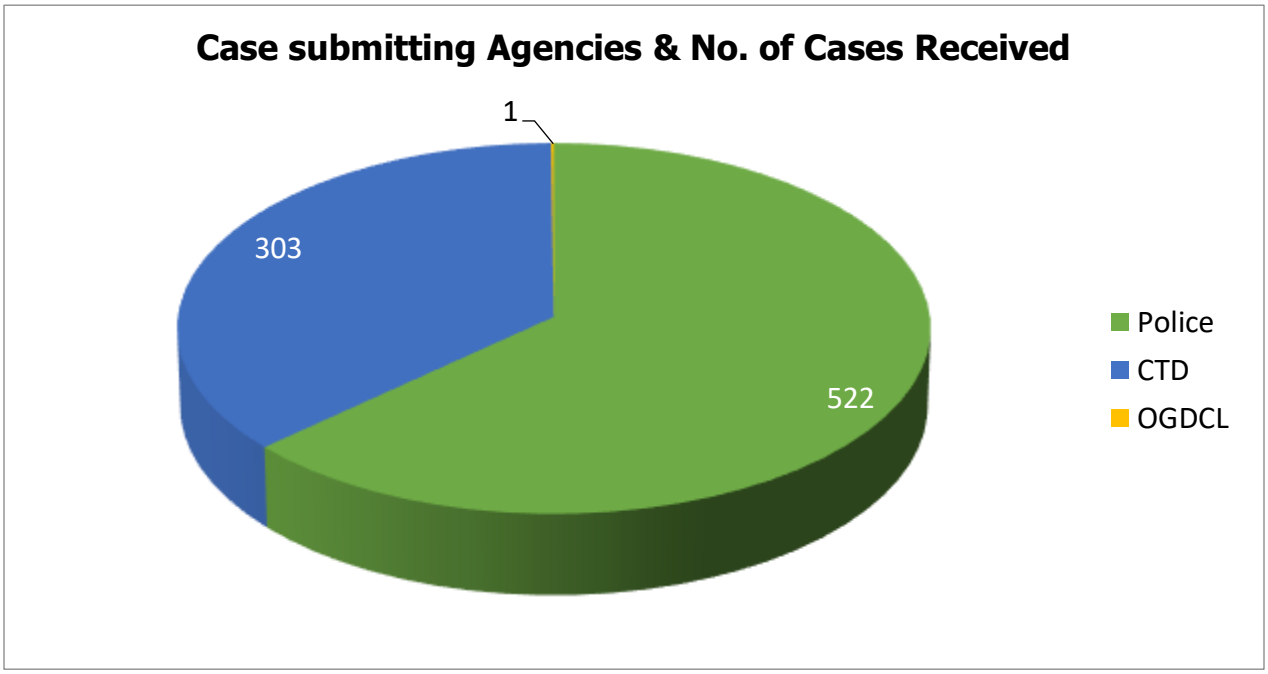
Case log of Trace Chemistry is as follows (January 2022 to December 2022):

Total No. of Cases received at PFSA in 2022	**826**
Reports Issued	**975**
In Process	**26**
Incomplete / Closed	**0**
Pending	**166**
NOTE: 341 cases were reported from the backlog of previous period.	

Cases classification based on test types shown below according to the evidence submitted:



Trace Chemistry cases submitted agency wise in Year 2022:



QUALITY ASSURANCE (QA) MEASURES AT PFSA

ISO/IEC 17025:2017 Implemented

➢ Measures to Ensure Validity of Test Results

PFSA successfully meets all applicable clauses of the standard ISO/IEC 17025:2017 to ensure competence of testing laboratory and has achieved accreditation against this standard.

Following are some examples, in addition to many other, of quality control measures taken in different sections of PFSA:

(i) Use of the certified reference materials or quality control materials.

(ii) Functionality (performance) check(s) of measuring and testing equipment

(iii) Use of control charts (e.g. blood drug and blood alcohol quantitation control charts)

(iv) Intermediate checks on measuring equipment (e.g. weighing balance)

(v) Replicate tests if required using the same or different method (e.g. testing on same sample with two different methods/techniques)

(vi) Correlation of the results for different characteristics of an item if necessary (e.g. detection of drug and its metabolite in same blood sample)

(vii) Technical and administrative review of cases

(viii) Proficiency testing/ inter-laboratory comparison

(ix) Implementation of daily quality controls

(x) Bi-annual random case file review

(xi) Court testimony monitoring

(xii) Internal audits

➢ Achievements

Punjab Forensic Science Agency has achieved many objectives during 2022, following are some examples of such achievements:

1- Published 2 articles (one DNA and one trace chemistry) in international journals.

2- 6 case studies abstracts were presented at annual conference of The International Association of Forensic Toxicologists (TIAFT).

3- PFSA databases are growing rapidly, during 2022;

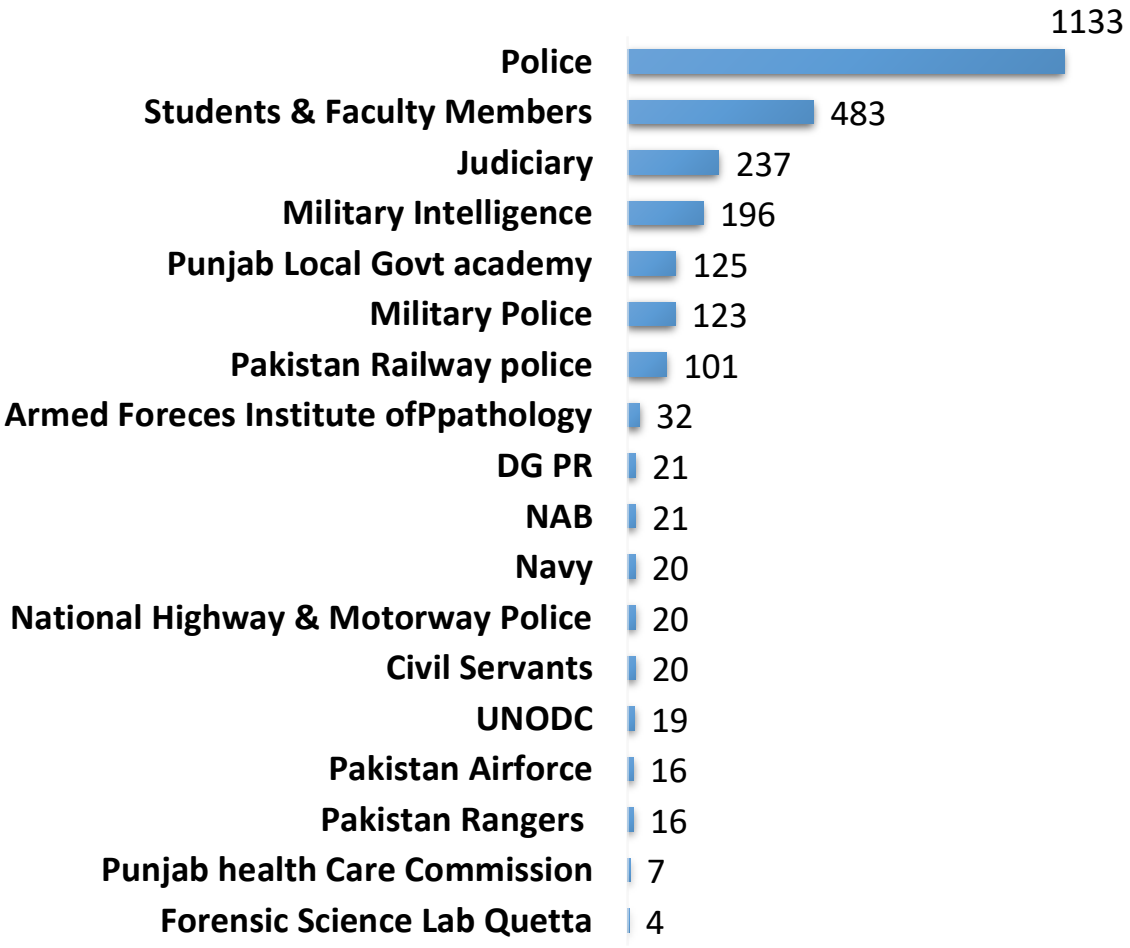
   a. Automated fingerprints identification system (AFIS) helped in solving 58 cases with the help of latent fingerprints recovered from crime scenes, this database has biometric record of 2,38,870 criminals.

   b. Automated Ballistic Identification System helped in solving 159 cases involving use of firearms size of database reached to 92,414 entries.

   c. DNA Database (48000 profiles) helped to solve 11 blind cases.

4- Surveillance assessment of Firearms and Tool marks, Latent Fingerprints, Questioned Documents Examination, Serology, Toxicology and Narcotics departments was successfully completed. A team comprised of Pakistan National Accreditation Council (PNAC) lead assessor, and technical assessors from European Forensic Laboratories performed the assessment and strongly recommended for accreditation renewal.

TRAINING AND AWARENESS-2022



Total Agencies/Institutes: 18

Total Participants: 2594


PUNJAB AGRICULTURE,FOOD & DRUG AUTHORITY
CENTRE OF FORENSIC SCIENCES
PUNJAB FORENSIC SCIENCE AGENCY
MAIN GATE
CENTRE OF FORENSICS SCIENCE