

---

## **APPENDIX H**

# **EPA's DRAFT POLICY ON THE USE OF DIGITAL CAMERAS FOR INSPECTIONS**



This page intentionally left blank.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

JUL 8 2002

OFFICE OF  
ENFORCEMENT AND  
COMPLIANCE ASSURANCE

**MEMORANDUM**

SUBJECT: Draft Policy on the Use of Digital Cameras in Civil Inspections

FROM: Michael S. Alushin, Director *M. S. Alushin*  
Compliance Assessment and Media Programs Division

TO: Addressees

Digital photography is becoming more and more common-place, including use by Regional and State inspectors. Within EPA and at the State level, several offices have initiated development of draft policies to address the use of these cameras during inspections. In addition, Regions have raised a number of questions related to the use of digital cameras over the past couple of years by e-mail and during the National Inspector Workshops. As a result of this interest, we convened an informal workgroup including several offices that were in the process of developing policies to draft a National policy on the use of digital cameras during inspections.

I want to thank the following individuals for their work in developing this draft: Phyllis Flaherty, Sally Sasnett and Iliana Tamacas of OC; Walter Mugden, ORC, Region 2; Craig Kubick and Steve Sisk, NEIC; Rusty Herbert (ORC) and Richard Gigger of Region 6; and Kathy Clarke of ORE.

Please review and comment on the draft policy (attached) by August 9, 2002. Regional commentators are requested to provide their comments through the Regional Enforcement Coordinator, who can ensure a coordinated Regional response. The policy addresses: minimum requirements to ensure the credibility of digital photographs (photos); a brief overview of digital camera technology; recommended "Best Practices" for use in developing standard operating procedures (SOPs) tailored for specific needs; and some basic recommendations regarding selection of digital cameras and supporting equipment.

As you review the document, we would appreciate your thoughts and comments particularly concerning item #11 of the Requirements (page 3). This item deals with the necessity for printing the photos referenced in the Inspection Report. The draft policy currently requires that a printed copy of all photos referenced in the Inspection Report be included with it. We would appreciate your thoughts on whether: all photos must be printed, all referenced photos must be printed, key photos must be printed, or whether it is necessary to print any photos, provided the digital storage media accompanies the inspection report.

Draft June 27, 2002

DRAFT, DO NOT CITE OR QUOTE

---

## USE OF DIGITAL CAMERAS FOR INSPECTIONS

---

---

### STATEMENT OF POLICY

---

EPA has determined that the use of digital cameras/photographs for documenting civil investigations is acceptable provided certain requirements related to their use are met.

---

---

### INTRODUCTION

---

This document discusses the rationale for support of digital cameras for civil inspections, sets forth minimum requirements to ensure the credibility of digital photographs (photos) to document inspections, provides an overview of digital camera technology, suggests good practices related to digital camera use, and provides recommendations concerning the selection of digital cameras and supporting peripheral equipment.

---

---

### REQUIREMENTS

---

Because digital photography is a somewhat new technology, taking a few precautions will assist in ensuring the credibility of the digital photos. Further discussion of the technology and technical considerations related to use of digital cameras and recommendations for "Best Practices" are provided later in this document, but certain steps are essential to ensuring digital photo credibility. The following are minimum requirements which must be met when using digital photographs to document EPA civil investigations:

1. The digital photo must be a fair representation of the object/scene at the relevant time and must not be manipulated as to be indistinguishable from the original image.
2. When the photo is used as evidence, the person testifying must be able to verify the authenticity of the image, how it was acquired, its relevance to the case and how it corroborates testimony as to issues which may be disputed in the case.
3. A digital camera with enough resolution to produce a photo equivalent to a 35 mm print or a Polaroid must be used. (At least 2.1 mega-pixel resolution is recommended to produce good quality 5" X 7" pictures, although resolution necessary is dependent on subject matter and final use. Please see the Basic Technical Information Section for more detail).

Draft June 27, 2002

DRAFT, DO NOT CITE OR QUOTE

4. Equipment must be available which will allow the secure use and storage of the digital photo images. (More detail is provided in the Basic Technical Information Section).
5. There must be a standard operating procedure (SOP) in place regarding digital camera use which includes guidance on: properly using digital cameras, capturing the digital images, securing the original images captured, and procedures on copying, storing, transferring, and handling of the "original" images. (Additional "Best Practices" recommendations for SOP elements are provided later in this document.) Each Regional or State office with inspectional authority which decides to use digital cameras should develop its own SOP governing their use.
6. A Photo Log (see attached example) must be kept for each inspection which is a record of: the identity of the photographer; the identity/type of camera used; the date, time, location, and conditions under which the photo image was taken; the name of the facility and the EPA facility registration system (FRS) number, (or any available EPA Facility Identification number), if known; and a brief description of the picture. The Photo Log must also include a record of the date, time, and identity of the person transferring the images from one storage media to another, and the date, time, type of change, and identity of the person making any change to an image which will be used as evidence. (No change should be made to the "original" image. Enhancements must be done only on a copy. Each change should be saved as a separate image file and documented so that all enhancements can be reconstructed, if necessary.)
7. Original images must be saved to alternate storage media to create an "archival original" as soon as possible after image capture. This "archival original" must be labeled as such and kept secure and any enhancements needed should be made only to a copy. NEVER EDIT THE ORIGINAL OR ARCHIVAL ORIGINAL [Ideally a read-only Compact Disk (CD-R) should be used as the "archival original" but if a CD-R or a CD-"burner" is not available, a floppy disk may be used for the "original" copy. If a CD-R is not used, an option is to use cyclic redundancy check software to verify the images. See discussion in the Basic Technical Information Section for more detail.]
8. Access to the "original" images must be limited and a Chain of Custody which identifies anyone having access must be maintained from the time the picture is taken until the case is closed. (See attached).
9. When mailing the "original" via postal mail, it must be placed in a jacket, pouch or equivalent with a custody seal. The same procedures used for

Draft June 27, 2002

DRAFT, DO NOT CITE OR QUOTE

mailing samples must be used with the "original" to ensure its integrity.

10. If copies of the photos are given to a facility, a record of what has been given must be kept. This record may be a list of the photos noted as part of the field notes, a separate photo list, or a separate Photo Log. The record must identify and describe the photos.
  
11. The Photo Log and printed copies of the digital photo images which are referenced in the report with corresponding identifying information from the Photo-Log must be attached to the inspection report. If printing is not feasible, the Photo-Log with the properly labeled storage media containing the "original" digital images must accompany the inspection report.

---

## **Background Information**

---

### **Rationale for Policy**

---

Changes in photographic technology have made digital cameras common-place. Digital cameras offer many advantages over traditional cameras and could soon become more widely used than traditional film cameras. Many law enforcement agencies, including the FBI, have recognized the utility of digital imaging in field applications. Because the use of digital cameras and photos is becoming so common-place for enforcement purposes, and because it is a somewhat new technology, it could meet with resistance and challenges when used in case support, if proper precautions are not taken. Provided proper steps are taken to protect the chain of custody from the time of image capture until the case is closed and the records are archived, a photo taken by a digital camera is as much an "original" as one taken by traditional means.

Standard operating procedures which ensure the authenticity and document the chain of custody of the pictures are key to the defensibility of use of digital photos for case support. Just as in cases using other photographic evidence, the witness will need to identify the scene; explain how he/she is familiar with the scene; and establish that the picture is a fair representation of the scene at the relevant time.

### **Advantages of Digital Camera Use**

---

Digital photos offer the user a fast and efficient way to collect documentation of visual observances during an inspection, such as to document violations observed, or

Draft June 27, 2002

DRAFT, DO NOT CITE OR QUOTE

to convey a complex scene by e-mailing the pictures to others off-site and getting advice regarding appropriate actions. Digital photos can be reviewed at the site to be certain that important details are captured and notes can be corroborated. Any poor quality pictures can be deleted and shot again at the site before scene conditions change. Inspectors have reported that many facilities prefer the digital images and are more amenable to this type of photo being taken, particularly if they are given the opportunity to review them at the conclusion of the visit. Sharing the images at the conclusion of an inspection may provide facilities with a greater comfort level regarding what the inspection has revealed, particularly in terms of "proprietary information." This may result in fewer claims of confidential business information because unnecessary images containing proprietary or sensitive (i.e., military or government) information could be deleted at the scene. In addition, digital cameras can be used in unique settings when special detail is needed, as, for example, by taking a picture through a microscope using its lens as the enlarger.

Because digital photos can be stored as data files on a computer disk, hard drive, or CD, storage requires less space and the photos can be easily catalogued and quickly retrieved using a simple search query. Although digital images can be developed commercially, if the necessary equipment is available, in-house processing can offer some advantages. For example, there may be a security advantage by allowing control of the image from capture through use. When time is an essential element, hard copy photos can be produced quickly for review; and inexpensive copies can be produced when fast information-sharing is critical. Also, like traditional photos, digital photos can be enhanced and edited, but much faster and more easily. Because the processing generates less waste, digital photos are also more environmentally friendly than film.

### **Basic Technical Information Related to Digital Camera Use**

Digital and film photography share many similarities. Both create an image through use of a light-sensitive medium. In the case of digital cameras, light falls on a grid of detectors known as a charge coupled device, or CCD, and produces a pattern of electrical charges that are measured, converted to numbers and stored. Each value in the grid corresponds to a picture element, (also known as a pixel) in the digital image<sup>1</sup>. The electrical output of the CCD is sent to a converter that changes the image to a digital output which is then stored in the camera as a computer data file with each file representing a different photograph<sup>2</sup>. Following is a discussion of some important factors relevant to digital camera use.

---

<sup>1</sup> Erik C. Berg, "Legal Ramifications of Digital Imaging in Law Enforcement", *Forensic Science Communications*, October 2000.

<sup>2</sup> Penney Azcarate, "Digital Imaging Technology and the Prosecutor", *Prosecutor*, January/February 2000.

Draft June 27, 2002  
Resolution

DRAFT, DO NOT CITE OR QUOTE

Digital camera resolution is the amount of sharpness or detail in the image and is dependent on the number of pixels in the image. This is generally determined by the number of pixels across the width and height of the CCD. Pixel count is established by multiplying these numbers. Therefore, it is important to know the maximum CCD resolution (total number of pixels in a camera's sensor) in order to know the film equivalent capability of the digital camera. This is generally stated as "x" mega pixels. For example, 1280 x 960 pixels would give the film resolution of a 5" x 7" print and 1600 x 1200 pixels would give the film resolution of an average 8" x 10" print. A digital camera with this resolution as its maximum would be in the 2.0 mega pixel range. Although an 8" x 10" image from a camera having 2.0 mega pixels maximum resolution could be further enlarged, the quality of the photo would be degraded.

Digital cameras are available with a wide range of CCD resolution from around 1.0 mega pixels to 6.0+. Generally, low end cameras have a resolution of 1.0 mega pixels and cost around \$100. These would probably be insufficient for all but the most basic of photographs.

The next CCD resolution level is about 2.0 mega pixels. This would allow for a picture at fine resolution roughly equivalent to an average 8" x 10" 35mm print taken by a conventional camera. If further enlargement is required, some image loss will occur. Cameras in this range currently cost around \$300 with cost differences primarily depending on the image storage capacity and optical zoom capability.

For good quality, multi-purpose use, CCD resolution in the 3.0+ mega pixel range is needed. The higher the mega pixel level, the more and larger images with high resolution can be stored. This is important where larger photos may be necessary and where greater detail is important. It is also important if more than a few high resolution pictures are going to be needed during a session use. Cameras with this CCD resolution currently cost from \$400 up.

### Storage Media/Memory

A digital camera uses and/or contains random access memory (RAM) to store the images. When RAM is used up, it must be restored in order to take more pictures. There are currently several types of storage media used to record digital photos. The most common ones are Smart Media, Compact Flash and Stick memory. Additionally, some manufacturers use a standard 3.5" floppy to store images (although this technology is becoming outdated). Floppy disk cameras typically create lower resolution images than card-based cameras to keep file sizes small enough to fit on the floppy disk. Floppy disks can store 1.4 Mega Bytes (MB) compared to 8 - 16 MB on a standard memory card (with expanded ones available now up to 5 gigabytes). Also available now is another card-sized storage media, an IBM "Microdrive," which fits the Compact Flash Type II card slot and can store up to 1 gigabyte of data when used with a compatible camera. Regardless of the storage media used by the camera, pictures

Draft June 27, 2002

DRAFT, DO NOT CITE OR QUOTE

can be downloaded and stored either on the computer's hard drive, or on a compact disk (CD) if the computer is equipped with a CD "burner."

The number of photos which can be taken per session is a function of the resolution selected and the amount of memory required. This is somewhat dependent on the file format used. Most digital cameras use a file format which "compresses" the image so that more pictures can be stored on the storage media. There are two file types used to store the digital images on the storage media. A "lossless" file is one where no data is lost. Two file format types frequently used by digital cameras to capture "lossless" images are TIFF (Tagged Image File Format) and RAW. Lossless files or lossless compressed files tend to be quite large. Because these images require so much memory, to store more than one or two digital images in this format requires a very high capacity (and expensive) storage media, so this is primarily used only by professional photographers using high-end equipment.

Another file type in which some data may be lost is known as a "lossy" file. Images stored this way take up less much less room but may lose some data or image quality. However, the resultant "loss" may not be significant to over-all picture quality. One type of "lossy" file format that is currently used by most digital cameras is a standard file format known as JPEG (Joint Photographic Experts Group). This file format is designed to address the known limitations of the human eye and was named for the committee that devised and wrote the standard. At the highest JPEG resolution, even though there may be some small loss of image quality, it would not be obvious to the human eye. (This is less true for pictures of things like signs or other very hard-edged objects). When an image is captured by a digital camera using this file format, JPEG automatically compresses the file, allowing for a greater number of pictures to be stored on the storage media. Generally, a 3.1 Mega Pixel (MP) camera using a 16 Mega Byte (MB) storage medium at high resolution could store approximately only two TIFF files, but could store at least 12 JPEG photos with no noticeable image loss. However, if JPEG images are repeatedly compressed and decompressed (such as by repeated viewing before saving) or if the picture needs to be enlarged significantly, some noticeable image loss may occur.

Most digital cameras come with built-in picture file identifier (which assigns a unique number to each picture), date, and time stamps. This is an important feature for establishing chain of custody records.

### Power Supply

Because they are electronic, digital cameras require significantly more power than other types. All or most of their functions are electronic, so batteries can drain quickly. This can be true even when batteries left in the camera are not in use. Repeated viewing of images through the camera's liquid crystal display (LCD) screen can rapidly deplete batteries. This is particularly significant for digital cameras because battery depletion can cause the camera settings to be lost, in addition to being problematic if the power suddenly disappears when needed during use.

Draft June 27, 2002

DRAFT, DO NOT CITE OR QUOTE

Most digital cameras take AA batteries. There are several types of these: nickel metal hydride (NiMH, rechargeable), nickel cadmium (NiCd, rechargeable), lithium (non-rechargeable), and, of course, alkaline (non-rechargeable). Of these, the NiMH is the most economic because of their basic cost, rechargeability, length of charge, and long service life. (They are also environmentally preferable to the nickel cadmium batteries which are gradually being phased out). The lithium batteries are useful as cold-weather back-ups. Having extra batteries sets is essential when using digital cameras for anything more than a few quick shots.

## **Other Technical Considerations**

---

### Optical Zoom

Another factor affecting picture quality, particularly for close-ups or distance, is optical zoom. Optical zoom is "true zoom" or telephoto, which makes the image appear closer without losing detail; digital zoom is really just built in image enlargement with some resulting loss of photo detail. Cameras with a higher degree of optical zoom allow for a greater degree of flexibility in use without loss of image quality.

### Photo Storage and Printing

Storage and printing are other important considerations for use of digital cameras. The computer is most often the mechanism used to store and print digital photos. To transfer images from the digital camera's memory to the computer, the camera is connected to the computer using either a serial port or the Universal Serial Bus (USB) port (except when the camera uses a standard 3.5 inch floppy disk). Most computers have a USB port that simply connects to the camera with a plug-in cable and images can be downloaded to the hard drive. If a USB port is not available, a card reader can be connected to the printer port to transfer images to the computer and the images then can be stored on the computer's hard drive. However, if the hard drive were to fail, the images could be lost, so back-up storage is necessary. Some cameras are also equipped to transfer the images directly from the camera to the computer. The disadvantage of this system, however, is that if the transfer is interrupted some images could be lost.

If a computer is equipped with a CD "burner," the images can be stored on a read-only CD (CD-R). This has several advantages. Images stored to a read-only CD-R are created by permanently altering the disc with a laser light beam. CD writers cannot delete laser marks, so the images can be stored without alteration and any alteration would be detectable. (This is only true for CD-R, not CD-RW (read-write)). The "original" images could be stored this way to form an unalterable archive and it is feasible to store large numbers of images in a small amount of space. (A typical CD can store hundreds of images). Both CD burners and CD-Rs are now economically feasible with CD burners

Draft June 27, 2002

DRAFT, DO NOT CITE OR QUOTE

costing in \$175 range and CD-Rs costing a dollar or less each. Once the images are archived to a CD-R, copies of the unaltered "originals" can be made on a CD-RW and any necessary enhancements, such as improving contrast or "cropping" can be done on the copies and properly noted in a photo log for future reference. (Each change should be saved as a separate image file and documented so that all enhancements can be reconstructed, if necessary).

An alternative to using the CD-R is to store the images on floppy disks and use commercially available software to perform a "Cyclic Redundancy Check" (CRC) on the stored images. The software performs a calculation that generates a unique number which can be checked later against the stored data to ensure that they match, indicating that the data also matches. NEIC uses MARESWARE software (see websites list) for this function.

Images can be printed at the same time they are downloaded, or printed as needed. For truly photographic quality prints, a commercial developer is recommended, particularly if large pictures are required. (Commercial developers have access to a different process that can provide better color and resolution than that afforded by in-house processing). For in-house viewing or most general purposes, a good quality color ink-jet printer using archival inks is recommended, particularly if the photos will be stored for a long period of time. For high quality images, premium glossy photo paper will give a great degree of color accuracy, even under magnification. For general purposes, plain paper, photo quality ink-jet paper, premium photo paper, etc. can be selected depending on the necessary quality outcome.

### Computer Requirements

A computer has two types of memory, hard disk storage and Random Access Memory (RAM). The computer's hard disk drive is the memory used to store the digital images before transferring them to another storage medium, such as a CD-R. A high-capacity hard drive is needed if many digital images will be "down-loaded" at one time. A hard disk drive should not be filled to more than 70% of its maximum capacity in order to not cause performance deterioration. A computer with at least a 10 gigabyte hard drive is recommended at a minimum, but the amount of hard drive memory needed will depend on what other programs are resident which use memory, and how many pictures will be down-loaded from the camera's storage media before being transferred to CD-R or other permanent storage.

Computer speed is another consideration. Speed is normally measured in millions of cycles per second or MHz. Speed affects how fast the digital images can be down-loaded or edited. A speed of at least 233 MHz is recommended, although computers are now available at speeds of 2000 MHz (2Ghz).

---

### **Guidelines for Ensuring Credibility of Digital Photos**

---

As long as the digital photo is a fair representation of the object/scene at the

Draft June 27, 2002

DRAFT, DO NOT CITE OR QUOTE

relevant time, has not been manipulated to be indistinguishable from the "original" image, and corroborates the witness's testimony as to the issues disputed in a case, it should provide the necessary documentation to support a case. It is up to the witness who is testifying to demonstrate the authenticity of the image and to explain what the image shows, how it was acquired, and its relevance to the case. This will support the authenticity of the images and the testimony of the witness.

Because digital images are easier to manipulate than traditional 35 mm or Polaroid photographs, critical to ensuring the credibility of digital photos is having a Standard Operating Procedure (SOP) in place that establishes the proper security and record-keeping procedures for taking, storing and documenting digital images. Inspectors using digital cameras during field inspections must have and use a standard operating procedure (SOP) regarding digital camera use. Each Regional or State office with inspectional authority which decides to use digital cameras should develop its own SOP governing their use. The SOP should include: guidance on properly using digital cameras, securing the original images captured, copying the captured images and using a chain of custody (COC). If the digital images captured during inspections are used in civil cases as evidence, inspectors may need to defend the images in court, and the use of an SOP may increase the validity of the images as authentic evidence. In addition to the minimum requirements detailed previously, the following are "Best Practices" recommendations for items which should be included in Regional or State SOPs.

### **Best Practices**

---

1. Have the necessary equipment to capture, store, and distribute digital images. Use a digital camera with the required resolution to get pictures that are equivalent to a 35 mm print or a Polaroid. At least 2.1 mega-pixel resolution is recommended to produce good quality 5" X 7" pictures. Other equipment is needed to store, print, and reproduce digital images. Necessary equipment includes but is not limited to: computer (hard drive) with sufficient memory; electronic storage media (for example, Memory Stick, Compact Flash, Smart Card, CD, and/or floppy disk); USB cable; card reader (optional); battery and backup battery(ies); printer; and authentication software (optional). Before digital cameras are used for field activities, all the equipment should be available that is needed to capture images, store the images, produce unalterable "original" copies of the images, produce backup copies of the images, print the images, and any other equipment that may be required depending on the activity for which the camera will be used. This includes a computer with sufficient memory for down-loading images to the hard-drive before transferring them to the archival media.)
2. Be familiar with the camera and able to use it properly for capturing images during field activities. Anyone issued a digital camera should become familiar with its operation by reading the instruction manual of the camera. A person should know how to store an image; the capacity of the storage media being used; how to transfer images from one storage media to another; how and what is needed to print

Draft June 27, 2002

DRAFT, DO NOT CITE OR QUOTE

good quality images; how to use the different settings (resolution choice, digital zoom, flash, etc.) in the camera; and the camera's limitations (weather, zooming). Digital cameras are susceptible to damage from extreme temperature, strong magnetic fields, dust, noise, and/or vibrations. Note that digital images are not damaged by X-ray machines such as those found at security check points. It is recommended that digital cameras and their components NOT be left in vehicles where they will be subjected to extreme heat or cold. Efforts are to be taken to prevent theft, loss, or damage. It is very important to be aware of the limitations of digital cameras. An inspector should refer to the camera's manual to be familiar with the optimum operating conditions of the camera. (Note: it may be useful to have a conventional camera and film available as "back-up" in case of unforeseen circumstances).

3. Verify the digital camera's date, time and other applicable settings. All digital images are electronically inscribed with the date and time the image was taken and with the image number. This information automatically becomes a permanent part of the electronic image file and usually can be imprinted on the image when it is printed to hard copy. This information can be viewed through the camera. Before taking any pictures at a facility or site, the inspector should make sure that the camera's setting for the date, time and calendar are correct, so it reflects the correct date and time on the digital image. Depending on the camera, any additional settings in the camera should be calibrated and set to optimize the camera's capabilities according to the conditions in which it will be used (for example: resolution, zoom, lighting, file folders, and so forth). Note that the camera resolution setting should be high enough to produce the equivalent of at least an 8" X 10" traditional 35 mm print, particularly if detail is important to the image. Settings will vary depending on the camera, so refer to your camera's manual.
4. Take into account power considerations and/or limitations: Batteries must be checked at least weekly when not used. At least one extra set of Nickel Metal Hydride (NiMH) rechargeable batteries should be taken by the inspector to the field and a charger to recharge the batteries at the end of the day. Recommendations and instructions accompanying the chargers and camera should be followed. When changing the batteries always change the entire set. Batteries of different types should not be mixed. The cameras will operate on AA alkaline<sup>3</sup> batteries. Never try to recharge alkaline batteries. Never mix alkaline batteries and rechargeable batteries in the camera. Lithium batteries are a good option as back up batteries (especially for cold weather).
5. Ensure sufficient storage media is available for each inspection and clearly identify pictures captured for each session. The storage media may be any of the following (depending on the type of camera): compact flash, memory stick, smart media,

---

<sup>3</sup> While cameras will operate on alkaline batteries, they will last a very short time and cause the camera to respond slowly. Alkaline batteries should only be used in an emergency situation.

Draft June 27, 2002

DRAFT, DO NOT CITE OR QUOTE

compact disc, and/or floppy disc. In situations where more than one incident or case is to be worked closely together, images from more than one incident may be captured on the same electronic storage card. If images from more than one incident need to be captured on a single storage card, you may do so by inserting a "blank" image after the "end card" image. It is recommended that an "end-card" image be labeled and photographed before starting a new session. Images from one incident should not be split between two electronic storage cards unless a large quantity of images requires two cards or the storage media does not have enough memory to store all the images from one inspection. The different disks, floppy disks, and/or cards should be sequentially numbered and labeled with the name of the facility and date taken and should indicate what pictures from the inspection are contained in each.

6. Transfer the digital images to another storage medium to make an "archival original." An "archival original" should be made so that the storage media can be re-used and to secure the digital images from loss or tampering. To be certain that images are not lost in the transfer process, first transfer the images from the camera's electronic storage media card or floppy disk onto the hard drive of your computer. Make sure the computer hard drive has enough memory to store the pictures. Then, verify that the images have been successfully transferred. An "archival original" should be made from the hard drive image files. The original copy should NOT be changed in any way. The archival original should be labeled with the time, date, name of facility/site and filed in a secure location, and should have a chain of custody that contains the names of people with access to it. (See example, attached). At least one additional copy should be made as a back-up copy. This copy may be edited if the image needs to be enhanced. Any changes made to a picture must be noted on the photo log and inspection report. Originals should be labeled as such and copies should be identified as copies.

There are two alternatives in current use for creating a secure archival original. One is to transfer the images to a CD-R (read-only). The other is to use commercially available soft-ware to create a verifiable copy. In either case, the transfer should be documented in the Photo Log. The following is a brief description of each alternative.

A). If your computer is equipped with a "CD-burner," after down-loading the images to the hard drive, copy them onto a CD-R. A CD-R can be used to make an unalterable archival copy. This CD-R will be the "original" document of the digital images (similar to the negatives of a conventional camera). If changes need to be made to the images (such as enlargement, cropping or contrast), they can be made on another, writeable CD. Any change should be replicable and should be documented in the Photo Log.

B). A floppy disk also may be used as the storage media for the archival "original." (Note: floppy disks do not have as much memory as CD-Rs, so more than one floppy disk may be needed to store the images). If a floppy disk is used, it should

Draft June 27, 2002

DRAFT, DO NOT CITE OR QUOTE

be changed to the "read only" position when it is full and a custody seal should be used. When using a floppy disk as the archival original storage medium, the "Cyclic Redundancy Check" (CRC) software should be used to ensure verifiable images.

7. Use proper procedures for storing archival original images. The archival CD "Read Only" version (or other archival original storage media) of the digital images should be stored in a secure place with limited access. When the archival original is filed, a log should be kept and anyone accessing the archival original should sign off before using it. The archival original should be labeled and a proper chain of custody form should accompany it. (A sample chain of custody form may be found as an attachment to this document). It is up to each Region to use the archiving method that best suits them. Each Region should use a method that follows the guidelines for the applicable program. The archival original may be stored with the case file and/or in a separate area designated to store and archive all digital photo originals. Again, proper labeling and chain of custody procedures should be used at all times. Finally, it is very important that if a digital image is considered Confidential Business Information (CBI) by the facility, inspectors must have clearance to handle the information as such and that all CBI procedures must be followed.

---

### **Recommendations for Selecting/Using a Digital Camera**

---

There is a wide selection of digital cameras available now from the very basic "point and shoot" to the elaborate professional models with various types of storage media and many other options. In selecting a digital camera for use to support inspection documentation, the typical use conditions should first be considered, but potential extremes should also be considered in order to select the best digital camera for the anticipated use conditions. It should be remembered that traditional 35mm or Polaroid cameras may be the best choice for some scenes/conditions, such as where vibration, dust, or strong magnetic fields may be present or where a level of detail is desired which cannot be achieved using a digital camera.

For use in general field conditions and for average level of detail photos, a digital camera should have at least a 2.1 mega pixel capability. (Higher mega pixel capacity is important if photos will need to be enlarged to more than 8' x 10" or where a high degree of detail is needed). The camera should have external memory storage media capable of identifying each photo separately; have date/time stamp capability; and have a USB or card reader port so that images can be down-loaded to a computer hard drive. The amount of light present in most use situations should also be considered to select a camera with the appropriate ISO sensitivity. It is also helpful if the camera provides for resolution selection and has optical zoom capability. (This is useful for taking pictures from a distance without losing image quality. Digital zoom will enlarge the image, but some detail may be lost). A camera with these basic features should cost about \$300. These are basic recommendations, but camera selection will be dependent on the Region/Program's particular needs and resources. Most cameras come with at least 8

Draft June 27, 2002

DRAFT, DO NOT CITE OR QUOTE

MB of external storage memory. Additional external storage media cards holding 32 MB cost between \$23 - \$34 each, depending on the type. Nickel metal hydride(NIMH) batteries cost about \$5 for a pack of four or \$30 for a pack of four with a re-charger. A lithium battery pack is around \$10.

For whatever camera is selected, there must also be sufficient computer speed and hard drive capability. At a minimum, a computer should have at least a 10 gigabyte hard drive with enough memory available to fit the number of pictures that will be downloaded from the camera's storage media during a session. Computer speed is less important but will impact how quickly the transfer can occur and any copying or editing that will take place. A minimum of 233MHz is recommended for the average digital camera storage medium of 16 MB. A CD "burner" is also highly recommended for storing "archival originals." CD "burners" currently cost around \$175 and are included in many newer computers.

A good ink-jet printer is recommended for printing copies of the photos to include with the inspection report. Epson makes printers specifically designed for this task but there are many other printers available as well. They cost between \$150 - \$500, depending on print speed and resolution.

## References/Additional Information

---

1. Berg, Erik, "Legal Ramifications of Digital Imaging In Law Enforcement," Forensic Science Communications, Vol 2, No. 4, October 2000, available at [www.fbi.gov/hq/lab/fsc/backissu/oct2000/berg.htm](http://www.fbi.gov/hq/lab/fsc/backissu/oct2000/berg.htm)
2. Azcarate, Penney, "Digital Imaging Technology and the Prosecutor," Prosecutor, January/February 2000, (34 FEB Prosecutor 26)
3. "Guidelines for Field Applications of Imaging Technologies," Scientific Working Group on Imaging Technologies (SWGIT), Version 2.0, June 8, 1999, Forensic Science Communications, Vol. 2, No. 1, January 2000, available at [www.fbi.gov/hq/lab/fsc/backissu/jan2000/swgit.htm](http://www.fbi.gov/hq/lab/fsc/backissu/jan2000/swgit.htm)
4. "Definitions and Guidelines for Use of Imaging Technologies in the Criminal Justice System," Scientific Working Group on Imaging Technologies, Version 2.2, December 7, 2000, Forensic Science Communications, Vol. 3, No. 3, July 2001, available at [www.fbi.gov/hq/lab/fsc/july2001/swgit.htm](http://www.fbi.gov/hq/lab/fsc/july2001/swgit.htm)
5. Camp, William W., "Practical Uses of Digital Photography In Litigation," ATLA Annual Convention Reference Materials, July 2000, Volume 2, Attorney's Information Exchange Group (AIEG).

Draft June 27, 2002

DRAFT, DO NOT CITE OR QUOTE

6. Keane, James I. , "585 Prestidigitalization: Magic, Evidence and Ethics In Forensic Digital Photography," Ohio Northern Law Review, 1999, Twenty-second Annual Law Review Symposium Courtroom 2000: Technology and the Legal System Symposium Article (25 Ohio N U I. Rev.585).

7. Carbine, James E. and McLain, Lynn, "Proposed Model Rules Governing the Admissibility of Computer-Generated Evidence," January 1999, Santa Clara Computer and High Technology Law Journal (15 Santa Clara Computer & High Tech L.J. 1).

8. Lynch, Peter A. "Digital Cameras and the Fire Investigator: A Trap for the Unwary?" , Cozen & O'Connor, San Diego Regional Office available at [www.interfire.org/features/camera.htm](http://www.interfire.org/features/camera.htm)

9. "Digital Imaging Issues and Image Verification Presentation" - Waynesboro VA Police Department, Investigations Division, at [www1.br.cc.va.us/wpd](http://www1.br.cc.va.us/wpd)

10. Staggs, Steven, "The Admissibility of Digital Photographs In Court," available at [www.crime-scene-investigator.net/admissibilityofdigital.html](http://www.crime-scene-investigator.net/admissibilityofdigital.html)

11. Herbert, Rusty and Gigger, Richard, (EPA Region 6), "Background Information for Digital and Photographic Imaging," and "Draft Region 6 Standard Operating Procedure Digital Camera Imaging," June 2001.

### **Websites:**

---

1. [www.digital-camerastore.com/digitalinfor2.htm](http://www.digital-camerastore.com/digitalinfor2.htm) - good basic info and lists of cameras/prices.

2. [www.cliffshade.com/dpfwiw/advice.htm](http://www.cliffshade.com/dpfwiw/advice.htm) – "Advice for first-time digital camera users" –good overview of digital camera use with links to more information

3. [www.cooking-italian-food.com/photography.htm](http://www.cooking-italian-food.com/photography.htm) – "Digital Camera Guide - Photography Definitions and Terminology," - discussion of resolution, optical/digital zoom, ISO, storage media, and other basic terminology.

4. "An Introduction to Image Compression" - [www.debugmode.com/imagecmp/](http://www.debugmode.com/imagecmp/)

5. "Resolution, File Size & Image Quality" - [www.haroldphoto.com/res.htm](http://www.haroldphoto.com/res.htm)

6. "Frequently Asked Questions on Digital Photography" - [www.photodrive.ru/faq6\\_e.htm](http://www.photodrive.ru/faq6_e.htm)

7. Maresware Forensic and Analysis Software - a list of commercial forensic software, including cyclic redundancy check. [www.dmares.com/maresware/DOCS/press\\_release.htm](http://www.dmares.com/maresware/DOCS/press_release.htm)

Draft June 27, 2002

DRAFT, DO NOT CITE OR QUOTE

8. "Error Detection and Correction" - description of Cyclic Redundancy Check -  
[www.linktionary.com/e/error.html](http://www.linktionary.com/e/error.html)

9. "Understanding Cyclic Redundancy Check -  
<http://4d.com/acidoc/CMU/CMU79909.htm>  
a description of how the CRC error detection system algorithm works

10. photoalley.com - on-line digital camera "store"

Attachment #1

**DIGITAL IMAGE CHAIN OF CUSTODY FOR "ARCHIVAL" ORIGINAL IMAGES (Sample Form)**

**IMAGE RECORD**

|                          |  |
|--------------------------|--|
| PHOTOGRAPHER(signature)  | INCIDENT NUMBER/Facility EPA Identification Number                     |
| DATE PHOTOS TAKEN        | IMAGE NUMBERS FOR THIS INCIDENT  |
| LOCATION(S) PHOTOS TAKEN | THESE IMAGES HAVE NOT BEEN CHANGED, ALTERED OR MANIPULATED IN ANY WAY. |
| COMMENTS                 | SIGNATURE OF PHOTOGRAPHER  |

**ACCESS RECORD**

| Name | Organization/Division | Phone Number |  |
|------|-----------------------|--------------|--|
|      |                       |              |  |
|      |                       |              |  |
|      |                       |              |  |
|      |                       |              |  |
|      |                       |              |  |
|      |                       |              |  |
|      |                       |              |  |
|      |                       |              |  |
|      |                       |              |  |

Attachment #2

**Example Facility Photograph Log**

1. Photographer \_\_\_\_\_
2. Facility Name \_\_\_\_\_
3. Facility EPA Identification Number (if available) \_\_\_\_\_
4. Type of Camera Used \_\_\_\_\_
5. Digital recording media \_\_\_\_\_
6. All digital photos were copied by \_\_\_\_\_
7. All Digital Photos were copied to \_\_\_\_\_
8. Original Copy is stored in: \_\_\_\_\_  
(ie. Laptop, PC hard drive (or zip disk).

At the end of each day, digital photos were downloaded to a zip drive disk, then transferred to the hard-drive, all by ..... Subsequently they were transferred by ..... to a CD-R. No changes were made in the original image files prior to storage on the CD-R.)

## 9. Log

| Date    | Time (camera recorded time) | Photo Filename (MVC-xxx.jpg) | Modifications made to digital image (if any) | Description of Image   |
|---------|-----------------------------|------------------------------|--|--|
| 5/21/01 | 0909                        | 001                          |  | Facility: <90 day storage area at Power House #1   |
|         | 0915                        | 002                          |  | Facility: Satellite accumulation area, within tank truck unloading pad containmen northwest corner of #1 steam plant |
|         | 0915                        | 003                          |  | Facility: Satellite accumulation area, within tank truck unloading pad containmen northwest corner of #1 steam plant |
|         | 0921                        | 004                          |  | Facility: Satellite accumulation area, within Tank 121 containment dike  |
|         | 0929                        | 005                          |  | Facility: Satellite accumulation area, fly ash drumming area on south side of stea                                   |
|         | 0932                        | 006                          |  | Facility: Satellite accumulation area, residue receiving manifold area on first floo plant                           |
|         | 0936                        | 007                          |  | Facility: Satellite accumulation area, residue receiving manifold area on first floo plant                           |
|         | 0942                        | 008                          |  | Facility: Satellite accumulation area, adjacent to boiler on second floor of steam                                   |
|         | 0945                        | 009                          |  | Facility: Satellite accumulation area, adjacent to boiler on second floor of Steam                                   |
|         | 1019                        | 010                          |  | Facility: Satellite accumulation area, Bldg. 3, Laboratory, room 1 (hood area)                                       |
|         | 1023                        | 011                          |  | Facility: Satellite accumulation area, Bldg. 3, Laboratory, room A (semi-volatile h                                  |
|         | 1027                        | 012                          |  | Facility: Satellite accumulation area, Bldg. 3, Laboratory, room A (volatile hood a                                  |