CHAPTER 2

Crime Scene Investigation

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Key Terms

artifact
bloodborne pathogens
context
crime scene investigator (CSI)
datum
feature
Material Safety Data Sheet (MSDS)
organic or environmental remains
provenance
Universal Precautions

Introduction

An argument becomes heated, old emotional wounds are re-opened, lingering hate resurfaces, there is a struggle, finally a heavy ceramic vase is hefted and crashes down on someone's head—and a crime is committed. Suddenly, normal household items are transformed into evidence, their importance changed forever. Processing a crime scene, collecting these items, this evidence, appears deceptively simple at first. But this perception comes from the investigations we read in novels and see on television and the movies where we *know* what's important (the camera lingers on the crucial evidence), *who* the short list of suspects are (they wouldn't be on the show if they weren't involved), and that it will be wrapped up in an hour (with commercials). We see the murder weapon being collected, bagged, and the next time it appears, it's presented in court to the witness! The reality of crime scene processing is more involved and detailed than what we read or see in the media.

Without a crime scene, nothing would happen in a forensic laboratory. The scene of the crime is the center of the forensic world, where everything starts, and the foundation upon which all subsequent analyses are based.

Normal household items are transformed from the mundane into that special category called "evidence." The importance of a properly processed crime scene cannot be overemphasized—and yet, it is where devastating mistakes occur that affect an entire case. Many agencies have recognized the significance of the crime scene and employ specially and extensively trained personnel to process them. The processing of a crime scene is a method of "careful destruction": It is a one-way street, and one can never go back and undo an action. Standard operating procedures and protocols guide the **crime scene investigator (CSI)**, providing a framework for comprehensive and accurate evidence collection, documentation, and transmittal to the laboratory.

This chapter will focus on the scene itself and the collection of evidence. Because the nature of evidence and how things become evidence can be complex, this subject will be discussed separately and in depth in the next chapter.

Of Artifacts and Evidence

The goal of an archaeological excavation is to carefully collect and record all the available information about a prehistoric or historic site of human activity. The goal of processing a crime scene is to collect and preserve evidence for later analysis and reporting. What these two processes have in common is that they are *one-way*: Once an action is taken, an artifact moved, a piece of evidence collected, it can't be undone any more than a bell can be "un-rung." Crime scenes and archaeological sites are made up of the physical remains of past human activity and, in a sense, are snapshots of the "leftovers" of a completed process. As mentioned previously, when a scene is processed or a site dug, the procedure is one of "careful destruction": The scene or site will never exist in exactly the same way as it did before the process started. All the information, the relationships, the **context** of the items must be documented as they are destroyed to allow for some level of reconstruction in the laboratory or museum. It is an awesome responsibility to work a scene or excavate a site, and neither should be taken lightly.

Several technical terms that are used in archaeology may be of use in crime scene processing. The first is the idea of a **datum**, a fixed reference point for all three-dimensional measurements. The datum should be something permanent, or nearly so, like a light switch (pick a corner!), a tree, or a post. If no datum easily suggests itself, an artificial one, such as a post, nail, or mark, can be made. Ultimately, all measurements must be able to be referenced to the datum.

Other terms that can be borrowed from archaeology suggest the nature of what is found. An **artifact** is a human-made or modified portable object. A **feature** is a non-portable artifact, such as a fire pit, a house, or a garden. **Organic** or **environmental remains** (non-artifactual) are natural remnants

that nonetheless indicate human activity, such as animal bones or plant remains but also soils and sediments. An archaeological site, then, can be thought of as a place where artifacts, features, and organic remains are found together. Their location in relation to each other sets the internal context of the site. To reconstruct this context once the site or scene has been processed, the investigator needs to locate the position of each item within the surrounding material (the **matrix**), be it soil, water, or a living room. Thus, the **provenance** is the origin and derivation of an item in three-dimensional space, in relation to a datum and other items. When an artifact is uncovered at a site, it is measured to the reference points for that excavation unit including its depth. A similar process occurs at a crime scene when evidence is located. As the noted archaeologists Colin Renfrew and Paul Bahn put it:

> *In order to reconstruct past human activity at a site it is crucially important to understand the* context *of a find, whether artifact, feature, structure or organic remain. A find's context consists of its immediate matrix (the material surrounding it), its provenience (horizontal and vertical position within the matrix), and its association with other finds (occurrence together with other archaeological remains, usually in the same matrix). (2000, p. 50)*

The similarities between archaeology and crime scene processing are numerous and deep. Serious crime scene students would do well to study archaeological methods to enhance their forensic skills.

Evidence can be defined as information, whether personal testimony, documents, or material objects, that is given in a legal investigation to make a fact or proposition more or less likely. Most of the evidence discussed in this chapter relates to physical evidence—that is, things involved in the commission of the crime under investigation. The nature of evidence will be discussed in more depth in the next chapter.

Crime Scene Investigation

As Paul Kirk, the noted forensic science pioneer, described it, forensic science is interested in the "unlikely and the unusual" (Kirk, 1963, p. 368). This is certainly true of crime scenes: Each one is unique. The crime committed, the location, the items used, the people involved, all vary from scene to scene. Although nearly every police and forensic agency has written protocols about processing a crime scene, these may be trumped by the circumstances of the crime scene. As Barry Fisher, retired Director of the Los Angeles County Sheriff's Department Crime Laboratory notes, "There are few absolute rules in crime scene investigations…. There are always cases where guidelines cannot be followed…. Situations demand that investigators be flexible and creative when necessary" (2004, p. 49). That is, crime scene investigators (or CSIs, for short), must know and follow their agency's protocols but must be ready to improvise, within accepted limits, to protect and/or preserve evidence, as shown in the example in Figure 2.1.

FIGURE 2.1 This little fellow, along with three of its littermates, was at the scene of a triple homicide in the northwest United States. Before they could be rounded up, they tracked blood around the crime scene; this photo was taken as a reminder. The cats were adopted by various agency personnel. (Anonymous by submitter's request.)

First on the Scene

The success of any crime scene investigation depends in large part on the actions taken in the first few minutes after the First Officer (or FO, for short) or CSI arrives. This sounds odd, to be sure. "How can a few minutes matter to a crime scene that's just been sitting there for hours or days?" one may ask. But crime scenes are a complex mix of static and dynamic information, a scene fixed in time like a photograph but slowly degrading, much like poorly archived historical photographs. The majority of the physical evidence will be generated by the processing of the crime scene, and the relationships between the people, places, and things (the context) will tell the story of what happened. Remember, facts alone are not sufficient; by themselves, they explain nothing. Facts must be interpreted in light of the circumstances or context surrounding the crime. Once an item is moved, it can never be placed back exactly as it was: The context is disturbed, and the subsequent interpretation may be biased and inaccurate.

The primary task of the FO at a crime scene is to *secure the scene and prevent destruction or alteration of the critical and sometimes fragile context of a crime scene*. The assumption is that the perpetrator has left physical evidence at the crime scene. Therefore, the FO's duties are simple in concept but complex in execution:

1. Detain any potential suspects.
2. Render medical assistance to those who need it.
3. Do not destroy, alter, or add any evidence at the scene.
4. Prevent others, even superiors, from doing the same.

But not all crime scenes are equal. A homicide in a small house's bedroom is certainly easier to seal and guard than a body found in the middle of a wooded park or a busy highway. The FO should not simply rush into a scene

but approach it carefully, thoughtfully. Sometimes the best thing to do is just prevent further entry until additional agency staff arrive.

Once the immediate scene is secured, the lead investigator further defines and evaluates the scene. The scene may be large or small, extensive or discrete, made up of several locations or centered in one area. With the crime scene defined and its borders identified, the initial surveyor begins to develop an overview and devise a plan of action.

Plan of Action

Preparation

The officers or investigators assigned to the scene should have obtained a search warrant, if necessary, by the time the crime scene processing begins. If there is time, the search should be discussed with involved personnel before arriving at the scene. A command station for communication and decision making should be established in an area away from the scene but still within the secured perimeter. If personnel task assignments don't already exist, they should be made before arrival at the scene. Depending on the number of personnel available, each may be assigned multiple responsibilities.

Optimally, the person in charge of the scene is responsible for scene security, evidence or administrative log, the preliminary survey, the narrative description, problem resolution, and final decision making. The person in charge of photography arranges, takes, and coordinates photography and keeps the photograph log. The person assigned to prepare the sketch does so in coordination with other methods of documentation; for complex scenes, multiple personnel may be assigned to this task for reconstructive purposes. An evidence custodian takes charge of items collected as evidence, logs them in, and assures that the packaging is labeled properly and sealed.

Communication between the various agencies' representatives, such as medical examiners, laboratory personnel, emergency medical technicians, and attorneys, is crucial to a smooth and successfully executed crime scene process. Questions that arise during the crime scene search can be resolved more easily (with less administrative backlash later) by involving and engaging the proper individuals.

Think ahead. Fifteen minutes of thought can save hours, and possibly lives, later on. Prepare the paperwork to document the search *before* searching. Agree-upon terminology—if everyone refers to an area as the "living room," then there will be less confusion afterward if questions come up ("Did we collect that from the *front* room?" "Do you mean the *living* room?"). Arrange for protective clothing, communication, lighting, shelter, transportation, equipment, food, water, medical assistance, and security for personnel. Processing crime scenes can be tedious, physically demanding work, and people, even professionals, perform poorly when they are tired. In prolonged searches, use multiple shifts or teams. If one doesn't exist, develop a transfer mechanism for paperwork and responsibility from one team to the next.

Secure the Scene, Secure the Item

If the FO hasn't done so, take control of the scene *immediately*. Determine the extent to which the scene has, or has not, been protected. Talk to personnel who have knowledge of the original condition. Keep out unauthorized personnel. Record who enters and leaves, even if they are an agency's superiors. Dick Worthington, a noted forensic instructor, suggests renaming the sign-in/sign-out form for a crime scene to "Subpoena Contact Form," to signal that entering a crime scene may make an individual eligible to testify about his or her presence. Now and throughout the processing of the scene, it is impossible to take too many notes.

Regarding note taking, it is important to remember the central nature of crime scene notes. These are the documentation of who did what when, contemporaneous with those activities. The adage from quality assurance, "if it's written down, it didn't happen," is a good guide on what to record. This means that if a supervisor tells a CSI to "process the front bedroom," the supervisor makes a note of that and the time in his or her notes—as does the employee in *his or her own notes*. Later, the two sets of notes should correspond, and if a question arises (say, in court), then the activities can be corroborated. Taking contemporaneous notes is crucial to a successful crime scene investigation.

Securing the scene is so critically important that we cannot overstate this point. Even the perception of an unsecured scene can show up in court, as it did in the Simpson-Goldman murder trial, where video was used to critique the testimony of a crime scene analyst. Video cameras from television crews, police cruisers, surveillance systems, not to mention photojournalists, police photographers, and the general public (with their cellphone cameras) can collect images that may portray reality or be used to distort it. What is important is that the *photographs*, the *notes*, the *documentation* demonstrate the quality of the work at the scene and that each item was properly collected and secured.

Preliminary Survey

The survey is an organizational stage to plan for the search. A few minutes' planning and discussion can be of great value later. Cautiously walk the scene. Crime scenes can be emotional experiences, but professionalism and calm are called for. Take preliminary photographs to establish the scene and delineate the extent of the search area. The initial perimeter may be expanded later if more evidence is found. Make note of special "problem" areas, such as tight spaces, complex evidence arrangements, or environments with transient physical evidence (blood in a running shower, for example). Take extensive notes to document the scene, physical and environmental conditions, and personnel tasks and activities.

Evaluate what physical evidence collection requirements there may be. Make sure enough supplies are available: running out of packaging or gloves halfway through is no good! Focus first on evidence that could be lost or

damaged; leave the more robust evidence for last. All personnel should consider the variety of possible evidence, not just evidence within their specialties.

Collection of evidence is more than just "bagging and tagging." The easily accessible areas, of course, are processed first, but then move on to out-of-the-way locations, like in cupboards, under rugs or carpeting, or in drawers. Look for hidden items, secret compartments, and false fronts. Things may not be what they seem, and crime scene personnel must evaluate whether evidence appears to have been moved or altered. Remember, things at a crime scene are just things until they are designated as evidence and then recorded and collected. In that sense, the evidence listing is like a "reverse shopping list," a tally of all the things that might be needed but only after they have been found. Another important reminder is that the scene may not even be *the* scene—the scene may be contrived to look like an accident or some other type of crime.

Photography

The photography of the crime scene should begin as soon as possible. The photographic log documents all the photographs taken and a description and location of what's in the photograph. A progression of establishing (overall or perspective views), medium (within 6 feet), and close-up (within 12 inches) views of the crime scene should be collected. Multiple views, such as eye level, top, side, and bottom, help to represent what the scene or a piece of evidence looked like in place. Start with the most fragile areas of the crime scene first; move through the scene as evidence is collected and processing continues. Document the process itself, including stages of the crime scene investigation, discoveries, and procedures. Photographs must at least be taken *before* the evidence is recovered.

Photographs should be taken with and without a scale. Photographs that include a scale should also have the photographer's initials and the date. This is easily accomplished by using a disposable plastic ruler and writing the pertinent information (case number, item number, etc.) on it with a permanent marker. Scales allow photographs to be reproduced at defined scales (1:1, 1:2, 1:10, etc.). Photograph the crime scene in an overlapping series using a wide-angle lens, if possible; 50 mm lenses are the standard issue for cameras—use both and lots of film. We honestly believe it's almost impossible to take too many photographs. All these images can help later with reconstruction questions.

When the exterior crime scene is photographed, establish the location of the scene by a series of overall photographs, including one or more landmarks, with 360° of coverage. Photograph entrances and exits. Prior photographs, blueprints, or maps of the scene may be of assistance, and they should be obtained, if available.

Sketch

Crime scene sketches may look crude at times, but they contain one very important element for reconstruction: numbers. Distances, angles, time, temperature—all these elements make the crime scene sketch, an example of which is shown in Figure 2.2, central to all subsequent work. Sketches complement photographs and vice versa. Items of evidence can be located on the sketch as it is made to help establish locations later. Although sketches are quantitative, they are normally not drawn to scale. However, sketches should have measurements and details for a drawn-to-scale diagram. A sketch should include the following:

- The case identifier
- Date, time, and location
- Weather and lighting conditions
- Identity and assignments of personnel
- Dimensions of rooms, furniture, doors, and windows
- Distances between objects, persons, bodies, entrances, and exits
- An arrow pointing toward magnetic north

Chain of Custody

Arguably, the single most important piece of paper generated at a crime scene is the chain of custody. This form, an example of which is shown in Figure 2.3, documents the movement of evidence from the time it is obtained to the time it is presented in court. The most compelling evidence in the world can be rendered useless if inaccuracies or gaps exist in a chain of custody. Where was the evidence? Who had control of it? When? Who last had this item? Could it have been tampered with during this gap in time? Having to document each exchange of an item from person, to evidence locker, to person, to agency may seem to be a nuisance, but it is the foundation that permits forensic science results to enter into a courtroom.

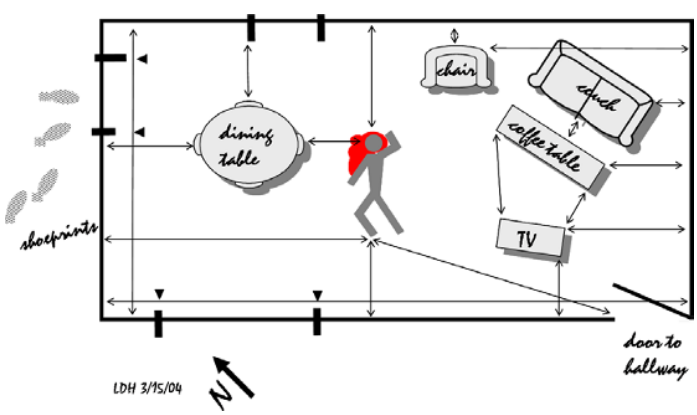

FIGURE 2.2 A typical crime scene sketch; measurements would accompany all the arrows and descriptions when the scene is completed.

Bakersfield Forensic Laboratory
123 Main Street
Bakersfield, WV 26501

Agency Number 72204

Laboratory number 615243

Chain of Custody

Received From	Delivered to	Date/Time	Items
D. Green	B. Putnam	7/22/04 2:14p	1-26, 28
Print Name: David Green	Print Name: Bradford Putnam		
Signature	Signature		
Received From	**Delivered to**	**Date/Time**	**Items**
D. Green	B. Schneckster	7/22/04 2:45p	27, 29
Print Name: David Green	Print Name: B Schneckster		
Signature	Signature		
Received From	**Delivered to**	**Date/Time**	**Items**
B. Putnam	D. Green	7/29/04 9:16 am	1-26, 28
Print Name: Bradford Putnam	Print Name: David Green		
Signature	Signature		
Received From	**Delivered to**	**Date/Time**	**Items**
Print Name	Print Name		
Signature	Signature		
Received From	**Delivered to**	**Date/Time**	**Items**
Print Name	Print Name		
Signature	Signature		
Received From	**Delivered to**	**Date/Time**	**Items**
Print Name	Print Name		
Signature	Signature		

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FIGURE 2.3 The chain of custody form documents the movement of evidence from the time it is obtained to the time it is presented in court. The most compelling evidence in the world can be rendered useless if inaccuracies or gaps exist in a chain of custody.

Crime Scene Search and Evidence Collection

The crime scene search should be methodical and performed in a specific pattern. The choice of pattern may be dictated by the location, size, or conditions of the scene. Typical patterns are spiral, strip or lane, and grid and are shown in Figure 2.4. Adhering to the selected pattern prevents "bagging and tagging" random items with no organization or system. Measurements showing the location of evidence should be taken with each object located by two or more measurements from non-movable items, such as doors or walls. These measurements should be taken from perpendicular angles to each other to allow for triangulation.

Be alert for all evidence: The perpetrator had to enter or exit the scene! Mark evidence locations on the sketch and complete the evidence log with notations for each item of evidence. If possible, having one person serving as evidence custodian makes collection more regular, organized, and orderly. Again, if possible, two persons should observe evidence in place, during recovery, and being marked for identification. Use tags, or if feasible, mark directly on the evidence.

Wear gloves to avoid leaving fingerprints—but be aware that after about 30 minutes, it is possible to leave fingerprints *through* latex gloves! Evidence should not be handled excessively after recovery. Seal all evidence packages with tamper-evident tape at the crime scene. An important activity often overlooked is the collection of known standards from the scene, such as fiber samples from a known carpet or glass from a broken window. Monitor the paperwork, packaging, and other information throughout the process for typographic errors, clarity, and consistency.

Simple geometry can help locate and reconstruct where things were in a sketch. Always take measurements from at least two locations. This will help with checking distances and triangulating "untaken" measurements later.

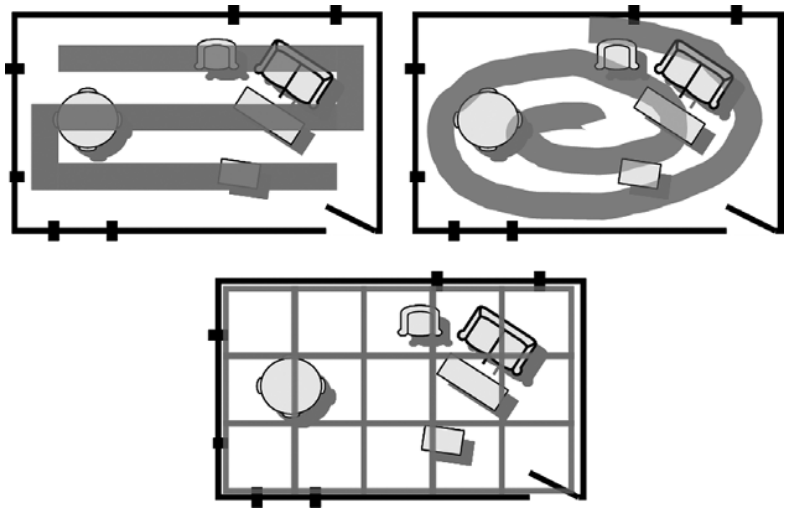

FIGURE 2.4 It is best to have an organized systematic search of a crime scene. The strip (or lane), the spiral, and the grid are three of the most common patterns.

In trigonometry and elementary geometry, triangulation is the process of finding a distance to a point by calculating the length of one side of a triangle, given measurements of angles and sides of the triangle formed by that point and two other reference points. In many ways, measuring a crime scene is surveying, the art and science of accurately determining the position of points and the distances between them; the points are usually on the surface of the earth. Surveying is often used to establish land boundaries for ownership (such as buying a house) or governmental purposes (geographic surveys). Large crime scenes may require standard surveying (and the prepared CSI would do well to learn a bit of surveying), but processing an *indoors* crime scene is much the same except for issues of points (guns, not mountains) and scale (inches, not miles).

Final Survey

When the crime scene is finished, there is still work to be done! A final survey is recommended to review all aspects of the search. Discuss the search and ask questions of each other. Read over the paperwork for a final check for completeness. Take photographs of the scene showing the final condition. Secure all evidence and retrieve all equipment. A final walkthrough with at least two people from different agencies (if possible) as a check on completeness is a must.

The crime scene can be released after the final survey; this event should be documented in the paperwork, including the time and date of release, to whom and by whom it was released. Remember that other specialists, such as a bloodstain pattern analyst or medical examiner, may need access to the scene before it is released. Once the scene has been released, re-entry may require a warrant; therefore, the scene should be released only when all personnel are satisfied that the scene was searched correctly and completely.

Submission of Evidence to the Laboratory

The collected evidence may be submitted to the laboratory by that agency's personnel (that is, laboratory personnel) or by CSIs or law enforcement officers. A form is typically filled out or a letter written detailing what is submitted, under what criminal circumstances, who is submitting the items, and what laboratory examinations are requested.

Safety

Walking into a crime scene is one of the most hazardous activities a forensic scientist or CSI can do. Chemical and biological threats abound, not to mention knives, firearms, explosives . . . the list goes on. Worse, coming in at or near the end of the action, crime scene personnel have

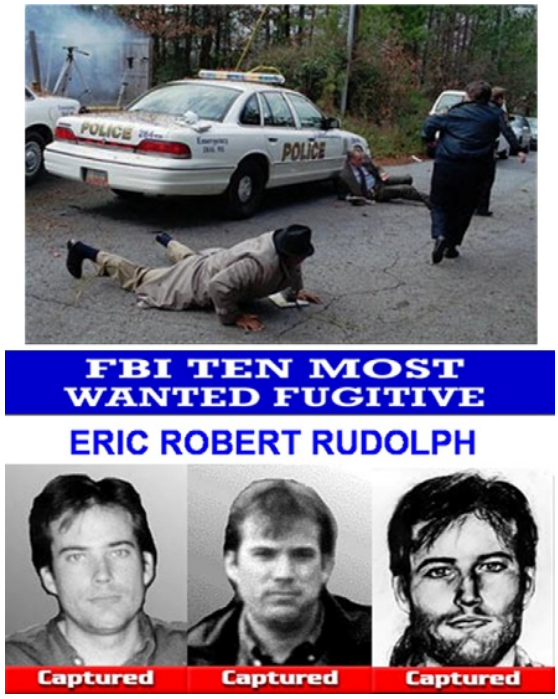

FIGURE 2.5 (Above) Bystanders protect themselves seconds after a second explosion detonated outside the Atlanta Northside Family Planning Services building in Atlanta on Thursday, January 16, 1997. Associated Press file photo. (Below) Eric Rudolph, the longtime fugitive charged in the 1996 Olympic Park bombing in Atlanta and in attacks at an abortion clinic and a gay nightclub, was arrested June 1, 2003, in the mountains of North Carolina by a local sheriff's deputy.

little or no foreknowledge of what's in store for them. Add in the prospect of intentional manufacture or use of chemical or biological agents or explosives by terrorists, and the issue of safety for crime scene personnel becomes of paramount concern, as shown in Figure 2.5.

The increase in **bloodborne pathogens** (AIDS and hepatitis, for example) and other pathogens that may be encountered at crime scenes (like the Hanta virus) has made law enforcement and CSIs more aware of personal protection when responding to crime scenes. Although the risk of infection to crime scene responders is exceedingly low, precautions are typically mandated by individual agencies' protocols. Additionally, federal laws or regulations from one of several health agencies may be applicable to crime scene personnel (see "On the Web: Safety").

On the Web: Safety

Occupational Safety and Health Administration, www.osha.gov
The mission of the Occupational Safety and Health Administration (OSHA) is to save lives, prevent injuries, and protect the health of America's workers. To accomplish this, federal and state governments must work in partnership with the more than 100 million working men and women and their six and a half million employers who are covered by the Occupational Safety and Health Act of 1970.

The Centers for Disease Control, www.cdc.gov
The Centers for Disease Control and Prevention (CDC) is recognized as the lead federal agency for protecting the health and safety of people, at home and abroad, providing credible information to enhance health decisions, and promoting health through strong partnerships. The CDC serves as the national focus for developing and applying disease prevention and control, environmental health, and health promotion and education activities designed to improve the health of the people of the United States.

The *Morbidity and Mortality Weekly Report*, www.cdc.gov/mmwr
The *Morbidity and Mortality Weekly Report* (*MMWR*) Series is prepared by the Centers for Disease Control and Prevention (CDC). The data in the weekly *MMWR* are provisional, based on weekly reports to the CDC by state health

departments. The reporting week concludes at close of business on Friday; compiled data on a national basis are officially released to the public on the succeeding Friday. An electronic subscription to *MMWR* is free.

National Institute for Occupational Safety and Health, www.cdc.gov/niosh

The National Institute for Occupational Safety and Health (NIOSH) is the federal agency responsible for conducting research and making recommendations for the prevention of work-related disease and injury. The Institute is part of the Centers for Disease Control and Prevention (CDC). NIOSH is responsible for conducting research on the full scope of occupational disease and injury ranging from lung disease in miners to carpal tunnel syndrome in computer users. In addition to conducting research, NIOSH investigates potentially hazardous working conditions when requested by employers or employees; makes recommendations and disseminates information on preventing workplace disease, injury, and disability; and provides training to occupational safety and health professionals. Headquartered in Washington, DC, NIOSH has offices in Atlanta, Georgia, and research divisions in Cincinnati, Ohio; Morgantown, West Virginia; Bruceton, Pennsylvania; and Spokane, Washington.

Sources and Forms of Dangerous Materials

Inhalation

At a crime scene, airborne contaminants can occur as dust, aerosol, smoke, vapor, gas, or fume. Immediate respiratory irritation or trauma might ensue when these contaminants are inhaled; some airborne contaminants can enter the bloodstream through the lungs and cause chronic damage to the liver, kidneys, central nervous system, heart, and other organs. Remember that some of these inhalants may be invisible!

Skin Contact

Because processing a crime scene requires the physical collection of items, skin contact is a frequent route of contaminant entry into the body. Direct effects can result in skin irritation or trauma at the point of contact, such as a rash, redness, swelling, or burning. Systemic effects, such as dizziness, tremors, nausea, blurred vision, liver and kidney damage, shock, or collapse, can occur once the substances are absorbed through the skin and circulated throughout the body. The use of appropriate gloves, safety glasses, goggles, face shields, and protective clothing can prevent this contamination.

Ingestion

Ingestion is a less common route of exposure. Ingestion of a corrosive material can cause damage to the mouth, throat, and digestive tract. When swallowed, toxic chemicals can be absorbed by the body through the stomach and intestines.

To prevent entry of chemicals or biological contaminants into the mouth, wash hands before eating, drinking, smoking, or applying cosmetics. Also, do not bring food, drink, or cigarettes into areas where contamination can occur.

Injection

Needlesticks and cuts from contaminated glass, hypodermic syringes, or other sharp objects can inject contaminants directly into the bloodstream. Extreme caution should be exercised when handling objects with sharp or jagged edges.

Universal Precautions

The Occupational Safety and Health Administration (OSHA) issued regulations regarding occupational exposure to bloodborne pathogens (BBPs) in December 1991. Those occupations at risk for exposure to BBPs include law enforcement, emergency response, and forensic laboratory personnel (Title 29 CFR, 1910.1030).

Fundamental to the BBP standard is the primary concept for infection control called **Universal Precautions**. These measures require employees to treat all human blood, body fluids, or other potentially infectious materials as if they *are* infected with diseases such as hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV). The following protective measures should be taken to avoid direct contact with these potentially infectious materials (Title 29 CFR, 1991):

- Use barrier protection such as disposable gloves, coveralls, and shoe covers when handling potentially infectious materials. Gloves should be worn, especially if there are cuts, scratches, or other breaks in the skin.
- Change gloves when torn, punctured, or when their ability to function as a barrier is compromised.
- Wear appropriate eye and face protection to protect against splashes, sprays, and spatters of infectious materials. Similar precautions should be followed when collecting dried bloodstains.
- Place contaminated sharps in appropriate closable, leak-proof, puncture-resistant containers when transported or discarded. Label the containers with a BIOHAZARD warning label. Do not bend, recap, remove, or otherwise handle contaminated needles or other sharps.
- Prohibit eating, drinking, smoking, or applying cosmetics where human blood, body fluids, or other potentially infectious materials are present.
- Wash hands after removing gloves or other personal protective equipment (PPE). Remove gloves and other PPE in a manner that will not result in the contamination of unprotected skin or clothing.
- Decontaminate equipment after use with a solution of household bleach diluted 1:10, 70% isopropyl alcohol, or other disinfectant. Non-corrosive disinfectants are commercially available. Allow sufficient contact time to complete disinfection.

In addition to Universal Precautions, prudent work practices and proper packaging serve to reduce or eliminate exposure to potentially infectious materials. Packaging examples include puncture-resistant containers used for storage and disposal of sharps.

Chemical Safety

A wide variety of health and safety hazards can be encountered at a crime scene. Some of those hazards are listed in Table 2.1. This awareness comes from the information contained in a **Material Safety Data Sheet (MSDS)** (for example, http://www.msdssolutions.com or http://siri.uvm.edu) and appropriate training. The MSDS provides information on the hazards of a particular material so that personnel can work safely and responsibly with hazardous materials; MSDS sheets are typically available through a vendor's website.

Remember, when working with chemicals, be aware of hazardous materials, disposal techniques, personal protection, packaging and shipping procedures, and emergency preparedness.

Personal Protective Equipment

Hand Protection

Hand protection should be selected on the basis of the type of material being handled and the hazard or hazards associated with the material. Detailed information can be obtained from the manufacturer. Nitrile gloves provide

TABLE 2.1 Numerous chemical safety hazards can be encountered at crime scenes.

Material	Examples
Flammable or combustible materials	Gasoline, acetone, ether, and similar materials ignite easily when exposed to air and an ignition source, such as a spark or flame.
Explosive materials	Over time, some explosive materials, such as nitroglycerine and nitroglycerine-based dynamite, deteriorate to become chemically unstable. In particular, ether will form peroxides around the mouth of the vessel in which it is stored. All explosive materials are sensitive to heat, shock, and friction, which are employed to initiate explosives.
Pyrophoric materials	Phosphorus, sodium, barium, and similar materials can be liquid or solid and can ignite in air temperatures less than 130° F (540° C) without an external ignition source.
Oxidizers	Nitrates, hydrogen peroxide, concentrated sulfuric acid, and similar materials are a class of chemical compounds that readily yield oxygen to promote combustion. Avoid storage with flammable and combustible materials or substances that could rapidly accelerate its decomposition.

Source: National Research Council, 1981.

protection from acids, alkaline solutions, hydraulic fluid, photographic solutions, fuels, aromatics, and some solvents. It is also cut resistant. Neoprene gloves offer protection from acids, solvents, alkalies, bases, and most refrigerants. Polyvinyl chloride (PVC) is resistant to alkalies, oils, and low concentrations of nitric and chromic acids. Latex or natural rubber gloves resist mild acids, caustic materials, and germicides. Latex will degrade if exposed to gasoline or kerosene and prolonged exposure to excessive heat or direct sunlight. Latex gloves can degrade, losing their integrity. Some people are allergic to latex and can avoid irritation by wearing nitrile or neoprene gloves.

Gloves should be inspected for holes, punctures, and tears before use. Rings, jewelry, or other sharp objects that can cause punctures should be removed. Double-gloving may be necessary when working with heavily contaminated materials; double-gloving is also helpful if "clean" hands are needed occasionally. If a glove is torn or punctured, replace it. Remove disposable gloves by carefully peeling them off by the cuffs, slowly turning them inside out. Discard disposable gloves in designated containers and, it should go without saying, do not reuse them.

Eye Protection

Safety glasses and goggles should be worn when handling biological, chemical, and radioactive materials. Face shields can offer better protection when there is a potential for splashing or flying debris. Face shields alone are not sufficient eye protection; they must be worn in combination with safety glasses. Contact lens users should wear safety glasses or goggles to protect their eyes. Protective eyewear is available for those with prescription glasses and should be worn over them.

Foot Protection

Shoes that completely cover and protect the foot are essential—*no sandals or sneakers*! Protective footwear should be used at crime scenes when there is a danger of foot injuries due to falling or rolling objects or to objects piercing the sole and when feet are exposed to electrical hazards. In some situations, shoe covers can provide protection to shoes and prevent contamination to the perimeter and areas outside the crime scene.

Other Protection

Certain crime scenes, such as bombings and clandestine drug laboratories, can produce noxious fumes requiring respiratory protection. In certain crime scenes, such as bombings or fires where structural damage can occur, protective helmets should be worn.

Transporting Hazardous Materials

Title 49 of the Code of Federal Regulations codifies specific requirements that must be observed in preparing hazardous materials for shipment by air, highway, rail, or water. All air transporters follow these regulations,

which describe how to package and prepare hazardous materials for air shipment. Title 49 CFR 172.101 (http://hazmat.dot.gov) provides a Hazardous Materials Table that identifies items considered hazardous for the purpose of transportation, special provisions, hazardous materials communications, emergency response information, and training requirements. Training is required to properly package and ship hazardous materials employing any form of commercial transportation.

Summary

The crime scene is the center of the forensic world. The importance of a carefully processed crime scene cannot be overstated. The processing of a crime scene is a one-way street; there is no going back. Standard operating procedures and protocols guide the crime scene investigator, but training, experience, and education all play a role in adapting to each unique crime scene.

Test Your Knowledge

1. What is a chain of custody?
2. What is a crime scene?
3. What should the first officer or CSI at the crime scene do?
4. Name four safety issues for CSIs.
5. Is it okay to only take photographs or only draw sketches? Why not?
6. How many photographs should you take at a crime scene?
7. Name three agencies that regulate worker safety.
8. What is a datum?
9. What is provenance?
10. When is it acceptable to release a crime scene?
11. What is an MSDS?
12. Who should be involved in the final walkthrough of a crime scene?
13. What should be included in a crime scene sketch?
14. Should you take photographs with or without a scale?
15. What does "BBP" stand for?
16. Which type of protective gloves should be used when handling bases and oils?
17. What is a "universal precaution"?
18. Why is processing a crime scene considered "careful destruction"?
19. What's involved in making a plan for a crime scene?
20. Why is it important to have a plan for a crime scene?

Consider This . . .

1. How would you process an underwater crime scene? A homicide scene on a beach? Outside during a thunderstorm? What protocols would change? How would you process and package evidence? How would you maintain the integrity of the evidence?

2. How would you process a crime scene (use Figure 2.3 as a basis) with two people? Assign tasks and duties. How would you process the same scene with 10 people? What would you do the same or do differently? Would the quality of the scene processing be the same?
3. Take one of the extreme examples in Consider This #1. How would you explain to a jury that you followed your agency's protocols—but also did not?

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