



## TECHNICAL INFORMATION BULLETIN

# Baggage X-ray Scanning Effects on Film

This document was updated November 08, 2001

### New Baggage Scanning Equipment Can Jeopardize Your Film

Because your pictures are important to you, this information is presented as an alert to travelers carrying unprocessed film. Over the past two years new FAA-certified explosive detection systems have been used in more than 50 U.S. airports to scan (x-ray) checked baggage. This stronger scanning equipment is also being used in many non-US airports. The new equipment may fog any unprocessed film that passes through the scanner.

**Note:** X rays from airport scanners don't affect digital camera images or film that has already been processed, i.e. film from which you have received prints, slides, KODAK PHOTO CD Discs, or KODAK PICTURE CD Discs.

This document does not cover how mail sanitization impacts film. If you would like information on that topic, click on this Kodak Web site: [mail sanitization](#).

### Suggestions for Avoiding Fogged Film

X-ray equipment used to inspect **carry-on** baggage uses a very low level of x-radiation that will not cause noticeable damage to your film. However, baggage that is **checked** (loaded on the planes as cargo) sometimes goes through equipment with higher energy X rays. Therefore, take these precautions when traveling with unprocessed film:

- Don't place single-use cameras or unprocessed film in any luggage or baggage that will be checked. This includes cameras that still have film in them.
- If an attendant or security personnel informs you that your carry-on baggage will have to be checked, ask if you can remove your unprocessed film.
- Put your film in a clear or mesh bag so it can be seen easily.
- Have your exposed film processed locally before passing through airport security on your return trip.
- If you're going to be traveling through multiple X-ray examinations (more than 5 times), request a hand search of your carry-on baggage. FAA regulations in the U.S. allow for a hand search of photographic film and equipment if requested. (See **Note** below for further FAA information.) However, non-US airports may not honor this request.
- If you're asked to step aside for a more thorough search, you will probably be advised that film could be harmed and you will be allowed to take it out of your luggage.
- Lead-lined bags, available from photo retailers, will weaken the x-radiation on film and reduce potential harm. However, the effectiveness of any particular lead bag depends on the intensity and electric potential of the X-ray generator, the lead's thickness, and the film speed. If you use a lead bag, check with the manufacturer for the effectiveness of their products with airport X-ray devices. The inspection process may be triggered by a lead bag on the scanner screen. In a typical airport surveillance situation, the baggage may be pulled aside for additional inspection.
- Consider shipping unexposed or exposed film through an expedited carrier, but first check with the carrier to determine what package examination procedures they are using.
- Be polite, helpful and patient. Please remember that security personnel are trying to protect the traveling public.

**Note:** The FAA provides air travelers in the United States the right to request a non-X-ray inspection of photosensitive products (FAA Reg. 108.17-AIRPLANE OPERATOR SECURITY). The complete regulation is very informative, but

section Part 108.17e is most important to travelers carrying film. Click here to go to the FAA Web site: [FAA](#), or to view that regulation: [FAA Reg. 108](#). Remember that this only applies to air travelers in the United States.

## **Corrections Can't Be Made at the Processing Lab**

The processing lab cannot separate X-ray fog from camera exposure, and because this type of X-ray fog often appears in patterns, it is impossible to correct this damage in the duplicating or printing process. Therefore, make every effort to keep your film away from baggage scanning devices.

## **The X-ray Scanning Process**

There are two types of higher-dose scanners. The first type is similar to a hospital CAT scan and uses a low dose scan followed by a higher-dose scan on specific areas of the baggage. The other type gives a high-dose, full bag scan on the first pass, damaging the film immediately.

Tests indicate that there is significant fogging of unprocessed film when the film sustains a direct hit by the scanner's high-intensity X-ray beam. The faster the film, the more dense the fog stripe. Because the type of equipment at each airport is unknown to the traveler, avoid putting film in your checked baggage.

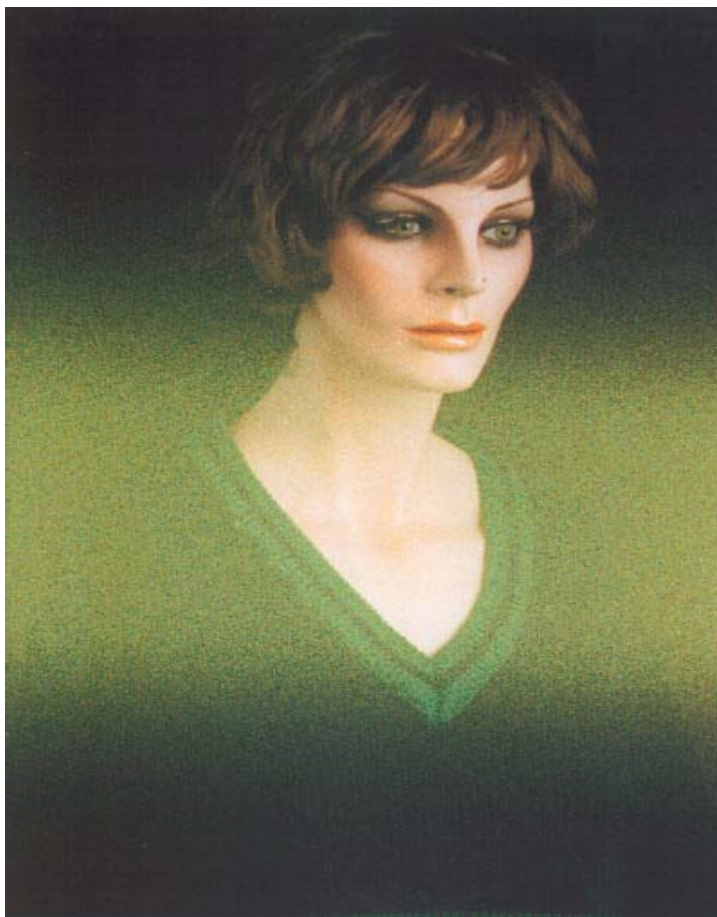
## **X-ray Fog Appearance**

Fog caused by the new baggage scanners is usually more pronounced than fog caused by other means. Fog from the CAT scan type of scanner typically appears as soft-edged bands 1/4 to 3/8 inch (1 to 1.5 cm) wide. Depending on the orientation of the film to the X-ray beam, the banding may be linear or wavy and can run lengthwise or horizontally on the film. It can also undulate, depending on the combination of the angle of exposure and the multiple laps of film on the roll. (See images below.) However, the fog will usually lack the more subtle patterns produced by traditional types of X-ray equipment. The orientation of the fog stripe depends on the orientation of the film relative to the X-ray beam. Additionally, whether this stripe is seen in the photographic print may depend on scene content. Busy scenes with flowers, foliage, etc. may obscure or lessen the perception of X-ray effects.

- **On black-and-white negative films** - Dark areas in patterns as described above.
- **On color-negative films** - Dark areas with neutral or brown patterns.
- **On color-reversal films (slides)** - Minus-density area (light patches) with patterns as described above.

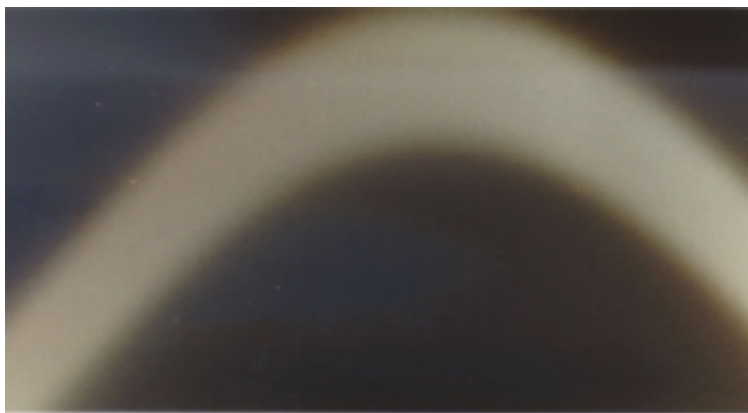
Fog from the second type of high-dose scanners affects the whole negative, causing it to appear over-exposed and grainy.

Effects of the CAT scan type scanner on 800 speed film as seen in a print:

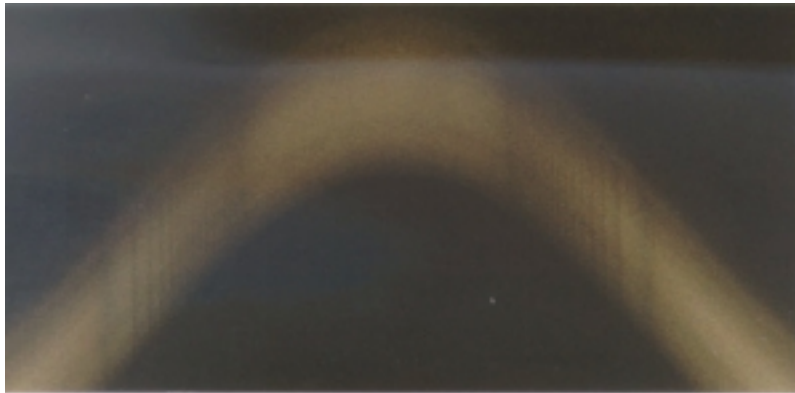


Samples of unexposed KODAK PROFESSIONAL PORTRA 400VC Film (color-negative) that have been scanned are shown below and illustrate some of the appearance and severity of the exposures.

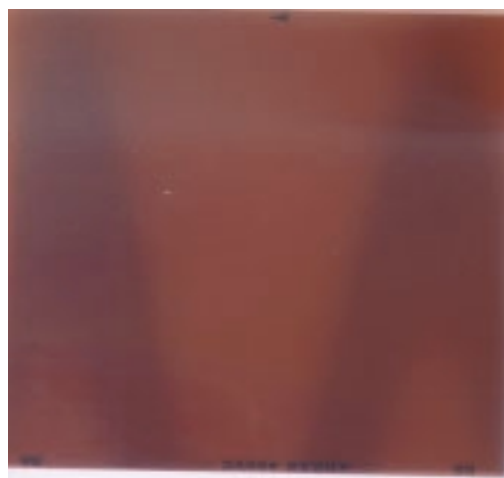
Print from color-negative film:



Print from color-negative film:



Color-negative film:



For more information on the impact of scanning equipment, click on this link to the International Imaging Industry Association's (I3A) Web site: [I3A](#). This association was formerly known as the Photo Industry Marketing Association.

## Other Conditions That Resemble X-ray Fog

Certain keeping conditions can produce effects that are confused with X-ray fog. However, you can usually distinguish the **more common types** of X-ray fog by its distinct patterns and increased granularity.

On 35 mm film, reverse-wind streaks are often mistaken for X-ray fog. However, these streaks are more evenly spaced and prominent, and tend to bow outward from the film perforations.

As noted earlier, exposure to the new airport security equipment produces a pronounced band of plus density or minus density (light patches) that lacks the subtle patterns associated with X-ray exposure by other equipment. The fog pattern can resemble typical white-light fogging that occurs in a defined path, i.e. from pinhole light leaks in equipment. The most defining characteristics of fog caused by the new equipment are the well-bounded width of the bands and a fairly uniform density, with increase in granularity within the band. The banding will typically run continuously through the whole roll, or be broken by patterns from the laps of film in the roll.

## Motion Picture, Professional Films and Special Processes

Travelers probably shouldn't worry about possible X-ray damage when hand-carrying their film unless they are carrying:

- Highly sensitive X ray or scientific films
- Film with an ISO speed or Exposure Index (EI) of 400 or higher
- Film of any speed which is subjected to X-ray surveillance more than 5 times (the effect of X-ray screening is cumulative)
- Film that is or will be underexposed. (See **Note** below.)
- Film that you intend to "push process." (See **Note** below.)

In any of these cases, you should request visual inspection of your film and of any cameras containing film. Depending on the format(s) of film you have, carrying a light-tight changing bag may be advisable to help the inspection process. Remember that this is only a guaranteed option in U.S. air travel. Outside of the U.S. you will have to comply with the local standards and regulations.

**Note:** X-ray fog is most noticeable in the lower-exposure range of the film, and underexposed film has more of the image recorded in this range. Therefore, the effects of X-ray exposure may further reduce the quality of underexposed images.

**Note:** push-processing involves over-development of film to increase the effective speed and density of underexposed images on color-negative and black-and-white films. On color-reversal films (slides), push-processing on underexposed images will decrease the density range. X-ray exposure has the potential to impact the quality of images that will be processed in a push condition.

Samples of unexposed KODAK VISION 200T and 320T Color Negative Film scanned by the baggage scanner are shown below to illustrate the appearance and severity of X-ray fog.

**Fog Effects from the  
Invision CTX 5500 Airport Baggage Scanner  
(Kodak Vision 200T Film )**



**CTX 5500 Exposure  
Side on exposure, outside core**



**CTX 5500 Exposure  
45 Deg exposure, inside core**



Below are samples of KODAK VISION 320T Color Negative Film (16 mm motion-picture film) exposed to the INVISION CTX-5500 baggage scanner.



## **Advice to Professional Photographers and Cinematographers**

Kodak suggests taking the following precautions when transporting film via the airlines:

- Never ship unprocessed film as **checked** luggage with commercial airlines. Keep all unprocessed film as carry-on baggage.
- If you plan to hand-carry unprocessed film on an airplane at an international airport, contact the airport security office before your flight and ask if they will conduct a manual inspection.
- Bring a light-tight changing bag in case it is needed.
- Be cautious with film not purchased through Kodak or authorized Kodak dealers. Ask about the source of the film, and consider shooting a test before you use it.
- Lead-lined bags, available from photo retailers, will weaken the x-radiation on film and reduce potential harm. However, the effectiveness of any particular lead bag depends on the intensity and electric potential of the X-ray generator, the lead's thickness, and the film speed. If you use a lead bag, check with the manufacturer for the effectiveness of their products with airport X-ray devices. The inspection process may be triggered by a lead bag on the scanner screen. In a typical airport surveillance situation, the baggage may be pulled aside for additional inspection.

This Web page will be updated as more information becomes available.

*Kodak, Kodak Professional, Photo CD, Portra and Vision are trademarks of Eastman Kodak Company.*