
CRIME SCENE CONTAMINATION AND ITS IMPACT ON CRIMINAL JUSTICE ADMINISTRATION IN INDIA

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ABSTRACT

Crime Scene Investigation provides the backbone for criminal investigation and serves as the bedrock for carrying out justice. The reliability of police evidence gathered at a crime scene influences what can be confirmed in forensic analysis and the strength of prosecution in a criminal trial. The integrity of a crime scene is likely to be destroyed when there is evidence contamination during the course of a crime; when it is changed or destroyed. Crime scene contamination can be caused by mishandling of evidence, failing to secure the scene of a crime, environmental exposure, or by negligence by first responders or investigators. Such contamination can severely influence the evidentiary value of forensic material and cause erroneous forensic interpretation. Forensic science has become an important tool for establishing the accuracy of crime and connecting the crime scene to the perpetrators in the modern legal system.

Methods like DNA profiling, fingerprint analysis, bloodstain patterns and trace evidence need the maintenance of the evidence at the scene of criminal activity. And as such, when contamination occurs, such scientific techniques can yield false or unreliable findings. As such, tainted evidence might corrupt a case for prosecution, result in false convictions, or be used to exonerate criminals, all of which can discredit the criminal justice process. In India, although substantial usage of forensic science services (and a string of recent amendments to criminal procedure laws) are on the rise, numerous structural and procedural problems remain that remain obstacles to managing crime scenes effectively. These problems encompass the insufficient forensic equipment, lack of training of police officers, lack of uniform procedures regarding handling evidence and delays in forensic process. Consequently, crime scene contamination continues to be a big problem in criminal inquiries and the outcome of any court cases. This article explores the term, causes of contaminated crime scenes and its wider implications for Indian criminal justice management. It concludes that due to insufficient evidence under present Indian criminal laws there remain problems arising in forensic evidence collection - and also it argues for better procedures concerning investigation, changes in policy processes.

Keywords: Crime Scene Investigation; Evidence Contamination; Forensic Evidence; Criminal Justice Administration; Chain of Custody; Evidence Law.

INTRODUCTION

Crime scene investigations is one of the most important phases of the criminal justice process, wherein authorities discover, document, collect, and maintain evidence that may later be presented in criminal trials. But the investigation that ends with the crime scene must be handled so that any evidence collected is scientific and admissible by the court. The dependence on forensic science in contemporary criminal justice systems necessitates successful handling of crime scene procedures. A crime scene can be considered as a place where the commission of a crime has taken place or where evidence pertaining to a crime could be found. It could be a site of where the offence was committed including the primary location and an incidental location, where evidence was collected, discarded, retrieved, or transported. The essential goal of crime scene investigations must be the preservation of the basic appearance of a crime scene such that investigators and forensic specialists cannot be misled into reconstructing the course of a crime. However, contamination is a threat to the integrity of a crime scene itself. Crime scene contamination describes the abnormal modification, destruction, or transfer of evidence at the crime scene that changes the reliability and evidence value of the crime scene.¹

Evidence collected at one particular crime scene is deemed to provide reliable evidence of its crime. Many factors can involve contamination; for example, the use of chemicals to the surfaces of crime scene materials, failure to secure the crime scene in time, environmental factors, or any disruption to the investigation by the investigation, the victims, or other community members. Some contamination is unintended in early investigation phases. It is the worst possible case situation that first responders use a situation when responding personnel do not follow protocols for making secure and documenting a crime scene. The effects of such contamination on the administration of criminal justice can be devastating. Forensic analysis can generate falsified, inaccurate information in forensic findings when evidence is flawed or preserved for any reason. Such errors can undermine the prosecution's case and add to the reasonable doubt in a trial. Sometimes tainted evidence even causes wrongful convictions if

¹ Paul L. Kirk, *Crime Investigation: Physical Evidence and the Police Laboratory* 1–5 (2d ed. 1974).

misleading forensic findings implicate innocent persons.²

On the flip side, it could also lead to the acquittal of guilty people if the courts do not accept evidence that has been corrupted. Hence, respect for the integrity of crime scenes can be vital to justice in criminal cases and as an element of forensic science with greater significance in the past few decades. Investigating agencies now use scientific techniques like DNA profiling, fingerprint identification, ballistics examination, digital forensic analysis, and ballistics for identification of suspects. Since the forensic procedure involved in those tests requires that criminal evidence be collected and preserved properly for the investigator to operate safely these techniques demand that police keep the evidence preserved. Realising that scientific means of investigation are of high importance, recent criminal law reforms have likewise given more weight to forensic evidence as a part of criminal evidence in criminal investigations. Nevertheless, a few practical problems keep cropping up in effective crime scene management in India. A number of problems confront the police, such as no professionals in their field, poor forensic facilities, lack of cooperation between police and forensic labs and uniform procedures for evidence collection.³

These issues heighten the risk for contamination and undermine the credibility of forensic evidence presented in the courts. There are also obstacles to the successful resolution of the present case. Thus, there is an opportunity to explore the problem of crime scene contamination in relation to the administration of criminal justice. An analysis of the origin and impact of contamination can illuminate deficiencies in investigative techniques and identify the necessity for reform and improvement in the management of crime scene activity. Enhancing the credibility of criminal investigations and justice administration has been shown to be very successful when investigative procedures have been strengthened and scientific methods introduced into their routine operations.

THE SCIENCE OF CRIME SCENE POLLUTION⁴

Crime Scene Contamination defines the way that information and materials can be influenced when left to become irrelevant or altered in a crime scene. In the case of criminal investigations, the preservation of the physical remains of a crime scene is necessary so as to enable

² Richard Saferstein, *Criminalistics: An Introduction to Forensic Science* 3–10 (12th ed. 2018).

³ Edmond Locard, *The Analysis of Dust Traces*, 1 *Am. J. Police Sci.* 276, 276–98 (1930).

⁴ Barry A.J. Fisher & David R. Fisher, *Techniques of Crime Scene Investigation* 45–60 (9th ed. 2013).

investigators and forensic professionals to properly assess physical evidence and piece together a plan of offence. The forensic examination of evidence that is obtained at the scene of crime will have a negative impact on the decision-making process and findings in a legal case if it has to do with the presence of contamination. As contamination is crucial to forensic science principles, based on the correctness & authenticity of evidence, it is closely related. A crucial concept of forensic science is the Lockard's Exchange Principle, which tells you everything you need to know about how things come to be. This assumption underpins a lot of forensic examination, enabling investigators to determine connections between suspects, victims and scenes of crimes.

Nevertheless, when contaminations are present, transfer of materials could produce conflicting forms of testimony or mask the true forensic findings of the offender. Contamination at the crime scene can also occur during the commission of any phase of the investigation. On forensic examination, contamination may be found or removed between a crime scene and the identification of suspects at time of discovery, at multiple stages and in different locations. In response to the crime, the typical first stage is when first responders approach the scene. Important evidence may be tampered with, destroyed, or otherwise damaged if the area is poorly secured or left unmanned. For instance, if the crime scene is not protected, footprints, fingerprints, stains or trace evidence (fibres, hair) can be modified or tampered. Evidence that is collected and managed can also develop contamination. Forensic scientists who do not conduct adequate data collection and evidence packing routines can introduce foreign material into their specimens. For example, without gloves or protective clothing to hand, fingerprints, DNA or fibres of investigators can contaminate the evidence.⁵

Likewise, poor evidence storage or disparate samples also cause cross-contamination and forensic result-mixed samples can result in cross contamination or contaminated storage or mixing up samples that can mislead forensic interpretation of forensic results. Environmental variables also contribute to contamination of the scene at crime scene pollution. Rain, heat, wind, or humidity as well as various conditions that may lead to degradation of biological evidence, for example in the form of either blood, saliva or semen, can lead to a degradation of blood, saliva or semen. Insects, animals and the litter of nature can also interfere with or even wipe out significant evidence in outdoor crime scenes. But if the crime isn't quickly secured, environmental contamination can harm evidence before forensic inspection is done.

⁵ Henry C. Lee & Timothy Palmbach, *Crime Scene Handbook* 25–40 (2d ed. 2001).

Another kind of contamination comes from investigation errors or procedural failures. Investigators may inadvertently relocate items from the crime scene without the necessary documentation. These can interfere with the normal chain and place forensic experts in circumstances where they cannot piece together the pattern of what took place. But in the same way, bad investigative practices or tools or even instruments may cause damage to delicate evidence. Crime Scene Contamination has grave impact in the judicial process as it is not only related to the initial investigations but also to the actual prosecution of the evidence. Forensic evidence is highly relied on by courts to confirm charges of guilt or innocence with persons accused of crimes. If the credibility of the investigation is questioned on the basis of contamination of evidence, the whole investigation will lose its credibility. In a range of circumstances, the courts might reject evidence if it may have been tampered with or polluted during the course of the operation.

Thus, knowledge of crime scene contamination is particularly valuable not only to investigators, but to legal professionals as well. So, it is necessary for investigators to follow investigative procedures, police personnel must be properly trained, and science-based methods used to collect and preserve evidence in order to avoid contamination. Investigating how the crime scene is maintained helps the criminal justice system to guarantee that forensic evidence becomes credible and helps with fair and accurate judicature.

TYPES OF CRIME SCENE CONTAMINATION

The different types of crime scene contamination can arise as a result of manipulation or damage to the evidence that accompanies the investigation. Knowing what types of contamination exist is really something that is vital with any investigation, as it helps the forensic staff to determine out of which kinds of materials may cause a certain type of contamination, and in the latter process, to design controls and preventive measures. For forensic work, contamination can result from anthropogenic activities, environmental context or procedural errors. Some of the major kinds of crime scene contamination are primary contamination, secondary contamination, environmental contamination and investigator-induced contamination.⁶

⁶ United Nations Office on Drugs & Crime (UNODC), *Crime Scene and Physical Evidence Awareness for Non-Forensic Personnel* 7–15 (2009).

3.1 Primary Contamination

The original evidence present at the crime scene is directly altered, damaged or destroyed, as known as the primary contamination. The former kind of contamination happens when people disturb the crime scene before they properly document and secure it. For example, walking through a crime scene without protective footwear would lead to a break in all the traces of blood or patterns formed by these objects. Primary contamination also may occur when objects at a crime scene are shifted or handled. The placement and positioning of objects often contain important information about the series of actions carried out in the commission of a crime. When such objects are disturbed, investigators might lose invaluable bits of information that could have contextualised the commission of the offence. Most often primary contamination starts in the very first stages of an investigation as first responders reach the scene. If such a part of the scene is not well cut off or other groups are allowed into, evidence can get changed or destroyed.

3.2 Secondary Contamination

Secondary contamination is when foreign materials are transferred from one source to another, introducing new evidence not originally present at the crime scene. A contamination of this nature is of particular significance in forensic science because of the way that it can induce misleading links between people, things, and places. It is possible researchers may mistakenly pass around fibres, hair, or soil from one crime scene to another by clothing, shoes or equipment. Also, biological substances including DNA can be transferred from person to person by indirect contact. These transfers can make it difficult for forensic work and it may be difficult to pinpoint the source of the evidence. Additionally, in forensic laboratories secondary contamination can be detected when procedures are not implemented for specimen handling and analysis. Mixing or improper labelling of samples can lead to the generation of cross-contamination, which can be detrimental to the quality of a forensic result.⁷

3.3 Environmental Contamination

Environmental contamination refers to the fact that natural factors including weather, animals, insects or environmental debris damage signs of decomposition at a crime scene. This sort of

⁷ National Institute of Justice, *Crime Scene Investigation: A Guide for Law Enforcement* 1–10 (U.S. Dep't of Justice 2000).

contamination occurs in outdoor crime scenes because environmental elements can quickly disintegrate biological and physical evidence. For example, rain will wash away bloodstains, footprints, or other traces found near the scene. Sunlight and heat can degrade DNA samples, complicating forensic analysis. Wind may scatter fibres or other small particles, and insects and animals can disturb or eat biological evidence. Contamination of the surroundings illustrates the significance of fast securing the crime scene and protecting the evidence from outside factors. Researchers need to quickly protect fragile evidence: covering the evidence, moving it fast, or limiting access to evidence areas immediately.

3.4 Investigator-Induced Contamination

When it comes to investigator-induced contamination, it is contamination driven by the efforts by law enforcement officers or forensic agents who undertake the investigation (which is usually done in an unsafe manner). Such contamination is commonly the result of mishandling of evidence, not adhering to standard operating procedures, or not being adequately trained. Non-professionals can unintentionally inject their fingerprints, DNA or fibres onto the crime scene without gloves, masks, protective clothing, or other protective technology. Failure to do this, for example, leads to either mixed samples or loss of integrity of evidence without proper packaging or chain of custody at storage. With proper training and adherence to forensic protocols, investigator-induced contamination is highly concerning. Adhering to evidence collecting, packaging and documentation in a standardized manner will greatly minimise the risk of contamination by investigators.

ROLE OF FORENSIC SCIENCE IN CRIME SCENE INVESTIGATION

In modern criminal investigations, forensic science is an essential tool utilising scientific principles and techniques to identify and collect evidence, as well as to analyse evidence. It acts as the liaison between science and law, helping investigators piece together events, discover who the perpetrators are, and bring trustworthy evidence in front of courts. However, the utility of forensic science rests substantially on the efficient handling and preservation of crime scenes. Accurate and reliable forensic analysis can be seriously compromised when evidence is contaminated or mishandled. A primary role of forensic science in crime scene investigation is the identification and collection of physical evidence. In addition to biological material types, other samples could be used as biological evidence – blood, saliva, hair (amongst others) and possibly even non-biological media — fingerprints, fibres, weapons, and

digital devices. To find such actual evidence, forensic specialists closely look for evidence to be collected and collected by scientifically approved methods. Photography, image making or drawing at the scene of a crime is vital, as it documents both the time spent there and the time taken to analyse this evidence. DNA profiling is one of the most common methods that allows investigators to identify a person's genetics.⁸

DNA testing is currently one of the best and most trusted evidence for forensic identification particularly in homicide, sexual offenses and other violent cases. Still, how reliable DNA evidence actually is requires sound collection and preservation of biological samples. Contamination of DNA proof can result in inaccurate findings and potentially deceive investigators. Also fingerprint analysis, being among the most significant forensic methods used to identify individuals who have been exposed to items found on the scene and touching an object. Fingerprints are distinctive unique to each person, and this difference makes the indelible property of fingerprints also of great assistance to the scientific personnel for the criminal investigation. If fingerprints are interrupted or contaminated during the investigation, we may find it hard to precisely identify a person.

Forensic science also involves looking at patterns in blood staining--which can assist investigators so that they can reconstruct the chain as to what happened during that particular violent crime. Bloodstain pattern analysis can provide further clues about the location the victim and perpetrator are in on the scene of a violent crime; the type of weapon used; or what sort of attack was perpetrated by the perpetrator. Contamination or perturbation of bloodstains on the other hand, may result in bloodstains being distorted, causing interpretation error. Trace evidence analysis alongside the aforementioned methods in crime scene relationships plays a vital role in connecting a criminal to a crime scene. One of these is trace evidence which can be minor items like fibres, soil particles, glass shards and paint chips which are often transferred during the crime activity. Even microscopic traces can yield useful information about individuals and objects involved in the crime. A key component of legal procedure is to maintain the chain of custody – the well-established method of processing and transporting trace material from crime scene to forensic labs into court. The chain of custody is how the evidence will be collected, analysed and protected during the entire recovery process.⁹

⁸ Edmond Locard, *The Analysis of Dust Traces*, 1 *Am. J. Police Sci.* 276, 276–98 (1930).

⁹ Keith Inman & Norah Rudin, *Principles and Practice of Criminalistics: The Profession of Forensic Science* 95–110 (2001).

If a chain of custody is broken or not well recorded, the evidence can be refused in court. So forensic science is important by enhancing investigations into crime and for adjudication. But the ability of forensic science to be applied only takes into account the preservation of crime scenes and strict obedience to investigative processes. So preventing contamination and preserving evidence integrity is the key for forensic science to serve as a useful tool for the criminal justice system.

LEGAL FRAMEWORK GOVERNING CRIME SCENE EVIDENCE IN INDIA

The collection, management, and admissibility of evidence gathered at the scene of a crime in the Indian criminal justice system are both stipulated by statutes and are decided upon judicial principles. We rely on adequate legal infrastructure and policies to ensure reliable and admissible evidence collected during criminal investigations in legal proceedings. The contamination resulting at the crime scene becomes an important legal issue as flawed information can be challenged during trial proceedings, which in turn may prejudice the prosecution's case. The Bharatiya Sakshya Adhinyam, 2023 (BSA)¹⁰ — replacing the previous Indian Evidence Act of 1872 as one crucial legislation dealing with the sufficiency of evidence — is also one of the significant laws about the admissibility of evidence in India. It establishes rules of law on evidence relevance and admissibility in criminal trials. It also is a law that considers documentary, oral, and electronic evidence as evidence.

DNA reports, fingerprint analysis, and other scientific findings are expert evidence depending on the law. Court discretion is appropriate only on such evidence, obtained and preserved in compliance with legal and scientific standards. Similarly, the Bharatiya Nagarik Suraksha Sanhita, 2023 (BNSS)¹¹ is another relevant statute to criminal investigations replacing the Code of Criminal Procedure, 1973. This legislation allows police authorities to search, seize evidence, examine witnesses, and record statements. Careful documentation and evidence handling during the investigation should be done properly to prove evidence during the investigation remains admissible. The credibility of these claims is then put into question if investigators are seen not to adhere to the prescribed procedures. The law also makes expert testimony the focus of cases that involve forensic evidence. Forensic experts analysing materials from crime scenes regularly provide scientific opinions that help courts make sense

¹⁰ Bharatiya Sakshya Adhinyam, No. 47 of 2023, §§ 39–45 (India).

¹¹ Bharatiya Nagarik Suraksha Sanhita, No. 46 of 2023, §§ 176–184 (India).

of complicated technical issues.

The reliability of such expert evidence rests heavily on the authenticity of the tested materials. If contamination occurs during the processing of evidence, the reliability of expert opinion may be called into question during cross-examination. An equally important legal rule is the chain of custody, or the fact of history and order through proper documentation of the evidence's receipt from the crime scene to the hearing and evidence transfer time. By the chain of custody, it is ensured that all evidence is presented by a chain the same as the evidence that was collected during the investigation. If or when a chain of custody is broken in a manner that is irregular or is irregular in or out of place, doubt may be cast on the integrity of the evidence and the chance that may lead to the evidence itself being rejected by the court. Indian courts have long emphasized the importance of leaving intact evidence in criminal investigations where evidence is essential to ensure the integrity of evidence.¹²

Courts may give more weight to the idea that where the evidence looks like it was manipulated, corrupted, misappropriated, or tainted but has failed to produce cleanliness or evidence, they will not take it at face value or reject it. Such circumstances may play a major role in determining the success of crimes against citizens or the State in a criminal case, due to the fact that corrupted documents are not viable evidence of guilt. As a result, within the Indian criminal justice system, the legal context for such evidence requires good investigation procedure along with scientific means for evidence collection and storage of such evidence. Compliance with these standards is critical to avoid contamination and to guarantee reliable forensic evidence in the law-enforcement process.

IMPACT OF CRIME SCENE CONTAMINATION ON CRIMINAL JUSTICE ADMINISTRATION

Crime scene contamination can be harmful to the effectiveness and justice in the administration of criminal justice since the reliability of criminal investigation greatly relies on the reliability of the evidence and the trustworthiness of the crime scene. As well as being part of the problem itself, when a crime scene gets contaminated, altered, or destroyed it is also a hazard to the forensic technique employed by agents and the means for investigators, lawyers and judges to find out the truth. As a consequence, contamination can impair all aspects of the criminal justice

¹² Selvi v. State of Karnataka, (2010) 7 SCC 263 (India).

system — from investigation to prosecution and adjudication — with it. One of the most serious side effects of a crime scene contamination is that it undermines court cases. Unlike the prosecution may get involved in criminal trials that requires them to prove beyond reasonable doubt that an accused person is guilty. Crime scene forensic evidence often plays a pivotal role in establishing this evidence. When the defence can prove contamination or mishandling of that evidence then perhaps, that evidence is not credible.¹³

Courts might refuse to accept such proof, undermining the prosecution's case and encouraging an acquittal. Contaminated evidence can also lead to wrongful convictions, notably when contaminated forensic results are misinterpreted. Example would prove that DNA samples are contaminated with potential suspects leading to false matches or linking the crime scene to innocent individuals. With such contaminated evidence, if investigators use them without valid verification, there is a risk that the prosecution of people who were not directly responsible for the crime will follow. A false conviction is a terrible injustice not only for the innocent individuals but also for the true criminals who get to go free. An additional devastating consequence is the backlog at criminal trials and prosecutions. If there is suspicion of contaminated evidence, investigators can be compelled to carry out further forensic examinations, or to gather other evidence to bolster their case. This process can cause a very long delay in investigations and criminal trials. In a justice system struggling already with significant case backlogs, these delays can add more pressure on courts and criminal investigation bodies. Contamination of a crime scene could also erode public trust in the justice system.¹⁴

The public wants that police and forensic experts are professional with their investigations. Disproportionate accountability leads to a lack of trust in our institutions in the long run and in the integrity of law enforcement organizations. In addition, contaminated evidence could disrupt the true reconstruction of crime events. The forensic investigator depends on the fact that objects and bloodstain patterns are there and trace evidence as well as other materials at the scene are there. If the crime scene has become obstructed, broken, twisted, or otherwise contaminated by a source such as Mold, impurities, etc. then investigators might find it hard to assemble the sequence of events accurately. This can result in falsely determined evidence or

¹³ M.S. Rao & R.K. Sharma, Role of Forensic Science in Criminal Justice System in India, 4 *Int'l J. Forensic Sci. & Pathology* 102, 104–08 (2016).

¹⁴ Bharat B. Bhardwaj, Forensic Evidence and Criminal Justice Administration in India, 6 *Indian J. Criminology & Crim.* 89, 95–98 (2018).

understanding the crime to a lesser than it may have been possible. Therefore, to maintain accuracy and reliability in criminal investigations, and remain lawfully sound they need to work hard at preventing crime scene contamination. To preserve the integrity of evidence and protect crime proof, it is necessary for crime scene management to work effectively, investigators must receive training, and forensic protocols must be strictly adhered to — with such precision that the judicial system gains strength.¹⁵

CHALLENGES IN CRIME SCENE MANAGEMENT IN INDIA

Effective crime scene management is a cornerstone to reliability of forensic evidence and effectiveness in managing criminal justice. However, in India multiple practical and institutional difficulties prevent the effective preparation and maintenance of crime scenes. This causes risk of evidence contamination, in many cases jeopardizing the quality of the investigation. One major problem is that first responders and police officers generally have little specialized training. In many cases the police officers arriving at crime scenes not only possess inadequate knowledge of forensic procedures and techniques regarding how best to preserve evidence, but this can also result in their inadvertently trashing critical evidence as they try to keep at least the crime scene secure or help victims. In the absence of a complete, well-trained, understanding of crime scene management, investigators will not be able to appreciate the importance in certain kinds of evidence and samples such trace evidence and biological data, for example.

The other important issue is the poor forensic infrastructure in much of the country. Despite some number of forensic science labs in India, they usually operate in overburdened capacity with few resources. A delay in forensic examination may delay the timely analysis of evidence recovered from crime scenes. Furthermore, certain parts of the country do not have the resources of mobile forensic vehicles and special equipment which makes it impossible for documenting/collecting evidence. Standards of protocols and consistent procedures for investigation are not well established too. There are legal rules related to investigating a crime scene, but those rules will differ from state to state and police department to police department. Inconsistent investigative procedures, like that of any forensic researcher, can result in procedural errors that may further expose investigators to a higher risk of contamination or

¹⁵ M.S. Rao & R.K. Sharma, Role of Forensic Science in Criminal Justice System in India, 4 Int'l J. Forensic Sci. & Pathology 102, 104–08 (2016).

losing evidence. Public interference and a lack of proper crime scene security provide the other challenges. And there are still many other reasons why crime scenes are not properly cordoned off so that persons who were not supposed to watch the scene — bystanders, media personnel, relatives of victims — aren't able to. This interference can disturb evidence and make forensic analysis more complex.¹⁶

So the crime scene must be tightly controlled to maintain integrity. Moreover, lack of coordination between investigating agencies and forensic experts makes crime scene management ineffective. Some forensic experts might not be consulted when investigating, and the evidence may be mishandled or improperly packaged. There seems to be a lack of cooperation between the police and the forensic scientists required to ensure that what is gathered is maintained according to science. The issue is also the result of technological limitations and failure to exploit modern investigative tools effectively. Modern crime scene reconstruction, digital evidence documentation, and automatic forensic analysis systems, etc., are being deployed to increase investigative precision and accuracy of the findings in better developed countries. But adoption of such technologies is low across many sections of India. These challenges call for far-reaching reforms in training, infrastructure enhancement, and institutional coordination measures. Enhanced forensics capabilities, strict adherence to crime scene investigation protocols, and compliance should work towards the elimination of such contamination.¹⁷

COMPARATIVE PRACTICES AND INTERNATIONAL STANDARDS IN CRIME SCENE MANAGEMENT

Crime scene management is a national concern, but also a subject of international standards and best practices developed to promote and ensure the scientific integrity and reliability of criminal investigations. The number of forensic technologies, specialized investigative units, and standard protocols that are developed to avoid contamination of crime scenes and to ensure the trustworthiness of forensic evidence have been well documented in many countries. Looking at these international standards can serve as a valuable guide on improving crime scene management in India. One of the fundamental international principles in crime scene investigation is the strict preservation and isolation of the crime scene that must take place as

¹⁶ Peter White, *Crime Scene to Court: The Essentials of Forensic Science* 50–65 (2010).

¹⁷ United Nations Office on Drugs & Crime (UNODC), *Guidance for the Collection and Preservation of Physical Evidence* 8–14 (2010).

soon as possible after a crime is reported.¹⁸

The US and UK law enforcement follow very comprehensive procedures and standard operating procedures when securing a crime scene. Officers first to arrive at the scene are trained to create a fixed perimeter of security around the crime scene and limit access only to authorized people as instructed to officers. This will minimize the chances of unauthorized entry, contamination, and/or other problems. Special crime scene investigation units are another very critical standard of international practice. In several places, investigators are deployed to handle the crime scenes. These teams have trained forensic specialists with expertise in digital tools and methods for collecting and documenting evidence. Given their specialized education, they do not waste their time identifying and preserving traces, minimizing the likelihood of contamination in addition to mistakes by a detective. International standards of evidence protection and anti-contamination are also recommended for human persons. Investigators are also required to wear gloves, masks, shoe covers, and protective attire when they go to crime scenes. The precautions are intended to aid in preventing the transfer of foreign materials including fingerprints, fibres, or DNA from investigators to the crime scene. Evidence is also stored in separate containers so that cross-contamination between samples isn't possible.

Advanced technology is another major advancement in international crime scene management to this day and advanced technology in crime scene documentation and reconstruction. Three-dimensional crime scene mapping, laser scanning, and other forms of technology (think three-dimensional crime scene mapping and laser scanning, digital cameras) can aid the examination of a scene and keep it in a proper state for investigative purposes. Such systems now allow forensic researchers and regulators to recreate the incident scene regardless of how the site changed from the physical location. There are also guidelines on best practices for crime scene investigation by entities like the UNODC (United Nations Office on Drugs and Crime) and International Association of Forensic Sciences (IAFS). The above guidelines put great importance on good preparation, regular processes, and scientific approaches in gathering and analysis of forensic evidence. A comparison of the international practices reveals numerous lessons learned with a focus on where the Indian approach has possibilities for growth. Incorporating special crime scene units, modern technology in investigation, and standard procedures for handling evidence would greatly improve the efficiency of crime scenes. In this

¹⁸ S.K. Sarvaria, *Law of Evidence* 315–320 (2019).

manner, the development of these international standards with support of domestic research techniques will help India fortify the reliability of forensic evidence and bring efficiency to the criminal justice system.¹⁹

FINDINGS AND ANALYSIS

Investigations of crime scene contamination and its impact on the management of criminal justice system in India demonstrate several important findings. Arguably one of the main conclusions is that the quality of forensic evidence is generally related to the security, analysis, and documentation of a crime scene as it occurs in its early stages of investigation. A great deal of contamination possibility becomes apparent when first responders do not work with caution, the credibility of forensics is affected. Most crime scene contamination happens because of failed procedures or lack of professional training of crime officers, according to another landmark finding. Investigators frequently inadvertently disturb the crime scene in the course of assisting victims or conducting pre-investigatory investigations, in a few instances. Not knowing the forensic processes can make law enforcement lose sight of how important it is to retain trace evidence like fibres, fingerprints, biological samples, or bloodstain patterns for forensic analyses. It is further affirmed by research which further states that there is a shortage of forensic infrastructure and resources in India compared to the increasing demands for modern-day criminal investigations.

Forensic science laboratories help analyse the evidence obtained from crime scenes for analysis of evidence, but many laboratories have problems getting their work completed when the workload is high and there is a shortage in a specialist team of trained professionals. Such delays have the effect of delay affecting how swiftly evidence can be examined by a court of law and compromise the expeditious evaluation of criminal-investigation efficiency. Evidence contamination is also caused by differences in the implementation of evidence analysis protocol from place to place. Guidelines for crime scene management are there, although their implementation may depend upon the resources, training, and administrative practices of the diverse police departments.

This inconsistency can be conducive to irregularities in service protocol that ultimately affects evidence integrity. The study also indicates that many crimes suffer from public interference

¹⁹ International Association of Chiefs of Police, *Crime Scene Processing and Investigation Best Practices* 22–30 (2012).

and poor crime scene security. Crime scenes are vulnerable to a number of threats when not properly cordoned off such unauthorized parties can enter and inadvertently disturb or destroy important evidence. This is especially problematic when cases receive public media coverage. According to the legal perspective, this study serves to emphasize that authenticity and reliability are the preeminent issues before the courts of law. Evidence may be treated with reluctance or excluded entirely if there are concerns about the credibility of the evidence, its chain of custody and other forensic science. As such, contamination of the crime scenes can have a direct impact on the outcome of criminal trials by undermining the prosecution's case. This is consistent with the belief that effective crime scene management should involve expert scientific work, procedural discipline, and institutional coordination. These three ingredients are crucial if the likelihood of contamination is not to be compromised and which can be detrimental to the credibility of the criminal justice system in the long term.

SUGGESTIONS AND REFORMS

Reforms and preventive strategies may have to be implemented to limit the possibility of contaminating a crime scene and thus provide more reliable forensic evidence. Specialized training can be provided to the police officers and first responders on crime scene management in addition to forensic evidence handling and forensic skills. Training would have to concern securing crime scenes, securing their equipment, the way that they gather evidence, maintaining chain of custody and preventing contamination of evidence. A further reform can be to strengthen the forensic infrastructure, the laboratories. More laboratories, modern equipment and trained forensic experts all help the efficiency and reliability of forensic investigations. There would also be a significant advantage to having dedicated crime scene investigation units in the police department to investigate crimes. These specialized units should comprise trained forensic professionals and be charged with examination and documentation of crime scenes using scientific techniques. Such units can prevent any procedural mistake and guarantee that evidence is placed in the order required according to standardized protocols. Uniform national rules must be introduced: those regulations should also be followed by all police agencies.

These standards should outline the roles of first responders, investigators, and forensic personnel, as well as their procedures for evidence collection, documentation, and preservation. Another imperative reform is that of embracing new technology at the crime scene. Tools like

digital pictures, 3D scene reconstruction, forensic databases and systems that auto-analysis evidence can make investigations far more precise and efficient. The public awareness and strict enforcement of crime scene security is equally important. Crime scenes, therefore, need to be carefully cordoned off, access limited to those within and trained personnel only. Until an investigation is complete media personnel are not to be allowed interference with a crime scene. By executing such reforms, it is quite feasible to significantly reduce the risk of contaminating a crime scene in India, and to improve the quality of criminal investigations.

CONCLUSION

Crime scene contamination is one of the most serious problems that undermines the effectiveness of the criminal justice system and its credibility. So how much of the credibility of criminal cases is built on the reliability of what is pulled at the crime scene? If evidence becomes contaminated, manipulated, or poorly handled, the result can be forensic analysis that is distorted and investigators and courts are at risk of being unable to find the truth. As a result, contamination can result in wrongful convictions, acquittal of guilty individuals, or delays in service to justice. Considering today's forensic science-dependent criminal inquiries, preservation of crime scenes has never been more important. Science techniques like DNA analysis, fingerprint examination and trace evidence analysis are extremely regulated in the way researchers conduct investigations. With the slightest lapse in crime collection and handling, one's preservation of evidence will significantly lower forensic resources and impact on the integrity of criminal cases fair trial evidence. Despite changes in laws and forensic skills in India, many hurdles impede effective crime scene management. Lack of sufficient initial forensic infrastructure, poor training of first responders, insufficient forensic services, absence of standardized protocols or rules, as well as public intervention can be the number one causes when evidence becomes contaminated. These shortcomings indicate the necessity for more concern to scientific investigation methods and professional investigative practices.

A full set of systematic reforms targeting crime scene management should be put in place to enhance criminal justice management as it relates to crime scenes in order to enhance the management of criminal justice systems. This entails a number of steps, including giving advanced training to police officers, strengthening forensics facilities, developing the skills of investigators and modern investigative technology, and maintaining strict adherence to evidence collection and disposition rules. Crime scene investigation units and inter-agency

coordination between investigators and forensic specialists can also dramatically minimize contamination. In the long run, maintaining the purity of crime scenes is essential to the quality of investigations, dependable forensic work, and fair trials. Good crime scene treatment not only leads to high-quality criminal investigations but also gives people (and the world) confidence in the criminal justice system: just evidence, fair verdicts and no shortcuts in the field.