

# FORENSIC SCIENCE INSIGHTS

Gossman Forensics - David Gossman, Louise Denlinger

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## **Quality Assurance and Quality Control in Evidence Collection and Laboratory Analysis**

Evidence collection, handling, transportation and laboratory analysis in any fire and/or explosion plays a critical role in all aspects of an investigation and litigation. Ensuring the quality of evidence collected and analyzed in the laboratory is essential for origin and causation determination and also in litigation and case strategy. It is important to demonstrate scientific reliability and validity in any process that involves the evidence from a fire or explosion scene. This is best achieved through a stringent quality assurance and quality control program. The terms quality assurance and quality control are related, but can sometimes be misunderstood.

### **Quality Assurance (QA)**

Quality assurance uses a broad methodology of compiling and following written procedures for the collection, handling, preservation, transportation and laboratory analysis of materials to ensure reliability and accuracy. A well-developed quality assurance program should address any action in an investigation where error or inconsistencies can be introduced. For example, quality assurance protocols in evidence collection may include written standard operating procedures (SOPs) and data quality objectives (DQOs). SOPs are a clearly written and maintained set of instructions that will ensure processes are carried out in the same manner each time they are performed. DQOs define the criteria that a data collection program should satisfy. Examples of evidence collection quality assurance methodology include video and/or photo documentation, sample selection criteria, evidence labeling procedures, collection methods, sample storage protocols, chains of custody, sampling plans and transportation conditions and documentation.

In the laboratory, quality assurance addresses the actions necessary to provide confidence in all analytical results. A successful quality assurance program will be utilized to verify that the laboratory's analytical process is operating within acceptable limits. Some ways this is achieved are by the use of training and training criteria to ensure analysts are performing at a high degree of accuracy and precision, equipment and device maintenance and calibration according to manufacturer's guidelines, and traceability of all standards and reference materials.

It is valuable to have an experienced investigator assess laboratory selection and analysis issues. An important element of quality assurance is correct selections of analytes to be tested, sample extraction methods, sample preparation procedures and choice of analytical methods. The focus of laboratory services is to perform analyses using the equipment they possess. The experienced investigator's focus is to identify the analytical plan needed to best establish the causation and circumstances of the incident.

### **Quality Control (QC)**

Where quality assurance defines goals, quality control identifies the on-going mechanisms used to achieve those goals. Quality control monitors and confirms the precision and accuracy of the results. Quality control in the evidence collection process frequently will demonstrate proper techniques were followed by the investigator collecting and/or sampling evidence. Collecting background samples or replicate samples are just a few examples that will provide an opportunity for quality control in the use of field samples. Laboratory QC programs typically include analyzing blanks for all reagents (or procedures) used in the analysis process, performing duplicate analysis on a

percentage of samples, analyzing a certain number of standard reference materials with every sample set and running spiked samples to determine the accuracy of an analysis.

Laboratories typically have well developed QA/QC for their routine testing. The non-typical nature of many forensic samples and sampling environments, however, also requires additional and/or different QA/QC steps in the laboratory. This can include duplicate or triplicate testing of every sample, the use of additional test methods for a given parameter or other forms of confirmation testing. To help control costs, screening tests may be followed by more specific and/or accurate tests depending on the screening results. It can be a difficult task to develop a successful quality program for forensic samples.

The nature of forensic evidence will vary greatly with each incident scene. It is essential to have a laboratory that has the flexibility and knowledge to ensure a quality program can be implemented successfully for the given type of incident/evidence situation. It is often necessary that the fire investigator work side-by-side in the laboratory with the lab analysts. The fire investigator may further need to perform his or her own analysis of the lab data beyond what the laboratory is in a position to do. This usually requires that the fire investigator utilize specialized software and databases to perform this analysis of the lab data.

### **Case Application**

Proper QA/QC is useful in the assessment of laboratory results to rule in or rule out various potential chemical processes. It may be necessary to assess all these alternative potential chemical processes to discover what actually happened. Without proper QA/QC, valuable lines of investigation can be easily overlooked. Generally it is the investigator, not the laboratory, who identifies appropriate additional analyses based on the assessment of laboratory results at each step in the process.

QA/QC is beneficially used in the court in a number of ways. Inadequate QA/QC is often the foundation for attacking the opposing expert's evidence. This tactic can be pursued based on holes in the laboratory QA/QC, or even on the basis of a complete lack of QA/QC. An experienced investigator can assist in the development of deposition strategies, including the identification of specific lines of questioning. In some circumstances, it is possible to "turn" the opposing expert based on either insufficient QA/QC or on well qualified data that points in another direction. An experienced investigator also helps ensure that the case for their client has solid and impeccable QA/QC. It should not be unexpected that the final outcome of the case is often rooted in the credibility of the chemical analysis and interpretation of the evidence.

### **Conclusion**

Quality assurance and quality control procedures in evidence collection, handling and laboratory analysis are paramount in importance for any fire and explosion incident. A successful investigation and causation determination by the fire and explosion expert rests on adherence to QA/QC procedures when collecting evidence and performing laboratory analysis. Selecting a laboratory that is lacking in this area will only discredit any opinions by the expert and litigation efforts can unravel, even if a case is solid. The importance of working with a laboratory that is committed to QA/QC can not be underestimated.

Proper documentation and adherence to procedures brings confidence in the results and the subsequent opinion of the expert. Gossman Forensics requires all laboratories utilized for analysis to undergo an assessment of their quality program. We are experienced in laboratory set-up and all areas of operations as part of ChemRight Laboratories, Inc. We realize that when evidence is properly managed in every aspect of the investigation, causation can be determined with confidence and litigation can proceed toward justice.