

Case Management: The Foundation for Crime Scene Reconstruction

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ABSTRACT

Case management is organizing evidence to be workable, retrievable, and understandable in the context of the scene, providing the foundational and structural framework for crime scene reconstruction (CSR). The importance of proper organization to reconstruction cannot be overstated and has been recognized in the past by pioneers in the field. Organizational efforts should begin at the onset of an investigation with a mindset towards later reconstruction. The author provides an illustrated methodology for organizing case information within a flexible framework that facilitates later identification, retrieval, correlation and analysis. The approach builds upon and expands common evidence documentation techniques, and allows for later inclusion of all types of forensic analysis. The result is a more thorough and comprehensive reconstruction in which supporting documentation is easy to reference and retrieve.

Keywords: case management, event segment analysis, contextual bias, bloodstain pattern analysis, crime scene reconstruction, forensic science

ARTICLE INFORMATION

Received: 11 February 2016
 Revised: 17 June 2016
 Accepted: 11 July 2016
 Published: 22 July 2016

Citation: Graff GW. Case Management: The Foundation for Crime Scene Reconstruction. *J Assoc Crime Scene Reconstr.* 2016;20:35-43.

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Introduction

Case management is organizing evidence and information to be workable, retrievable, and understandable in the context of the scene; providing the foundational and structural framework for both the investigator and crime scene reconstruction (CSR) analyst. Proper organization facilitates a thorough, comprehensive investigation, and analysis and helps avoid duplication of effort. This premise is not new. Charles E. O'Hara (1912-1984), physicist, New York Police Department detective, author, and early pioneer of crime scene investigation, suggested an approach to more complicated crimes that stressed the

importance of organizing and correlating evidence in preparation for analysis [1].

CSR is usually thought of in terms of a formal analysis, which occurs after all of the evidence is collected, forensic reports are completed, and other analyses finished. However, many CSR techniques including evidence relationship identification, sequencing, flowcharting, and scientific method application may be utilized and results organized from the onset of the investigation. Case organization principles described in this article are applicable during both the investigation and reconstruction.



Two key principles should guide an investigation from its inception. First, assume every case is going to trial and conduct a thorough, comprehensive, investigation accordingly. Second, starting from day one, memorialize, document, and organize all evidence as it is collected with a mindset of future reconstruction. Well-organized case materials ensure an accurate and efficient flow of the CSR analyst's work from one phase to the next. These two principles lay the foundation for a comprehensive investigation with evidence ready for formal reconstruction.

In collecting and organizing evidence, investigators and technicians should first follow agency policy. Case management software is available, but often too inflexible for use in varied applications. The 5-step case management process for CSR described below begins with effective methods for reviewing and organizing evidence.

The first step in preparing for analysis is to conduct a review of case materials. An analyst should review all the evidence. The first time through should be a familiarization, making notes as needed. Subsequent reviews are for organization and detail. Trying to both organize and analyze materials during the first review may be frustrating and counterproductive. Any concerns regarding contextual bias should be addressed early and handled as deemed appropriate [2]. The term contextual bias as typically used in forensic science describes the unconscious influence other irrelevant information might have on analytical judgements. Although addressing contextual bias issues is beyond the scope of this article, proposals to remedy such bias may include structuring the order in which a CSR analyst views evidence.

The second step is to organize case materials. Electronic or hard copy folders may be organized by subject matter. Folders for suspects, witnesses, and victims could include information such as details and images related to their residence, vehicles, and property, criminal history, bankruptcy court records, public and law enforcement data base information, interview reports, reports referencing the person, and all forensic reports regarding the person. Prepare separate folders for other case materials such as investigative reports, logs, data base searches, forensic reports,

administrative reports and images. Include an index in all folders that tracks information as it is entered. Organizing the above information aids later retrieval, comprehension of context, and identification of relationships between the scene, suspects, witnesses, victims, and other evidence. From these relationships in context with other evidence and analysis, investigative questions and answers may later emerge.

Once case materials are organized by subject matter, document the evidence to make it easily identifiable, retrievable, and understandable in preparation for further analysis. Methods vary based on the needs of the analysis and preferences of the investigator or analyst. The approach below is exemplified through a homicide case, fictionalized for illustration purposes using real crime scene images.

Example Scenario

The victim, a maintenance manager for King Resorts, had become aware that the suspect, the General Manager of King Resorts, was embezzling funds from the company by ordering products from two false vendors (fictitious companies). The victim was blackmailing the suspect, collecting \$2,000 cash per month for his silence, which the victim then gave to his mistress for safe keeping.

According to a witness statement, the suspect invited the victim to his residence after dark. The victim was subsequently shot in the chest. The suspect later informed police he was awakened by the sound of shattering glass from his patio door and subsequently mistook the victim for an intruder. Figure 1 depicts victim's position on the floor of the den near the patio door at the suspect's residence.

The following illustrations exemplify how information and physical evidence from this scene may be documented in preparation for further analysis.

A witness information tracking spreadsheet (Figure 2) summarizes key points of relevant information provided by witnesses and suspects. The potential fallibility of witness evidence does not diminish the need to organize and account for it in the analysis. Reconstruction of objective evidence is often used to corroborate or refute statements. This spreadsheet is especially helpful for tracking numerous witness statements. Reference the source of all information for later retrieval.





FIGURE 1: In the example scenario, the victim’s body was found on the floor of the den and is shown from outside through the broken glass patio door. The scene sketch shows the victim’s position relative to other objects in the den including the hammer near his right hand.

WITNESS INFORMATION TRACKING SHEET

Witness	Reference	Evidence	Summary of information/evidence
Adams, Ben	Interview Rpt 6/5/15 p.2	#1421 .45 Cal Pistol, S&W	Next door neighbor. Heard 2 gunshots, a few seconds apart, from Suspect’s residence about 2100 hrs., 6/3/15. Heard sound of glass breaking about 5 minutes later. ID .45 cal. S&W as belonging to Suspect.
Johnson, Sandra	Interview Rpt 6/5/15 p.1		Wife of Victim (V). Overheard phone call from Suspect to (V), 2000 hrs., 6/3/15 where Suspect invited (V) to come over. (V) left for suspect’s house 2030.
Manford, Angela	Interview Rpt 6/6/15 p.3	#1133 \$8,000 cash	Mistress of Victim (V). (V) was aware Suspect was embezzling \$. Suspect was paying (V) \$2000/month cash to keep quiet. (V) gave money to Manford each month for safe keeping.
General Manager (GM) Suspect 1	Interview Rpt 6/4/15 p. 4		Suspect went to bed early. Heard glass break. Got up, obtained .45 pistol, and saw figure entering his home through broken patio door. Believed it was home invasion. Fired two rounds at intruder from .45 pistol. Suspect believed Victim was mad at Suspect because Victim didn’t get a pay raise.

FIGURE 2: A witness information tracking sheet summarizes key points from witness and suspect statements and correlates it to physical evidence and other statements. Expand columns based on needs of the analysis.

A physical evidence tracking sheet (Figure 3) identifies, describes, and documents observations about the evidence collected. It may connect evidence identification numbers from the scene to department evidence numbers and referenced reports. It can be created from the scene evidence log and documented observations made at the scene. This spreadsheet may be further expanded for analysis purposes as described later.

Flow charts and timelines (Figure 4) may be used initially in a macro sense to maintain

case information in perspective and to show key physical and/or chronological relationships. These visual aids are helpful in explaining the case to others, including other experts, supervisors, attorneys and juries. A case overview depicted in a flow chart provides visual perspective and context. These flowcharts may be later expanded as evidence is refined during the formal analysis.

Analysis ultimately requires more comprehensive organization than just



EVIDENCE TRACKING SHEET

Dept Evidence #	Date Receive	Source of Evidence	Provider Reference Number	Description of Evidence	Remarks
100	2015/06/03	Suspect (S1) residence Master Bedroom	Report # 6-4-100	.45 cal S&W Item # 5	Compare to cartridge cases found at residence
101	2015/06/04	S1 Residence Den Officer Riley	Report # 6-4-48	Hammer, 6 lb	Small bloody print on handle
102	2015/06/04	S1 Residence Den Detective Barns	Report # 6-4-52	(2) .45 cartridge cases, Items 11 and 12	See item #s in scene sketch and evidence log
103	2015/06/03	Higdale PD Detective Johnson	2015-172	Victim's cell phone recovered from his person.	

FIGURE 3: The evidence tracking sheet is used to identify and document evidence and may be created from the scene evidence log and documented observations made at the scene.

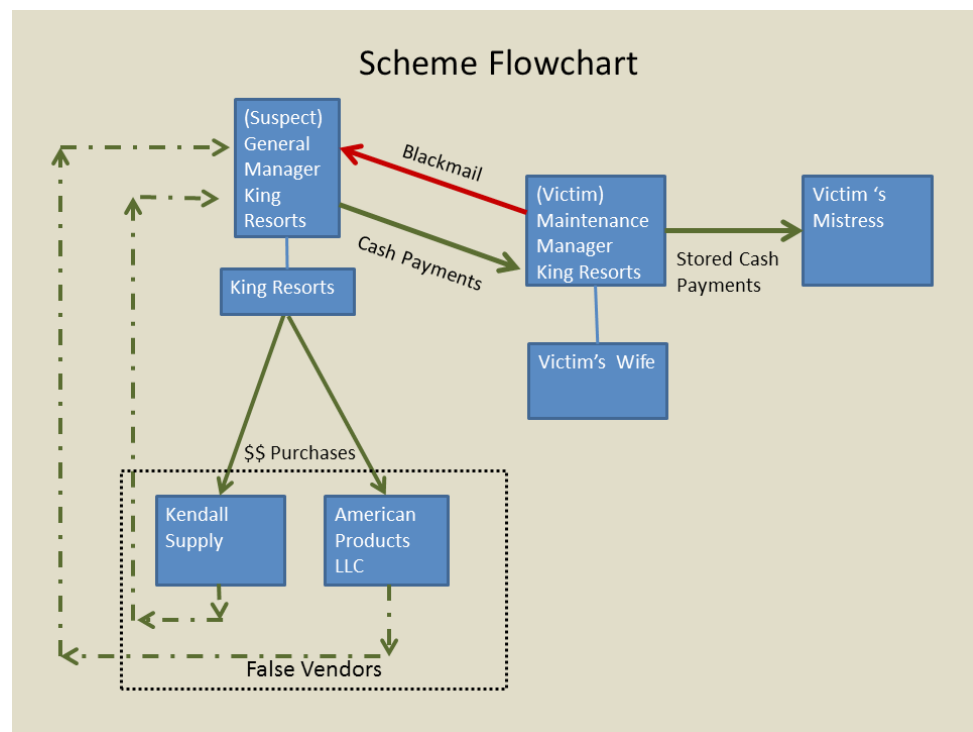


FIGURE 4: In the example scenario, a scheme flowchart illustrates key entities and evidence and their relationship to each other.

spreadsheets and folders of information, evidence and images. The third case management step prepares materials for formal CSR analysis by providing for documentation and organization of the analytical results and observations. This should not require the creation of new forms; rather, as the analysis progresses, the existing organizational framework for information, evidence and images is expanded to document evidentiary relationships, lab submissions, and analysis. Evidence tracking sheets may be expanded (Figure 5) to later note relationships with other evidence and cross reference items

of evidence to information and images. This provides for both preservation of and reference to evidentiary relationships used in analysis. Additionally, for evidence requiring DNA, trace, latent print, or other specialized analyses, columns may be added to track lab submissions and results. Tracking evidence through various forensic analyses may become a complicated exercise as each forensic entity assigns its own number often contained in a report with dozens of other numbers. Including all such numbers assigned to an item of evidence on one line of a spreadsheet makes the tracking process much easier. Including



EVIDENCE TRACKING SHEET (EXPANDED)

Dept Evidence #	Date Receive	Source of Evidence	Provider Reference Number	Lab Reference #	Lab Reference #	Description of Evidence	Image # (Photos)	Remarks
100	2015/06/03	Suspect (S1) residence Master Bedroom	Report # 6-4-100	State lab Firearms Toolmarks Case: # 43-FTM-A Item # 1		.45 cal S&W Item # 5	14, 42, 43	Compare to cartridge cases found at residence
101	2015/06/04	S1 Residence Den Officer Riley	Report # 6-4-48	State Lab DNA Unit Case: #1432-34-B Item # 2	State lab Fingerprint Unit Case # 1432-23-A	Hammer, 6 lb	25, 68,69	Bloody thumb print on handle, DNA and print match Victim.
102	2015/06/04	S1 Residence Den Detective Barns	Report # 6-4-52	State lab Toolmarks Case: # 43-FTM-A Item # 2-3		(2) .45 cartridge cases, items 11 and 12	17, 101-113	Compare to Suspect .45
103	2015/06/03	Higdale PD Detective Johnson	2015-172			Victim's cell phone recovered from his person.	311-341	Call log notes call from Suspect to Victim at 2000 hrs 6/3/15

FIGURE 5: The expanded evidence tracking sheet allows for later documentation and correlation of the evidence to laboratory results, images, and analytical comments regarding relationships to other evidence.

the analytical results with report reference on the same spreadsheet aids access and retrieval.

Evidence and images may be further categorized and documented by object, victim, or location in the scene based on the needs of the analysis. When images are the focus of in-depth analysis, separate spreadsheets are very helpful, especially when images are numerous.

Figures 6 and 7 are images from the den. Figure 6 shows broken glass from the patio door on top of the victim and blood, indicating the patio glass was broken after the victim began bleeding and had assumed this position. Figure 7 shows the victim's bloody hand next to the clean hammer handle he was claimed by the suspect to have been carrying. Not shown in this picture was the victim's bloody thumb print on the back side of the handle. All of these observations would be included in the image analysis log (Figure 8).

The image analysis log (Figure 8) correlates images to evidence, describes context, and documents observations. It can be created from a basic photo log, expanded for later documentation of image analysis. The log spreadsheet can be sorted to allow focus only on images related to a certain location or object.

The information, evidence, and image spreadsheets may be cross referenced or combined into one spreadsheet based on the needs of the analysis. Office suite software such as Microsoft Office or Word Perfect Office

allows for easy manipulation of spreadsheet data.

Original images should be maintained in their original form. Copies of original images may be subcategorized or enhanced for analytical purposes. Enhancement techniques should be documented. For tracking and identification purposes, the electronic filenames of modified images could be an expansion of but otherwise include the filename of the original image.

Once evidence is organized and methods are implemented to record analytical findings, the fourth step is to formally conduct the analysis. Observations of evidentiary relationships were documented during the organization process, but formal in-depth analysis is conducted after organization is complete.

The essence of CSR involves the identification of event segments and their sequencing when possible based on scientific principles and the scientific method. Tom Bevel and Ross Gardner developed a 7-step methodology for event analysis [3] which included flowcharts for charting sequences and worksheets for applying the scientific method to difficult sequences. Regardless of the specific analytical method utilized, case management facilitates the process by organizing all of the evidence, images, and analytical findings into a format that facilitates identification and retrieval. As a result, evidentiary relationships are much easier to identify and sequence. However, evidence





FIGURE 6: In the example scenario, the victim was found supine on the den floor with a gunshot wound to the chest. Broken glass was on top of the victim and the victim's blood. This contradicts the suspect's statement noted in Figure 2 that he shot the victim after the victim broke the glass and had entered his home.



FIGURE 7: The clean hammer was found next to the victim's bloody right hand on the den floor.

IMAGE ANALYSIS LOG (Den)

Image #	Location	Evidence #	Description	Context	Remarks
17	Den	#102	(2) .45 cartridge cases, Items 11 & 12	View from Top	
67	Den		Victim on back, head toward patio door.	View from top	Blood soaked shirt from bullet entry to chest. Note patio door glass on top of body & blood. Glass broke after victim assumed position.
68	Den	#101	Hammer with handle close to victims right hand	View from top	Hand covered with blood, hammer handle clean except for bloody thumb print – DNA and print match Victim.

FIGURE 8: A portion of the image analysis log for the example scenario is shown for images taken in the den. Observations regarding broken glass being on top of the body and blood were noted, as were the bloody hand next to the clean hammer handle.

organization does not end when formal analysis begins. In Bevel's event analysis methodology, event segments are identified, interrelated to other segments, and sequenced establishing a flow for that event [3]. Event segments may be identified through review of the image and evidence spreadsheets (Figures 5 & 8) and listed in a separate event segment spreadsheet depicted in Figure 9. This format correlates the event segment with image and evidence information, source reference, analytical observations, and other related images. This information is used to identify relationships between the segments.

Once related segments are identified, the event segment spreadsheet may be sorted so as to group and then sequence related segments. All of the supporting information tracks along with the segment.

In the example scenario, event segments in Figure 9 were sorted from a list of event segments related to the den. For illustration purposes, they represent just a sampling of event segments that were related to each other. Figure 9 exemplifies the fruits of previous case organization efforts in that it references

information from evidence and image tracking sheets and other source documents. For example, previous notes in the image log (Figure 8) about the broken glass being on top of the victim were noted in Figure 9 under observations. Included in neighboring columns were references to supporting images, evidence and reports, all of which aid the analysis. The event segment spreadsheet depicted in Figure 9 may be expanded to memorialize additional analysis to include notes regarding sequencing of the event segments listed in the first column. This spreadsheet expands as the analysis expands from event to event within the overall incident and becomes a reference document for flow charting the results.

Discussion

Reference [2] Osbourne, et al., documents a comprehensive study into contextual bias in bloodstain pattern analysis. The study explored the influence of contextual information on bloodstain pattern classification. The participants in the study included 39 bloodstain pattern analysts. Results indicated

EVENT SEGMENTS (Den)

Event Segment	Image #	Description	Evidence #	Description	Source	Observations	Related Images
Hammer placed on floor	68	Steel hammer, wooden handle	101	6 lb sledge	EVL-P.4	Hand bloody, hammer clean except for thumbprint	25, 69, 1637
Patio door glass broken	018	Safety glass, shattered to inside			CSR-P.3	Door glass on top of V and blood. Glass broke after bloodshed and V down.	033, 1628, 044, 045, 046
Victim assumes final position	67	On back, blood soaked shirt			IL-P.5		033, 048, 156, 159, 160
Victim shot in chest	67			2 Perf shots, projectiles not recovered.	CSR-P.6	Blood pools outside on deck, drag marks from outside to inside	032, 1637, 1638, 021, 022, 023
Blood spatter on door jam	82	N side of jam, 54 " from floor	45	Forward spatter	BSPR-P.2	Forward spatter, consistent with GSW DNA=Victim	033, 1637, 1628, 086, 087

FIGURE 9: In the example scenario, event segments from the den are listed along with source information and analyst comments. The event segment spreadsheet extracts relevant information from the witness information tracking sheet (Figure 2), the expanded evidence tracking sheet (Figure 5), and the image analysis log (Figure 8) to identify and document evidentiary relationships and aid the sequencing of events.



that almost all forms of contextual information influenced decision making to some degree regarding bloodstain pattern classification. The authors referred to a process described as linear sequential unmasking as a means to review and incorporate contextual information in a step-by-step fashion into the reconstruction analysis to offset the influence of context. If such measures were deemed appropriate for a given case, the organizational procedures described herein could both account for and document contextual bias concerns and the steps taken to address them. For example, information, evidence, and image tracking sheets could help identify evidence to be initially withheld from analyst review. Spreadsheet columns could be added to these forms to document with date and time when the analyst studied a witness statement, image, or particular item of evidence.

In CSR, the analysis of evidence creates more investigative questions and hence more analysis

in a quest for the best explanation of what did or did not happen. As evidence taken in context is refined, so is the best explanation of events. Analyst comments contained in evidence, image, and event segment spreadsheets (Figures 5, 8, 9) should be continuously updated and correlated as new evidentiary relationships are developed. Figure 10 illustrates the progression of analysis where evidence and evidentiary relationships are documented, refined through analysis, and updated in a continuous cycle until a best explanation of events, memorialized in a report, is achieved.

The final step of the 5-step case management process for CSR involves CSR report preparation, peer review, and final report. Proper case organization, especially in complex cases, makes images, evidence, and analyst notes regarding evidentiary relationships easy to retrieve for insertion into the CSR report.

Case management also prescribes a

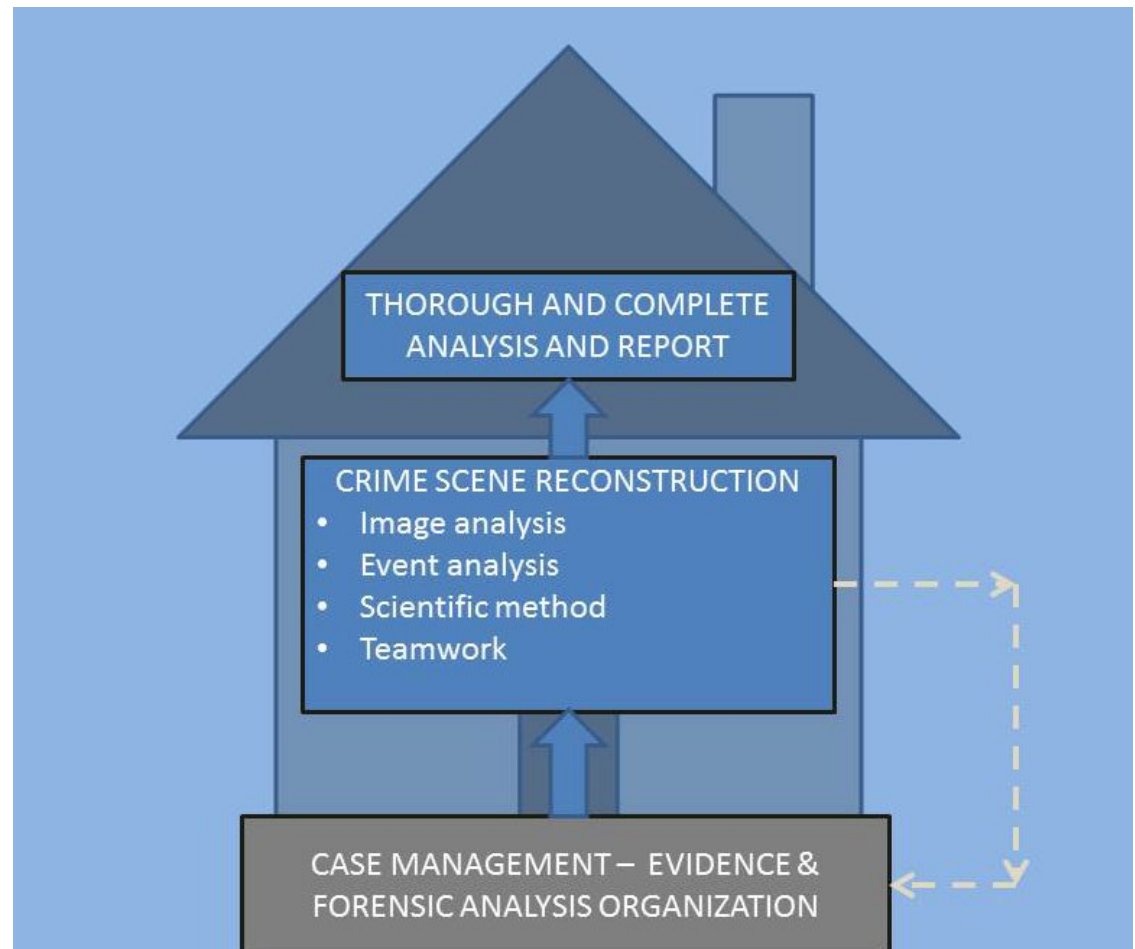


FIGURE 10: The house represents a reconstruction. The foundation is proper documentation and organization of the evidence which should begin at the scene. As the analysis progresses, evidentiary relationships are documented, refined, and updated in a continuous cycle until a best explanation of all events is achieved. The end product provides resource material for a thorough and complete analysis and report.

teamwork approach. The best investigative and/or analytical results are achieved when the investigative and forensic personnel are communicating with one another through an interdisciplinary teamwork approach utilizing collective training and experience. Persons providing input may include but not be limited to the case officer, crime scene processors, responding officers, applicable forensic specialists, pathologists, and CSR analysts. Throughout an investigation or reconstruction, “brainstorming sessions” may be conducted between two or more members of the team as needed to identify and review evidence, explain forensic analysis, identify investigative questions, identify and analyze key events and event segments, and determine types of specialized assistance needed. These sessions are beneficial from the initial onset of the investigation through preparation of the final CSR Report. The inclusion of scene level officers and technicians in the CSR brainstorm process also lends to their professional development.

Conclusion

Precise documentation of evidence is key to successful analysis, and should begin at the onset of investigation. Communication between

investigative, forensic, and reconstruction personnel is critical. Evidence organization and documentation of evidentiary relationships and other analysis greatly facilitate the analytical process enabling a more thorough and comprehensive result. Whether one uses the methods described in this article or another technique, the benefits of organization extend beyond the final report to the judicial process where easy retrieval of both information and methodology are often needed to support explanations.

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