

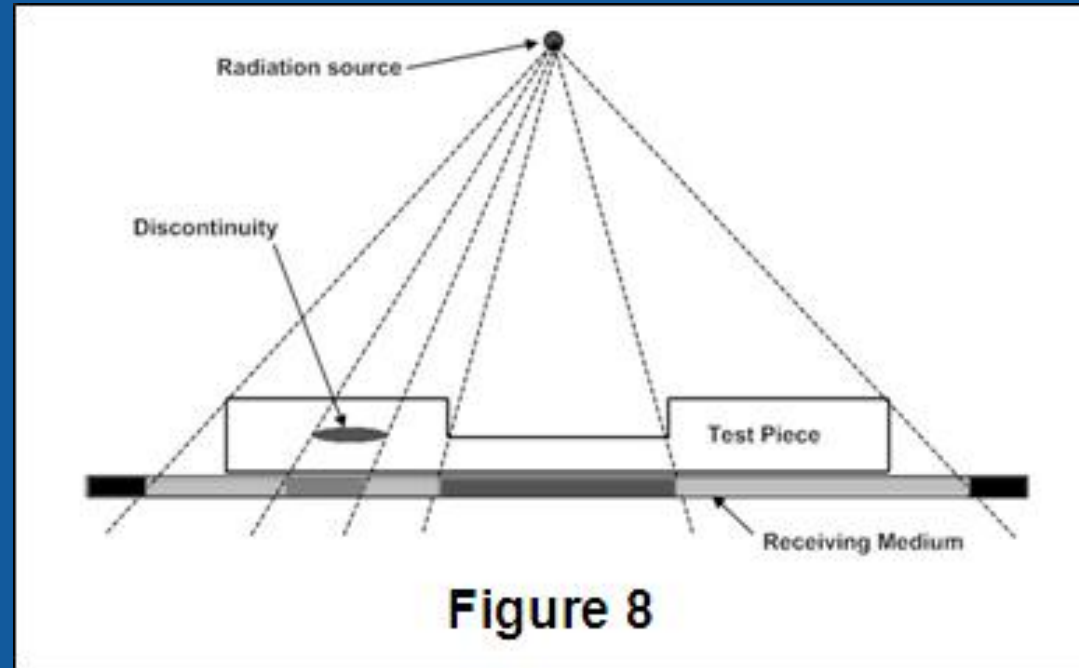
## **PART 4**

# **BACKGROUND ON NONDESTRUCTIVE TESTING AND NONDESTRUCTIVE EVALUATION**

## *Background on Nondestructive Testing and Nondestructive Evaluation*

Industrial radiography involves exposing a test object to penetrating radiation so that the radiation passes through the object being inspected and a recording medium placed against the opposite side of that object.

For thinner or less dense materials such as aluminum, electrically generated x-radiation (X-rays) are commonly used, and for thicker or denser materials, gamma radiation is generally used.



## *Background on Nondestructive Testing and Nondestructive Evaluation*

**Gamma radiation is given off by decaying radioactive materials, with the two most commonly used sources of gamma radiation being Iridium-192 (Ir-192) and Cobalt-60 (Co-60). IR-192 is generally used for steel up to 2-1/2 - 3 inches, depending on the Curie strength of the source, and Co-60 is usually used for thicker materials due to its greater penetrating ability.**

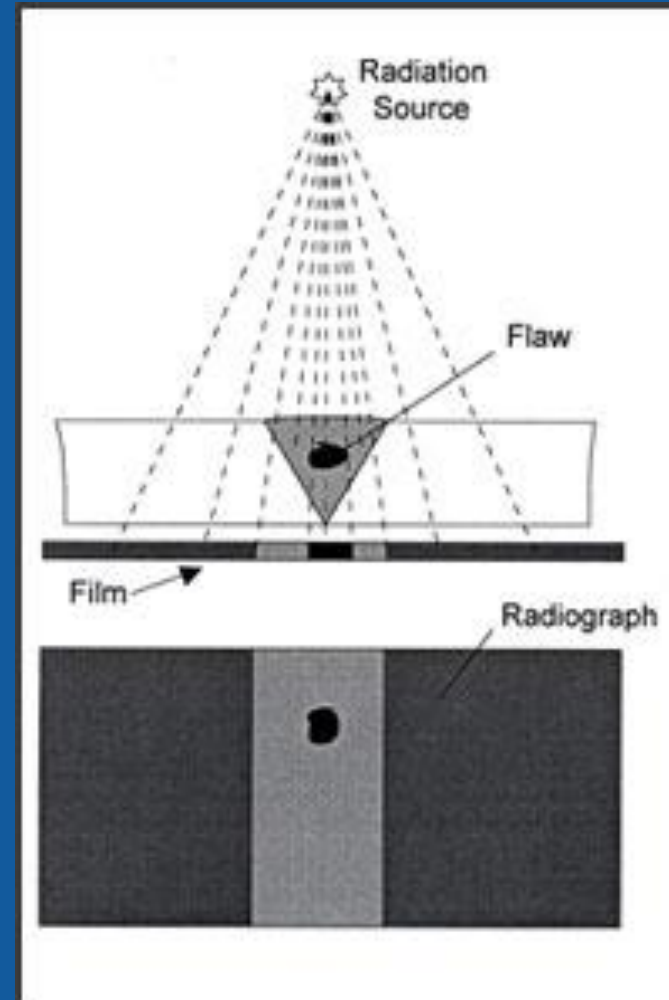
## *Background on Nondestructive Testing and Nondestructive Evaluation*

The recording media can be industrial x-ray film or one of several types of digital radiation detectors. With both, the radiation passing through the test object exposes the media, causing an end effect of having darker areas where more radiation has passed through the part and lighter areas where less radiation has penetrated. If there is a void or defect in the part, more radiation passes through, causing a darker image on the film or detector, as shown in Figure 8.



## Film Radiography

Film radiography uses a film made up of a thin transparent plastic coated with a fine layer of silver bromide on one or both sides of the plastic. When exposed to radiation these crystals undergo a reaction that allows them, when developed, to convert to black metallic silver. That silver is then "fixed" to the plastic during the developing process, and when dried, becomes a finished radiographic film.

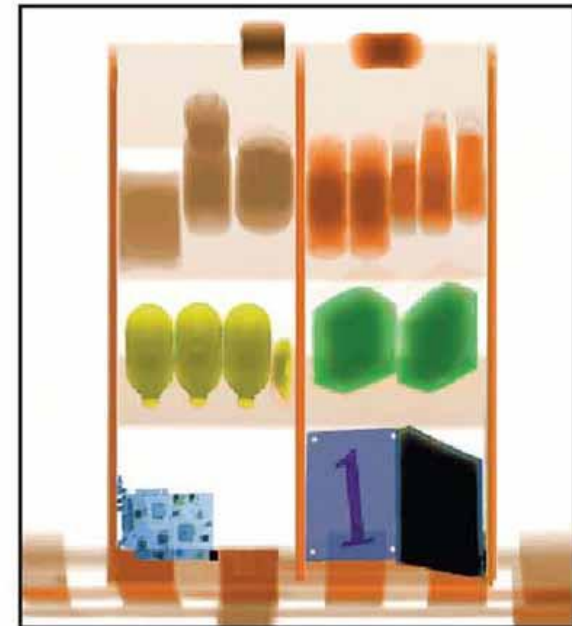


## *Background on Nondestructive Testing and Nondestructive Evaluation*

**To be a usable film, the area of interest (weld area, etc.) on the film must be within a certain density (darkness) range and must show enough contrast and sensitivity so that discontinuities of interest can be seen. These items are a function of the strength of the radiation, the distance of the source from the film and the thickness of the part being inspected. If any of these parameters are not met, another exposure ("shot") must be made for that area of the part.**

## Computed Radiography

Computed radiography (CR) is a transitional technology between film and direct digital radiography.





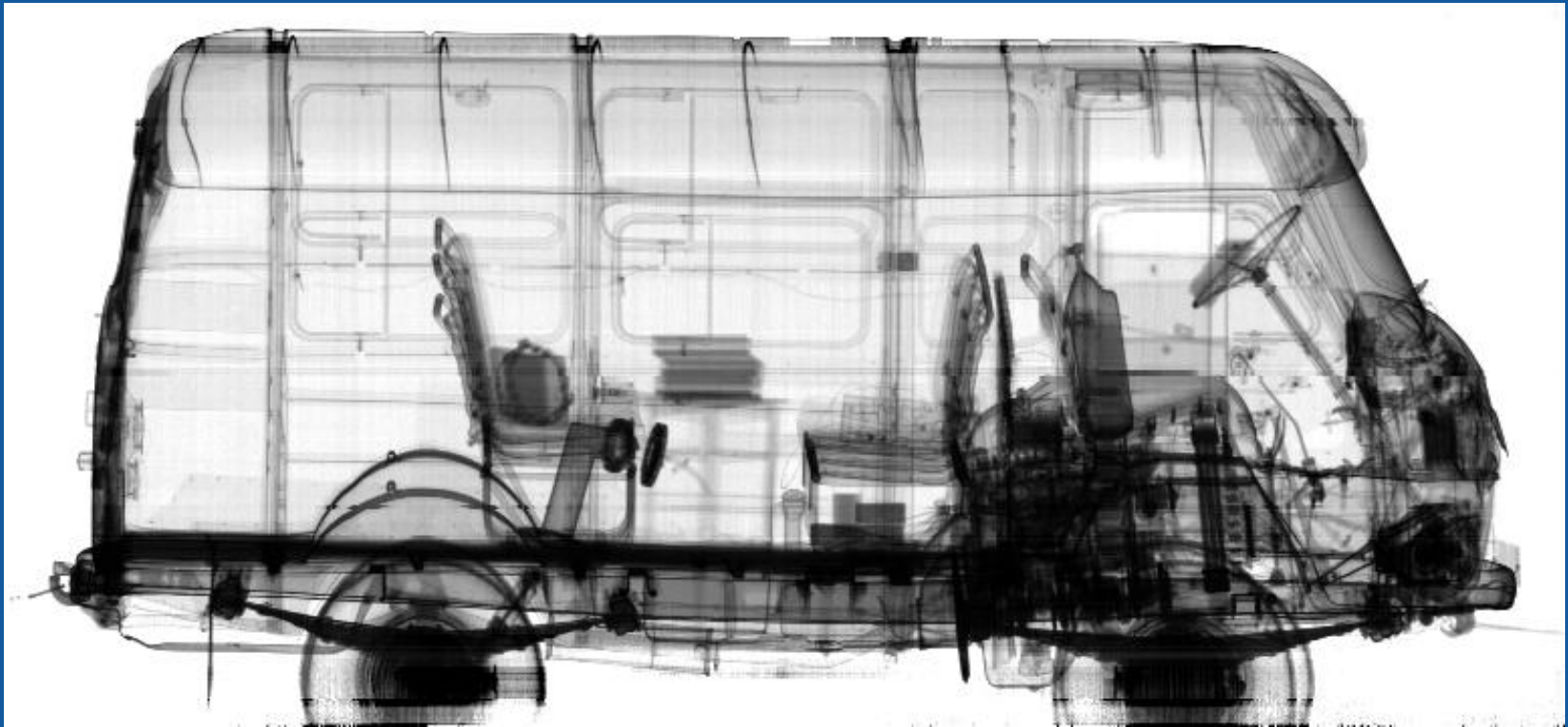
## *Background on Nondestructive Testing and Nondestructive Evaluation*

**This technique uses a reusable, flexible, photo-stimulated phosphor (PSP) plate which is loaded into a cassette and is exposed in a manner similar to traditional film radiography. The cassette is then placed in a laser reader where it is scanned and translated into a digital image, which take from one to five minutes. The image can then be uploaded to a computer or other electronic media for interpretation and storage.**



## Computed Tomography

Computed tomography (CT) uses a computer to reconstruct an image of a cross sectional plane of an object as opposed to a conventional radiograph, as shown in Figure



## *Background on Nondestructive Testing and Nondestructive Evaluation*

**The CT image is developed from multiple views taken at different viewing angles that are reconstructed using a computer. With traditional radiography, the position of internal discontinuities cannot be accurately determined without making exposures from several angles to locate the item by triangulation. With computed tomography, the computer triangulates using every point in the plane as viewed from many different directions.**

## **Digital Radiography**

**Digital radiography (DR) digitizes the radiation that passes through an object directly into an image that can be displayed on a computer monitor. The three principle technologies used in direct digital imaging are amorphous silicon, charge coupled devices (CCDs), and complementary metal oxide semiconductors (CMOSs). These images are available for viewing and analysis in seconds compared to the time needed to scan in computed radiography images. The increased processing speed is a result of the unique construction of the pixels; an arrangement that also allows a superior resolution than is found in computed radiography and most film applications.**