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## TECHNICAL INFORMATION

### Arson Scene Tool Kit Catalog No. AEC400

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<b>Application</b>	The obtaining or providing access to evidence at the scene of arson or other crime and containment for transportation to the lab for analysis.
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#### Information

This kit contains the most complete collection of tools required for obtaining or providing access to evidence at the scene of arson or other crimes. Tools for piercing walls for collection of remote samples are included. Concrete, plaster or wood can be drilled for entry of tubing in order to collect liquid samples. Removal of any building material containing absorbed suspicious liquids or melted substance



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can be achieved with the variety of implements contained in this kit. The necessary tools for the removal of articles fastened to other objects can readily be accomplished with a wide selection included in the collection. Proper instruments for scraping, scooping, lifting and securing physical evidence without contamination is the primary purpose of this kit. The implements are all made of impermeable material and should be cleaned thoroughly after each use.

<b>AEC400 Contents</b>	<ul style="list-style-type: none"><li>1- AEC401 Heavy-Duty Sledge-Type Mallet</li><li>1- AEC402 9" (22.9cm) Tongs</li><li>1- AEC403 Hammerhead and Hatchet</li><li>1- AEC404 Collapsible Folding Steel Shovel</li><li>1- AEC405 Heavy-Duty Rubber Glove Pair</li><li>1- AEC406 Pair of Safety Goggles</li><li>3- SF0072 Disposable Jumpsuits</li><li>1- AEC407 5" (12.7cm) Wire Cutter Pliers</li><li>1- AEC408 8" (20.3cm) Scraper/Putty Knife</li><li>1- AEC409 11" (27.9cm) Screwdriver</li><li>1- AEC410 7" (17.8cm) Screwdriver</li><li>1- AEC411 8" (20.3cm) Phillips Screwdriver</li><li>1- AEC413 All-Purpose Hack Saw w/8 Blade Positions</li><li>1- AEC412 Claw Hammer</li><li>1- AEC414 1/4" (6mm) Electric Drill</li><li>1- AEC415 5/16" (8mm) Masonry Drill Bit</li><li>1- AEC416 3/8" (9mm) Masonry Drill Bit</li><li>1- AEC417 1/2" (12mm) Masonry Drill Bit</li><li>1- AEC418 1/2" (12mm) Drill</li><li>1- AEC419 1" (25mm) Heavy-Duty Masonry Chisel</li><li>1- AEC420 1.25" (31mm) Wood Chisel</li><li>1- AEC421 6" (15.2cm) Regular Pliers</li><li>1- AEC422 Blade Trowel</li><li>1- AEC400C Metal, Tool Box-Type Carrying Case</li></ul>
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<b>Hazards/Safety Info</b>	<p><b>Warning!</b> Any and all liquids found and collected at a fire scene have the potential to contain harmful chemicals and should be handled with caution.</p> <p><b>Caution!</b> Wear chemical resistant gloves, safety glasses and, when necessary, vapor filter respirator, chemical resistant overalls, and shoe covers.</p>
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### Component Instructions

The tools comprising this kit were selected for use with evidence collection kits specifically for arson (No. AEC200 and AEC300), however, these tools can be used in collection of evidence at any crime scene. Unique among these implements are the drill and long bit for piercing walls to collect evidence from a distance. Also included are tools to make possible collection of samples from soil, wood, plaster, concrete, and miscellaneous materials such as excelsior or cloth. Cutting, collecting, removal, locating, uncovering or localizing evidence are possible with these tools. The implements are compactly packaged in a heavy-duty toolbox for easy access. Protective gloves and disposable clothing are also included.

### Special Procedures

- *While it is imperative to begin evidence collection as quickly as possible, neither the fire marshal nor the arson investigator should enter the scene until it has been deemed safe.*
- *The scene should be fully recorded by photographic and/or videographic means prior to evidence collection.*
- *When collecting evidence for storage in cans, jars, nylon or polyester bags, it is imperative that sufficient head space be left in the container. The general rule is to fill the container to 2/3 full of debris leaving the remaining 1/3 volume open as head space.*
- *If the amount of material to be collected exceeds the number of available cans or jars, it is appropriate to use nylon or polyester bags, and not polyethylene bags. Fill bags ½ full with debris, and then twist the top of the bag, fold over and secure with tape, twist-ties, etc. This should still leave sufficient head space.*

- *After collecting samples of debris and other materials from areas suspected of having accelerants present, it is also essential to collect reference samples (exemplars) of the same materials where it is evident that accelerants were not present.*
- *Floor surfaces are generally the best area for the arsonist to apply accelerants, and they are best areas to search for the presence of accelerants. Different floor surfaces require different collection techniques.*

## **Sampling Procedures For Seven Common Floor Types**

### **Ignitable Liquid Residue Sampling Techniques**

Photograph any pour pattern before sampling it. Gently remove debris by layer from the floor keeping in mind that absorbent materials lying flush on the floor within the suspected pour burn pattern may present outstanding sampling potential. Remember, floors are seldom built perfectly level and human and machine traffic patterns create wear depressions over time. Liquids tend to flow to, and pool in low areas.

Assemble all collection and documentation equipment into a crime scene headquarters convenient to the area of origin. Clean all tools before going into the area of origin and between evidence collection sites. Wear latex gloves when physically handling evidence. Change gloves as required between evidence sampling sites. Limit scene access to evidence collection personnel. Wear appropriate eye protection.

#### **(1) Carpet:**

Carpet is a woven composition material manufactured from a variety of materials including wool, nylon, other synthetics or blends of these products. Many modern carpets and carpet padding are of petrochemical origin and, thus, share molecular similarities with many ignitable liquids. Comparison sampling is important. Most of these products have strong absorption and retention qualities, which make them ideal for ignitable liquid residue sampling.

Suggested tools for sampling carpet include: sharp utility knife, large-blade screw driver or pry bar,

latex gloves, liquid dishwashing detergent with grease solvent, a clean scrub brush and flushing clean water.

- *Lift any remaining carpet to check its underside and padding for ignitable liquid odor or staining. Photograph staining or localized burn damage. If a suspect sample area is identified, cut a long strip of carpet and padding along the odor stain. Chimney-roll the carpet strip. Drain excess water. Place as much of the strip sample as possible into the bottom two-thirds of the container. Be sure to leave at least one-third volume head space below the lid. Seal the evidence can tightly, label it with its collection point, etc., and keep it in a cool place.*
- *Take samples from carpet remaining beneath furniture legs, metal edge strips between room, under carpet tackboards, behind and beneath mopboards (floor moldings) and threshold boards where a suspected pour pattern intersected with these areas. The bases of the furniture legs, carpet tackboards, bottom edge of mopboards and edges of threshold boards may also present excellent sampling opportunities themselves if they are within the floor pattern area.*
- *Many synthetic carpets and carpet pads share a petrochemical origin with ignitable liquid accelerants derived from crude oil. Seek comparison samples from protected areas on the same floor. Suitable comparison (exemplar) samples can be obtained from unburned carpet beneath file cabinets, dressers, or other "shields" distant from the suspected ignitable liquid burn pattern.*

## (2) Glazed Ceramic Tile:

Glazed ceramic tile is a product made essentially from a non-metallic mineral (clay) by firing at a high temperature. Glazing is a second step where a mixture of oxides (silica or alumina) is applied to form a moisture-impervious surface. Typically found in kitchens and bathrooms these products are non-porous and present very poor sampling potential.

**Suggested Tools for Sampling Ceramic Tile:** hammer, cold chisel, large blade screwdriver, pliers, latex gloves, dishwashing detergent and water.

- *Emphasize sampling grout, moldings, surface cracks, and absorbent materials found on top of the tile inside the pattern area.*

- *Emphasize sampling of any absorbent materials that may have been located on top of ceramic tile before the fire (throw rugs, piles of laundry, cardboard boxes) providing they are within the pour pattern area. Locate pre-fire cracks or imperfections in the tiles or grout; these may have soot deposition inside the crack or crevice. Collect from both edges and the base of the crack. Collect samples of the baseboard at the edges of the tile surface within the pattern area.*
- *To find comparison samples, locate a protected area of ceramic tile away from the suspected pattern area. Shatter some tiles with a hammer and pry up an appropriate quantity. Collect sections of tile, grout and adhesive.*

### (3) Concrete/Cement:

Concrete/cement is a hard, strong construction material composed of a mineral aggregate (sand or gravel), water and a cementing material such as Portland Cement (alumina, silica, lime, iron oxide and magnesia). (Untreated) concrete is somewhat absorbent depending on its composition.

- *Focus on isolating the locations of absorbent materials stored directly on the concrete floor in the pattern area. Also, search for pre-fire cracks, expansion seams, floor drains, lolly columns and areas where the ignitable liquid accelerant may have spread under pallets or other objects where temperatures would probably be lower.*

**Suggested Tools for Sampling Concrete:** squeegee, concrete "cold" chisel, 48 ounce hand sledge or carpenter's hammer, large section of clean cloth, required chemical absorbents or solvents, latex gloves, and liquid dishwashing detergent, a clean scrub brush and clean water.

- ***Special Note:** Common ignitable liquids poured on concrete and ignited often leave an intermixed and mottled black, brown and gray area of staining that corresponds to the shape of the original accelerant pool. This area may retain a mild odor of absorbed ignitable liquid and may repel a light coat of water. Document these characteristics. Concrete spalling from liquid accelerant fires remains a controversial topic. If spalling or any of the other characteristics are present in the suspected pour area, document them.*
- *Maintain objects (e.g., pallets, containers, stored products) in place within the pattern area to document damage and burn-pattern evidence consistent with a floor-burning ignitable liquid accelerant.*
- *Several collection techniques are applicable to this type of surface. Which of the techniques or combination of*

*techniques is chosen depends on the specific situation. Direct sampling from the base of absorbent objects stored on the floor within the pattern area, or from pre-fire cracks or sampling from the concrete itself may tend to yield stronger samples than the absorbent technique.*

- *Emphasize collection of samples from the bottoms and bottom edges of any absorbent materials stored directly on the floor within the suspected pour pattern area.*

**Sampling from Pre-Fire Cracks and Crevices:** Pre-fire cracks in the floor surface within the pour pattern area will usually display interior sooty edges after a fire caused by "wicking" and inefficient burning (sooting) of fuel vapors. Post-fire expansion or damage cracks will often have relatively cleaner crack edges. Using the cold chisel and hammer, break the edges of pre-fire cracks one-half inch on both sides. Include a sample from the base material (soil, etc.) beneath the crack. Try to identify and sample crack areas where ignitable liquid may have flowed beneath a shielding object. Pulverize the sample concrete into many small pieces. Loosely fill the evidence can to two-thirds volume and seal.

**Direct Surface Sampling:** Lay the cloth section over the outer edge (periphery) of the burn pattern. Using the hammer, sharply strike the floor at the accelerant pattern edge to fracture the concrete surface. Thin (1/2-inch thick), small, fractured concrete pieces of the floor surface may retain ignitable liquid residue. Fill the evidence container to two-thirds volume and seal.

**Chemical Absorbent Method:** The chemical absorbent method can be used if breaking up the floor's surface is impossible, or if large floor areas are to be sampled. Begin by cleaning the concrete floor where the burn pattern is located with a shovel, squeegee and water spray. Photograph and diagram suspected accelerant burn pattern evidence.

Wet down the entire burn pattern area with a mist of water. Spread a coating of finely ground agricultural lime (40/60 mesh ASTM) approximately 1/16- inch thick over the pattern area. Let stand for 30 minutes. Recover the absorbent with a shovel or squeegee, and place in an evidence can without packing down. The chemical is more absorbent than concrete and tends to soak up ignitable

liquid residues. Non-self-rising flour may be used as a substitute following the same directions. Although flour absorbs as well as lime, it tends to decompose in the can and yield alcohol and carbon dioxide, which may burst the container seal or needlessly contaminate the sample. If flour is used, either have it analyzed immediately or freeze it. Agricultural lime is commonly available in lawn and garden or hardware stores, and non-self-rising flour is available in any supermarket.

#### (4) Floor Tiles:

Floor tiles may be made from vinyl, ordinary ceramic or other substances. Asbestos and other substances were sometimes added to increase durability. This product may offer good residue collection possibilities because of the abundance of seams into which accelerant liquids may seep or be absorbed. Adhesives used with these products, and some of the products themselves (vinyl), may have a petrochemical basis. Comparison sampling is necessary.

**Suggested Tools for Sampling Floor Tiles:** cold chisel, 48 ounce or heavy carpenter's hammer, large-blade screwdriver or putty knife, utility knife, pliers, latex gloves, liquid dishwashing detergent, a clean scrub brush and clean water.

- *To start, gently clear and then clean the surface of the tiles with a gentle water rinse and a squeegee until any remaining burn pattern can be photographed. Include photographs of objects within the floor pattern that display damage patterns consistent with burning ignitable liquid accelerants such as wall or appliance surfaces.*
- *Photograph "ghost patterns," where ignitable liquid seeped into tile edges and either dissolved or seared the adhesive, leaving a checkerboard-like appearance. Photograph areas on the same floor outside the pattern where ghost marks are not present.*
- *Lift the edges of many tiles within the pattern area with a screwdriver or putty knife, and break them off about 1/2-inch from the edge of each seam. Fill the evidence can two-third full and seal.*
- *Comparison sampling of floor tile is important. Certain categories of floor tiles (i.e., vinyl) and many types of tile adhesives share a common petrochemical origin with common ignitable liquids. If an adequate comparison sample is not available, always take the residue sample. Seek comparative tile samples from protected areas outside*



*the pattern area beneath appliances and floor storage.*

#### (5) Linoleum/Vinyl Sheet Floor Coverings:

These thin-layer composition products are manufactured from a base of burlap, canvas, or similar material covered by a mixture of linseed oil, gum, cork dust and /or wood flour (linoleum flooring), or thermoplastic polymers of vinyl compounds (vinyl flooring). Sheet flooring may also contain substances like asbestos, which increases durability. Many are top-coated with a tough, nonabsorbent coating, which inhibits absorption into the product. They are often glued to sub surfaces using epoxy or glues containing hydrocarbon-based adhesives. Comparison sampling is important.

Pouring common ignitable liquid accelerants on linoleum/vinyl flooring will usually have two effects: (1) the surface will often mollify (soften) and begin to dissolve; (2) once ignited, the edge of the accelerant pool will begin to melt, burn and char. As the pool recedes during the fire, the burning and melting will recede with it, resulting in a burn pattern.

- *As with any type of ignitable liquid accelerant pattern, the center of the pattern is ordinarily exposed to the greatest heat and is less likely to produce a valuable sample. Tools for sampling linoleum/vinyl floor coverings include: utility knife, large-blade screwdriver, wood or cold chisel (as appropriate), 48 ounce hand sledge or heavy carpenter's hammer, latex gloves, liquid dishwashing detergent, a clean scrub brush and clean water.*
- *With this type of flooring focus on first sampling from absorbent materials (paper/cloth, storage boxes, throw rugs, collapsed ceiling materials, etc.) and lower portions and joints of any construction materials (floor moldings, door casings, threshold boards) within the pattern area using the appropriate tools.*
- *Look for pre-fire tears, rips or cracks within the pattern, especially near heavy appliances or items that may have been dragged across the floor. Using the utility knife and screwdriver, cut out the remaining surface and underlayment.*
- *Linoleum/vinyl is usually installed in six- or twelve-foot-wide sheets. Locate a seam between two sheets and trace it into the pattern area. Sample from between and beneath the two adjoining sheets in the pattern area.*
- *Identify the edge of the accelerant pool. Cut long, narrow strips of flooring along this periphery zone. "Chimney-*

*roll" and arrange the samples vertically in the evidence can, allowing for one-third volume headspace.*

- *Seek comparison samples outside the pattern areas on the same floor in a protected area. Good comparison samples can usually be found beneath heavy appliances, storage or furniture, which sit flush on the floor. Sample both the flooring and adhesive.*

#### (6) Sand/Soil Floors or Building Aprons:

Ignitable liquid accelerants draining onto or poured across dug cellars and crawl spaces, or exterior ignitions or a liquid-accelerant trailer running out of building to adjoining soil aprons are frequently encountered. Soil generally provides an excellent sampling opportunity because of its high surface-to-weight ratio and the fact it often remains moist and cool during an abutting fire, inhibiting ignitable liquid volatilization.

**Suggested Tools for Sampling Sand/Soil Floors:** mason's trowel, large-blade screwdriver, gardener's hand shovel, latex gloves, liquid dishwashing detergent, a clean scrub brush and clean water.

- *Determine the dimensions of the sampling area by lifting the top two inches of soil, or by pulling tufts of grass or other vegetation with root systems to check for odor. Sample the top four to six inches of topsoil from within the trailer or pour area. Include vegetation roots if they are the dense, surface types. Fill the evidence can to two-thirds volume. Do not pack down the sample. Clean the evidence container's V-groove and seal tightly.*
- *When soil evidence is believed to contain ignitable liquid residue, either transport it to the laboratory promptly, or make arrangements to refrigerate or freeze the soil samples. Naturally occurring bacteria present in soil degrades many common ignitable liquids derived from crude oil and will quickly break down the remaining residue unless precautions are taken.*
- *Take a comparison sample away from the pour/drain pattern area. If you sample the top four inches of trailer soil, then do the same when sampling for comparison purposes.*

#### (7) Wood Flooring:

Wood is used in a vast number of residential and commercial construction and cosmetic applications.

The most important uses for fire investigators seeking ignitable liquid residue evidence would be in the use of wood for flooring, floor moldings, threshold boards, door casings, furniture joints and stair-cases. Most arsonists pour ignitable liquids on a floor or staircase and ignite it.

- *Ignitable liquid residue sampling techniques with wood surfaces should concentrate on seams and joints.*
- *Investigators should also search within the pour pattern for places where wood grain is vertically aligned, such as in furniture legs or wooden door casings. Ignitable liquids reaching such areas are often absorbed into the vertical fibers of the wood boards in much the same way water is absorbed in a tree. Suggested tools for taking samples of wood surfaces include: 1" or 3/4" inch steel wood chisel, 48 ounce hand sledge or heavy carpenter's hammer, pry bar, wood or keyhole saw, latex gloves, liquid dishwashing detergent, a clean scrub brush and clean water.*
- *For tongue and groove or barnboard wood flooring, use the wood chisel and hand sledge to cut thin slivers from both sides of many adjoining board seams within the suspected accelerant burn pattern. Place splintered seams vertically in the evidence can until two-thirds of the volume is filled. Since ignitable liquids will not be absorbed very far into wood fibers, try to collect as many narrow cut seam edges as possible. Try to fill the evidence can to two-thirds volume for best results. If sufficient "hot" splinters cannot be found to properly load an evidence container to 2/3rd volume then use a smaller evidence can.*

**Note:** *When collecting evidence from wooden staircases, use a chisel to cut into the seam between the tread and riser within the accelerant burn pattern on the various steps.*

## References

1. American Institute of Applied Science, Fundamentals of Arson & Explosion Investigation, Lesson 2, North Carolina: American Institute of Applied Science Press Cp.: 2009
2. Inter Fire Online, "Motive, Means, and Opportunity, A Guide to Fire Investigation.", <[http://www.interfire.org/res\\_file/mmo5a.asp](http://www.interfire.org/res_file/mmo5a.asp)> May 5, 2009.
3. International Association of Arson Investigators. User's Manual for NFPA 921 2nd Edition. Sudbury, MA. Jones and Bartlett Publishers, 2005.

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