3.16 Powders and Particulates

3.16.1 Introduction

Fingerprint powders and particulate developers are very fine particles with an affinity for moisture throughout a wide range of viscosity. Palmer sweat, grease, oil, and most contaminants that coat the surface of friction ridge skin possess sufficient moisture and viscosity to attract and bind the fine particles together. Contact between friction ridge skin and a non-porous surface will sometimes result in a transfer of the skin coating to that surface. The non-absorbency of the surface prevents penetration by the deposited moisture. All fingerprint powders and particulate developers are indiscriminate in adhesion to moisture. Surfaces coated with residue in addition to suspected latent prints will attract powders and particulate developers throughout the surface.

Dependent upon the composition of the residue, the deposited moisture will range from a most apparent appearance to the barely perceptible or invisible, even under oblique lighting. Powder or particulate application is the effort to produce or improve the appearance for preservation.
The most effective agent in terms of adherence to moisture, non-adherence to dry surfaces, particle size, shape, uniformity, and intensity of color is carbon. Carbon is black, and as a result, black powders and particulate developers, which contain carbon, will consistently produce the best results. Other colored powders and particulate developers may be required due to the substrate encountered, but should be restricted to absolute necessity.
Magnetic powders are powder-coated, fine iron filings subject to magnetic attraction. These adhere to moisture to a lesser degree than carbon powders, but can be applied with less destructive force to the surface.
Particulate developers are substances, which produce extremely fine particle residue upon burning. Materials with a high hydrocarbon content such as camphor, pine knots, or crumbled masking tape burn slowly and release soot in large quantities. Fine particulate carbon soot adheres extremely well to more viscous moisture while heat from the flame softens the residue. Burning magnesium ribbon may produce White or light-colored soot.
Most commercial black fingerprint powders have a high carbon base. According to the manufacturer's particular formula and production methods, the carbon base may be from a variety of sources, including lamp black, bone, or wood charcoal. Ground carbon alone cannot match the adhesion ability of fine particle carbon soot, but commercial powders contain milled carbon of highly uniform size and shape along with additional ingredients to preserve the milled condition and retard air moisture absorption.

3.16.2 Safety Considerations

- Commercially Prepared Powders
- Camphor
- Magnesium Ribbon

This procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution should be exercised and the use of personal protective equipment should be considered to avoid exposure to dangerous chemicals. Consult the appropriate MSDS for each chemical prior to use.

Traditionally, fingerprint powders have been used with little regard for safety. Many commercial powders do pose a potential health risk and vary in their overall effectiveness. Some powders have been found to contain fluoranthene and pyrene, polynuclear aromatic hydrocarbons known to be carcinogens. Lead, manganese, nickel, aluminum, iron and actinium have all been found in commercial preparations. The affects of these chemicals range from carcinogenic to affecting the central nervous system to being radioactive. Powders applied in a laboratory environment or in the field require appropriate safety precautions. Ventilation systems, filter masks, or respirators are essential. The examiner should refer to the MSDS for the specific powder they are using and take the appropriate safety precautions when using that powder.

3.16.3 Preparations

No specific preparations are needed as the powders and materials being used are commercially prepared.

3.16.4 Instrumentation

See General Instrumentation

3.16.5 Minimum Standards & Controls

The Standards and Controls for the Powders and Particulates consist of insuring that the powders or materials being used are in the proper condition. Powders should not be exposed to high humidity or moisture. Powders may clump if exposed to excessive moisture or contaminants. Moisture content and contaminants may be minimized by keeping the stock container closed as much as possible and using containers with small amounts of powder to work from. This will minimize the moisture content as well as reduce any contamination of the stock container with substances from the item being processed. Powders may also be kept in desiccators designed to reduce the moisture in the atmosphere in the enclosed desiccators.

3.16.6 Procedure or Analysis

3.16.6.1 How and When to Dust with Regular Powders

For many crime scene investigators, more than half of the powder used is regular, nonmagnetic powder. It can be used on windows, counter-tops, television sets and many other items moved or touched at residential burglary scenes. At commercial burglary scenes, it can be used on metal file cabinets, painted doors, broken glass and metal window frames. Regular powders can be applied to the painted surfaces, glass windows and mirrors in recovered stolen vehicles. At most of the day-to-day crime scenes visited, the crime scene investigator will have the opportunity to use regular powder on many surfaces.
Regular powders are available in colors such as black, silver/gray, Bichromatic ™ and white. Choose a color, which will provide sufficient contrast with the background surface to obtain a clear photograph of the latent print. Black is one of the most popular colors used because once the latent print is lifted and placed on a backing card, the ridges of the latent print will be black against the white backing card. This makes it easy for the latent print examiner to compare the black ridges of the latent print to the black ridges of the inked print.
However, to be able to photograph the latent print against a dark-colored background, silver/gray powder can be used. It will be necessary to place it on a black backing card when it is lifted. For some latent print

examiners, this can cause difficulties having to compare the light colored ridges of the latent print to the dark colored ridges of the inked print. There is also the necessity of having to carry two jars of powder, two brushes and two sets of backing cards. To solve this problem, many crime scene technicians use Bichromatic ™ latent print powder.

Bichromatic ™ latent print powder is a combination of black and silver/gray powder, which can be dusted on a light or dark surface. On a light-colored surface, the latent print will appear dark so it can be seen and photographed easily. On a dark-colored surface, it will appear light. When lifted with tape and placed on a white backing card, the latent print will appear dark. This solves the problem for all involved. The crime scene investigator only has to carry one powder, one brush and one color of backing cards. The latent prints will be visible on a light or dark colored surface and the latent print examiner only has to compare the dark ridges of the latent print to the dark ridges of the inked print. Now that a color has been chosen, decide upon the method of application. Regular powders are applied with brushes.

Materials used to make brushes include camel hair, squirrel hair and fiberglass. Most crime scene investigators prefer a fiberglass brush, such as the Zephyr ® Fiberglass Brush, because it is easy to use, the powder can be applied quickly and the chances of damaging the latent print are fewer. Some crime scene investigators learned with camel hair brushes and that is all they want to use. Others learned with a fiberglass brush and nothing will convince them to switch to a camel-or squirrel hair brush.

Regardless of which brush is used, the technique of the crime scene investigator is very important. Just as one investigator can get excellent results with a fiberglass brush because of proper training and sufficient practice, another investigator will get poor results because of lack of training and insufficient practice.

Here are a few helpful hints in dealing with latent print powder. Keep the powder dry so that moisture does not cause it to become lumpy or hard. If the powder does turn into a solid lump, shake the jar (with the lid on) to break it loose. If necessary, place a couple of ball bearings in the jar to keep the powder loose.

Powders may be applied by various means, but the preferred procedure for most items is the use of a brush. Fiberglass brushes are the easiest to use and maintain while permitting application over a wider area. Powders are more effective if applied in very small amounts. While some examiners prefer pouring a supply of powder into a secondary container or a piece of paper, direct contact between brush and powder container is acceptable. Only the ends of the brush bristles should be coated with the powder, and the brush should be gently tapped several times to remove all but a minimum amount.

With the brush handle in a nearly perpendicular position to the surface, the bristle ends are lightly and delicately moved over the surface. Discoloration of the latent print residue will usually appear immediately. With a fiberglass brush and a proper amount of powder, the impression will develop in density with each light pass until no further development can be observed. Even slightly excessive amounts of powder will cause a fill to occur between ridges. This fill must be removed with continued brush strokes until the impression is as free of extraneous powder as possible. Except on highly polished surfaces, excessive brushing is rare with a fiberglass brush. However, at the first indication that the impression is being removed, all further brushing must cease.

Extraneous residue on the surface may cause a general painting effect, which obscures friction ridge detail. A lift made of the area can sometimes remove the extraneous material and permit a second application of powder. This second application may offer better contrast between latent print deposit and the background.

While the brush can be dipped directly into the jar of powder, a secondary container may be preferred, especially if the surface to be processed has visible contaminants. A small portion of powder can be poured into a secondary container to facilitate loading the brush with powder.

When applying powder to a surface, start with a light touch. It is easy to add more powder, if necessary, but it can be difficult to take away excess powder. Use the brush with gentle, light strokes. Latent print residue can easily be wiped away with too heavy of a stroke.

3.16.6.2 How and When to Dust with Magnetic Powders

Magnetic powders are used at special times when better results will be obtained than if regular powders are used. Generally, better latent prints will be developed on shiny magazine covers or boxes with a coated surface when using magnetic powders rather than regular powders. Some plastic materials, such as food storage containers and plastic baggies are choice surfaces for magnetic powders.

When dusting with magnetic powders, it is necessary to use a magnetic powder applicator. The applicator has a magnet in the end to pick up and hold the magnetic powder in the shape of a fuzzy ball. Apply the powder by lightly "brushing" it over the surface of the evidence. Do not let the tip of the applicator touch the surface. Only the ball of powder should touch the surface. If the tip of the applicator should touch the surface, it may wipe away or mark the latent print.

Magnetic powder must be applied with a magnetic application device. Wands, which contain a movable magnet, attract the powder when the magnet is depressed and release the powder when it is raised. Contact between powder and surface is completed without bristles and is more light and delicate than the fiberglass brush. However, the particle size, larger than standard powder, has a tendency to paint some surfaces. Excessive powder can sometimes be removed by passing the magnetic wand without powder near the surface. Since the magnetic attraction holding the iron particles is relatively weak, the supply can be depleted quickly. Surface areas examined generally must be processed more slowly with magnetic powders, and great care must be exercised to prevent actual contact between the end of the wand and the surface.

When you have finished dusting the surface, hold the magnetic applicator over the open jar of powder and pull up on the knob at the opposite end of the applicator. This draws up the magnet away from the end with the powder on it and the powder will fall loose into the jar. Any powder, which falls off of the surface or misses the jar can be picked up with the magnetic applicator and put back into the jar. Magnetic powder is economical, as very little is wasted.

3.16.6.3 Particulate/Soot Powders:

Particulate developers such as camphor are ignited and the surface exposed to the rising soot. The surface must not be placed in the flame and must be moved to insure an even coating of particulate material. Excessive coatings should be avoided. When the surface contains an adequate, even layer of soot, the surface is lightly brushed, preferably with a fiberglass brush dedicated for use with particulate developers, until the non-adhering soot is removed. This technique can only be applied to surfaces that will not be affected by the heat from the ignited camphor. Surfaces such as plastics should not be processed using this technique due to the extreme heat produced.

3.16.6.4 How to Lift a Latent Print after Dusting

Latent prints developed with either type of powder can generally be lifted with adhesive tape, such as rolls of frosted or clear tape, poly tape or Handi-Lifts ™ and Lightning Lifts ™ pre-cut tape strips. The process is simple. After the latent print has been developed with powder, press a piece of tape on the surface and rub it to make sure complete contact is made. Be sure that the size of the piece of tape is large enough to cover the latent print.

Remove the piece of tape from the surface and press it onto a latent print backing card. Use a white backing card for latent prints developed with black or Bichromatic ™ powders. Use a black backing card

for latent prints developed with silver/gray or white powders. Handi-Lifts ™ are available with a white, black or transparent backer attached to them.
It is important to make notations on the backing card to indicate from where the latent print was recovered. Preprinted backing cards have boxes to fill in for the date, time, case number and other information regarding the latent print lifted. Another method to provide a chain of custody record is to use numbered backing cards. You could use a series of numbered backing cards at a crime scene. These numbers would be noted in your crime scene notes.

3.16.7 Interpretation of Results

Powder and particulate-developed latent impressions must be properly preserved. Experiments have revealed that the developed latent impressions have a weaker adhesion to the surface than undeveloped, and, as a result, are more susceptible to damage from accidental contact. Two methods of preservation are normally afforded the powder or particulate-developed latent: photography and lifting.
Photographic preservation of the developed impressions on the item affords the best procedure in terms of minimal damage and complete documentation. Lifting is also an approved procedure but caution should be taken when lifting to insure that the lift will be successful. If the lift cannot be made with confidence that it will be successful the developed fiction ridge detail should be photographed prior to lifting.

3.16.8 Minimum Quality Standards and Controls

See Standards

3.16.9 References

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