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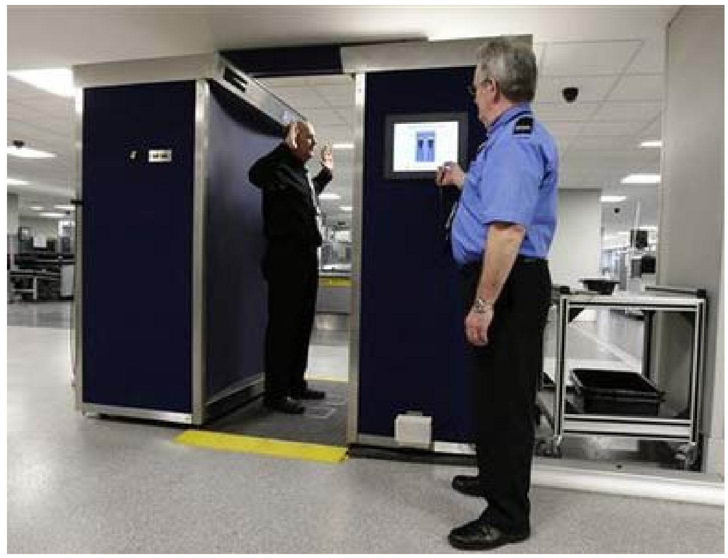
Airport Scanner Safety

Airport scanners



When it comes to airport scanner safety, there are four questions you should consider, including:

- What are airport scanners?
- Are there different kinds of scanners?
- How do scanners work?
- What are the risks of scanners?

After a bombing attempt that occurred on Christmas Day in 2009, airports around the United States and the world began installing different types of scanners to scan people passing through airport security.

Types of airport scanners

The two types of scanners typically used in airports include millimeter radio-wave and backscatter scanners.

Millimeter radio-wave scanners use millimeter radio waves similar to those generated by cellphones. This type of scanner does not use x-rays.

The second type, backscatter scanner, uses low intensity x-rays.

How do airport scanners work?

Millimeter radio-wave scanners?

A millimeter radio-wave scanner stands out at airports because of its design that includes a booth where people stand with their arms raised. Inside the booth, the person is scanned with millimeter radio waves.

Antennas then collect the reflected waves to generate images.

Because this type of scanner does not use x-rays, but instead uses millimeter radio waves similar to radio waves produced in a cell phone, there should not be concern about the effects of radiation from this scanner.

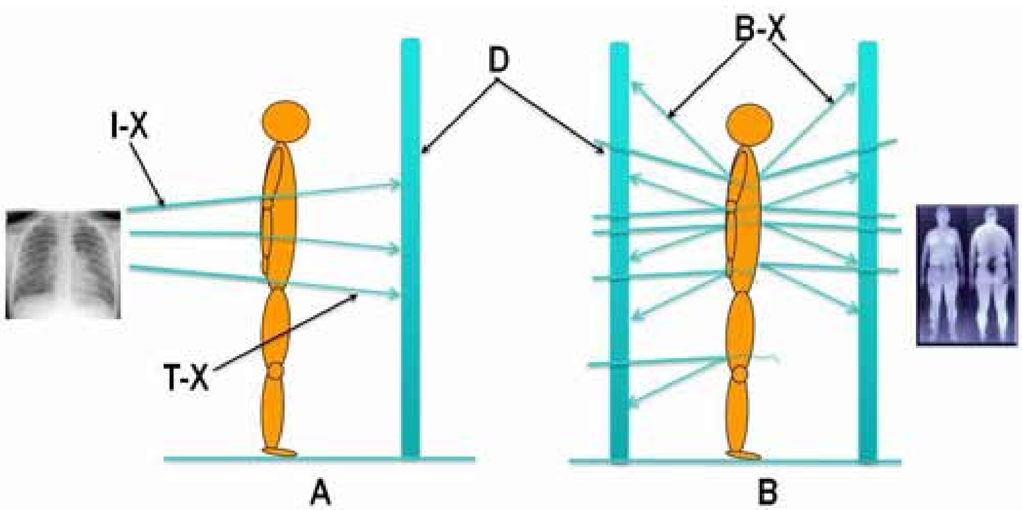
backscatter scanners

Backscatter scanners also stand out in airports because of their design, which includes two large boxes for individuals to stand between with their arms raised. Inside the backscatter scanner is an x-ray source that produces low intensity x-rays. The scanner uses a low intensity narrow x-ray beam to scan people at high speed and in a raster pattern. The scan typically takes between two to five seconds.

The large detectors capture the backscatter x-rays to create images within a few seconds. This method is useful for detecting objects hidden under clothes or taped to the skin surface.

Transmission x-rays vs. backscatter x-rays

The following illustration shows the difference between a transmission x-ray versus a backscatter x-ray.



Backscatter scanner

A = Transmission x-ray as in medical imaging	I-X = Incident x-rays
B = Backscatter x-ray as in airport full-body scanners	T-X = Transmitted x-rays
D = Detectors	B-X = Backscatter x-rays

In a transmission x-ray, which is used in medical imaging, x-rays from an x-ray source pass through the patient and the detector collects the transmitted x-rays on the opposite side to create an image such as a typical chest x-ray. For more detailed information see the Chest x-ray page.

In a backscatter x-ray system, the x-ray intensity is very low and not strong enough to penetrate or transmit through the body, even though a few of the x-rays may be absorbed by the body. However, the majority of the x-rays bounces off or scatters onto the surface. This is the reason for the two large detectors that collect the backscatter or scatter x-rays to create an image.

Radiation exposure from backscatter systems

Many people express concern about the long-term effects of radiation from x-rays and risks from backscatter scans. Findings show that radiation exposure for an individual scan is relatively low. A typical dose is between 0.00005 to 0.0001 millisievert (mSv) or 0.005 to 0.01 millirem. This is in comparison to a typical chest x-ray, which is between 0.001 to 0.01 mSv or one to 10 millirem.

Therefore, a person would have to receive 1,000 to 2,000 backscatter scans to get a dose equivalent to a single chest x-ray. This explains the reason why the radiation from a backscatter scan is considered relatively low.

Backscatter scanner compared to natural background radiation

According to the National Council on Radiation Protection & Measurements (NCRP), everyone is exposed to background radiation. In the United States, individuals receive approximately 3 mSv per year or 0.01 mSv per day (1 millirem per day).

When compared to this value, 100 to 200 backscatter scans is equal to one day of natural background radiation. In addition, the radiation dose from a backscatter scan is equivalent to approximately:

- 10 to 20 minutes of natural background radiation
- Two to four minutes of radiation received from air travel

The following tables depict radiation dose from a backscatter system and the number of backscatter scans equivalent to doses from various sources of radiation.

Radiation doses from backscatter systems and number of backscatter scans equivalent to doses from various sources of radiation

Source	Dose or dose equivalent
Backscatter scan (μSv/scan)	0.05-0.1
No of scans equivalent to typical chest x ray dose (100 μSv)	1000-2000
No of scans equivalent to annual dose limit for public from a single source (~250 μSv)	2500-5000
No of scans equivalent to one day of natural background radiation (10 μSv/day)*	100-200
No of scans equivalent to NID† dose	100-200
No of scans equivalent to average dose from air travel (4 μSv/h)	40-80

*Annual natural background radiation ~3100 μSv or ~2400 μSv

†NID=negligible individual dose (~10 μSv)

Table 1. Radiation doses from backscatter systems and number of backscatter scans equivalent to doses from various sources of radiation

Radiation Dose From Backscatter Systems (μSv/scan)*	Number of Scans Equivalent to Doses From Other Sources				
	Chest X-Ray†	Annual Dose Limit for Public‡	1 Day of Natural Background Radiation (~10 μSv/d)§	Negligible Individual Dose‖	Average Dose From Air Travel¶
0.1	1000	2500	100	100	40
0.05	2000	5000	200	200	80

Note: A dose of 0.1 μSv from backscatter scan is equivalent to about 10 minutes of background radiation and about 2 minutes of radiation received from average air travel. A dose of 0.05 μSv from backscatter scan is equivalent to about 20 minutes of background radiation and about 4 minutes of radiation received from average air travel.

*10 μSv = 1 mrem.

†Typical chest x-ray dose is about 100 μSv.

‡Annual permissible dose to the general public from a single source is about 250 μSv.

§Annual natural background radiation dose is about 3100 μSv or about 2400 μSv.

‖Negligible individual dose is about 10 μSv.

¶Average radiation exposure during air travel is about 4 μSv/h.

1,000 microsieverts (μSv) = 1mSv

ACR Statement on Airport Full-body Scanners and Radiation

January 2010 — Amid concerns regarding terrorists targeting airliners using weapons less detectable by traditional means, the Transportation Security Administration (TSA) is ramping up deployment of whole body scanners at security checkpoints in U.S. airports. These systems produce anatomically accurate images of the body and can detect objects and substances concealed by clothing.

To date, TSA has deployed two types of scanning systems:

Millimeter wave technology uses low-level radio waves in the millimeter wave spectrum. Two rotating antennae cover the passenger from head to toe with low-level RF energy.

Backscatter technology uses extremely weak X-rays delivering less than 10 microRem of radiation per scan — the radiation equivalent one receives inside an aircraft flying for two minutes at 30,000 feet.

An airline passenger flying cross-country is exposed to more radiation from the flight than from screening by one of these devices. The National Council on Radiation Protection and Measurement (NCRP) has reported that a traveler would need to experience 100 backscatter scans per year to reach what they classify as a Negligible Individual Dose. The American College of Radiology (ACR) agrees with this conclusion. By these measurements, a traveler would require more than 1,000 such scans in a year to reach the effective dose equal to one standard chest x-ray.

The ACR is not aware of any evidence that either of the scanning technologies that the TSA is considering would present significant biological effects for passengers screened.

Those interested in learning more regarding radiation associated with imaging and radiation oncology procedures as well as radiation naturally occurring in the Earth's atmosphere should visit the Safety Page.

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