

# Basic Radiation Safety in Industrial Radiography- Information for Auxiliary Staff



Issued by:  
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Website: [www.aerb.gov.in](http://www.aerb.gov.in)

# BASIC RADIATION SAFETY IN INDUSTRIAL RADIOGRAPHY

## WHAT IS INDUSTRIAL RADIOGRAPHY?

“Industrial Radiography” is a non-destructive testing method to check for defects (e.g. Cracks, lack of penetration, porosity, inclusion, pinholes) in pipes to ensure quality /durability in the metal products. With Radiography, we get information inside the metal just by taking a picture of it without breaking it or spoiling it. The industrial radiography devices are commonly called as cameras. They are either Gamma cameras or X-ray cameras.

## HOW DO THE RADIOGRAPHY CAMERAS LOOK LIKE?



**ROLI-2**



**DELTA-880**

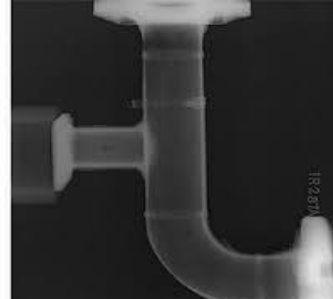
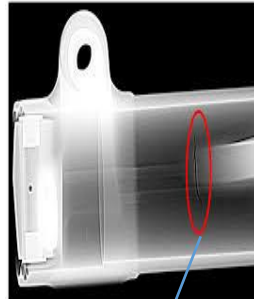
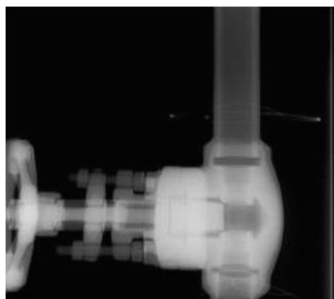


**TECHOPS**



**TYPICAL X-RAY CAMERA**

## THE RADIOGRAPHS (IMAGES TAKEN BY THESE CAMERAS)



*A crack in the pipe*

## WHERE IS RADIOGRAPHY CARRIED OUT?

Radiography is usually carried out in rooms with thick concrete walls. It could also be done in the open space such as during testing on gas /oil pipelines in the field is called “open field radiography”. Radiography is sometimes carried out in areas in shop-floor of a factory.



**Radiography in Rooms**



**Open- field Radiography**



**Radiography on the shop-floor**



## WHAT IS USED IN THE RADIOGRAPHY CAMERA?

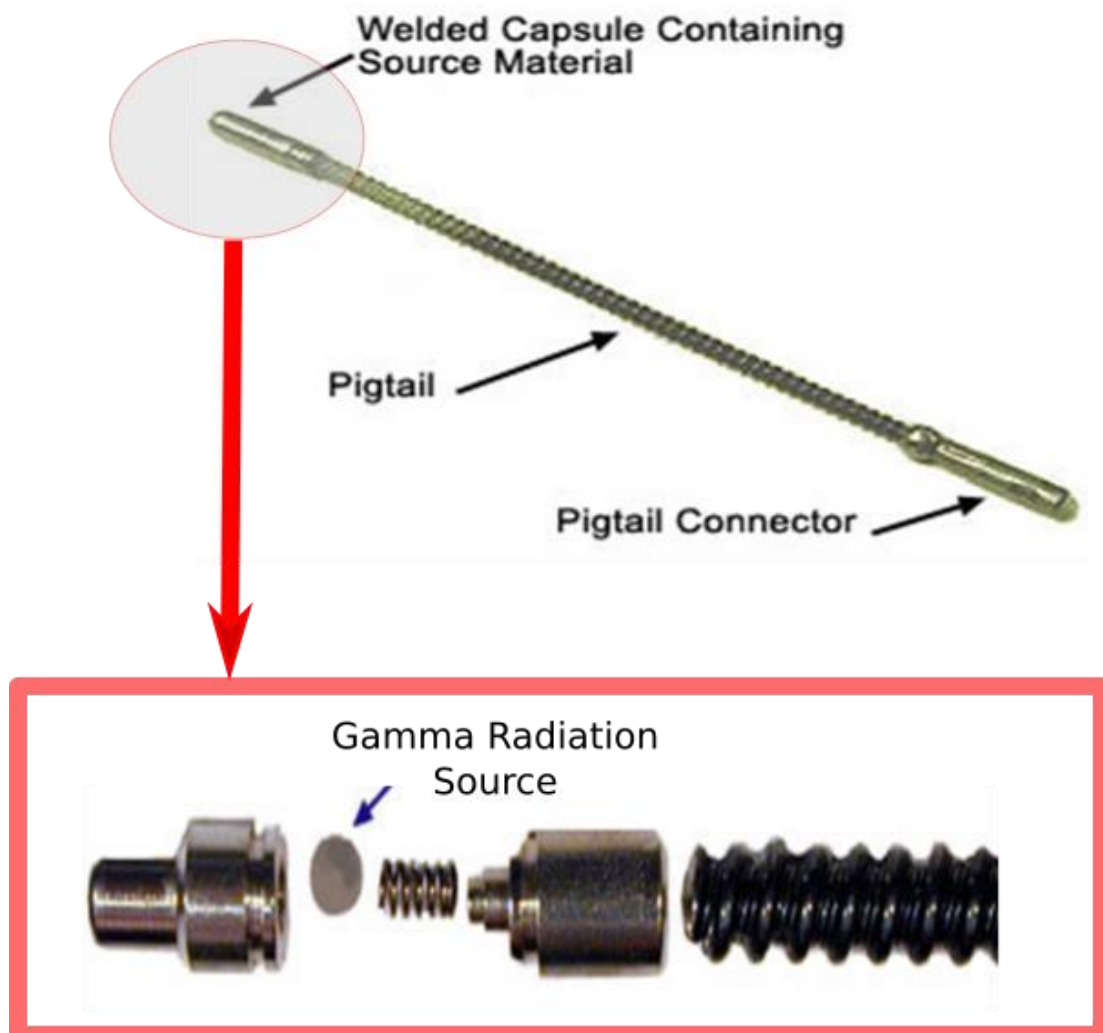
There are two different types of radiography cameras:

One uses the **Gamma radiation source** and another uses **X-ray radiation source**.

Inside the **gamma radiography camera**, there are small radioactive sources in the form of pellets (typically of the size 0.3 mm x 2.5 mm dia.) that gives radiation. This radiation goes through the metal parts and its image is taken. This is just like the X-ray of your chest by the Doctor. However, the difference is that the radiation coming from the radiography camera is highly penetrating as compared to the chest X-ray.

The gamma radiation source assembly is called as a PIGTAIL. Radiation is emitted continuously from the source even when the camera is not operating. The outer thick shielding of camera protects the people from this radiation when camera is not operating.

### PICTURE OF A PIGTAIL

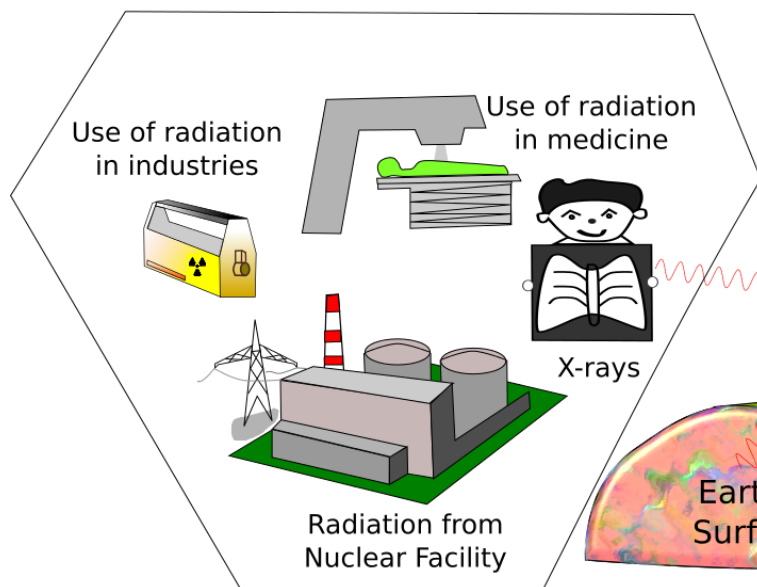


In **X-ray radiography camera**, the radiation is generated when machine is switched 'ON'. Once you switch 'OFF' the electricity, no radiation is generated from the X-ray machine.

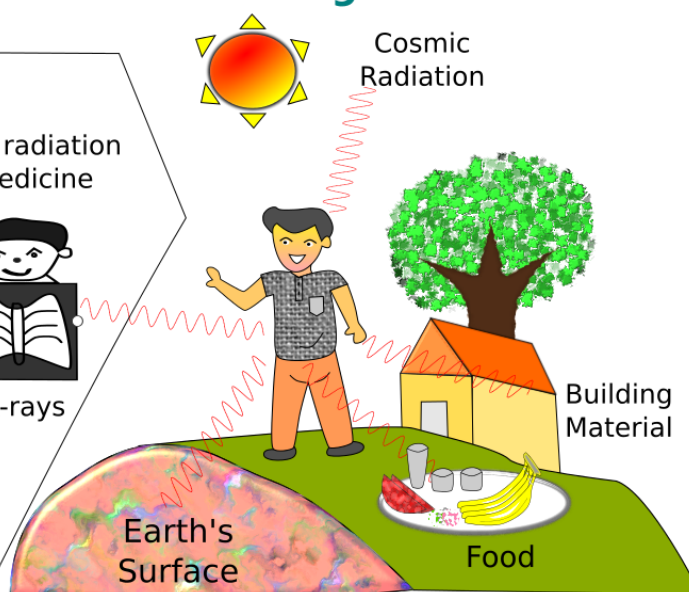
## WHAT IS RADIATION?

Radiation is natural and is everywhere. Radiation sources are in the Earth, Air, Sky and Water. The banana you eat also has small amounts of radiation source. Also the air we breathe and surrounding us, the water, tea, coffee you drink also have very small amounts of radiation sources. Apart from these natural radiation, there are artificial or manmade sources of radiation.

### Man-made Sources of Ionising Radiation



### Natural Sources of Ionising Radiation



## IS THE RADIATION FROM MOBILE PHONE SAME AS IONISING RADIATION?

No. The radiation from Gamma camera is called Ionising radiation and that from Mobile phone is non-ionising. More examples of ionising and non-ionising radiation is given below:

### SOURCES OF NON- IONIZING RADIATION



Mobile Towers



Microwave Oven



Mobile Phone

## SOURCES OF IONIZING RADIATION



X-ray clinic



Gamma Camera



X-ray Radiography

**In general, Ionizing radiation is more harmful than Non-ionizing radiation!**

### IS RADIATION HARMFUL?

Radiation can neither be seen, heard nor felt. It can be detected only through an instrument called radiation detector or survey meter. So it is very difficult to understand if you are entering an area where there is more radiation. Radiation exposure is potentially harmful if handled improperly. Therefore, Atomic Energy Regulatory Board (AERB) specifies limits to such exposure as per international norms.

Take for example, ELECTRICITY



Touching a battery of 1.5V cell is  
**NOT HARMFUL.....**

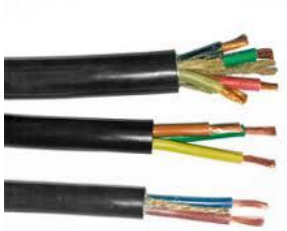


.....but touching a high tension  
wire results in **BURN INJURIES!!**

## HOW TO WORK SAFELY NEAR RADIOGRAPHY CAMERA

The Radiography camera is properly packed with thick metal with very minimum radiation leaks. Hence, it is safe to use, by properly following instructions.

Again taking the example of Electricity,



Touching an insulated wire is **NOT HARMFUL**, while touching a bare wire can cause injuries.



Similarly, using a **shielded camera with source properly inside** is not dangerous while **being near the source when the source is out**, is dangerous.

**Remember  
ALWAYS  
WORK  
SAFELY**

## DANGER WITH RADIOGRAPHY CAMERA

The Radiography camera has a small but powerful gamma radiation source in the pigtail. Normally the pigtail never falls from the camera because of its mechanical integrity with device. If by any chance, the pigtail falls due to untoward incident, run away from the place immediately and inform your seniors. They will use special tools to place the pigtail in a safe shielded container.

**DO NOT HOLD THE PIG TAIL WITH HANDS. ... IT WILL RESULT IN SEVERE BURNS SOMETIMES LEADING TO AMPUTATION OF FINGERS/HANDS!!!**



**A helper had held the pigtail and the result is severe burns**

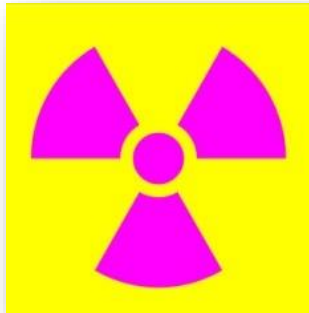
Always remember that radiation cannot be seen, heard or felt. So you will not come to know if you have been exposed, immediately. For such severe burns, there is no effective specific treatment available. So follow the instructions given below.

# RADIATION SAFETY INSTRUCTIONS

It is very important that you understand the following:

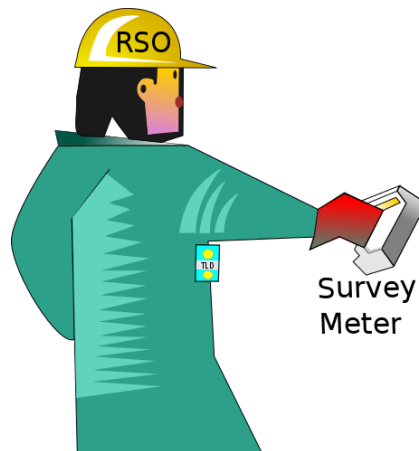
## 1. UNDERSTAND THE SYMBOLS

These symbols mean radiation sources:



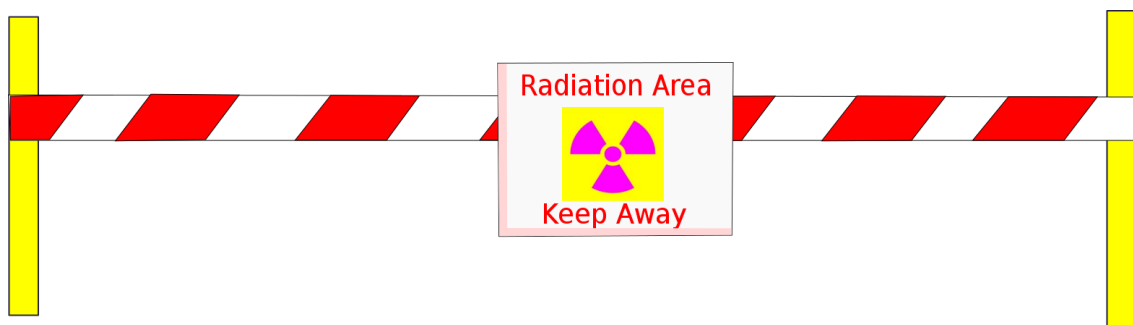
## 2. UNDERSTAND WHO TAKES CARE OF SAFETY

Every institution has a Radiation Safety Officer (RSO). Find out RSO of your institute. Always follow instructions of RSO.



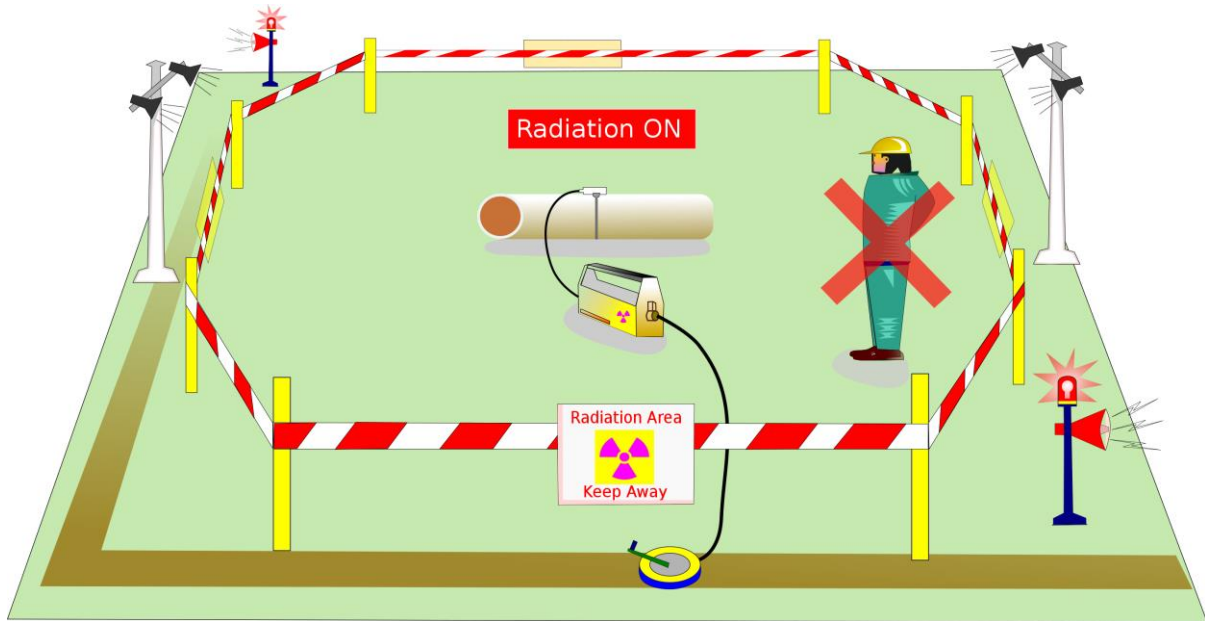
## 3. UNDERSTAND SAFETY WHEN GAMMA CAMERA IS USED ON THE SHOP FLOOR

3.1 Identify the cordon-off area.

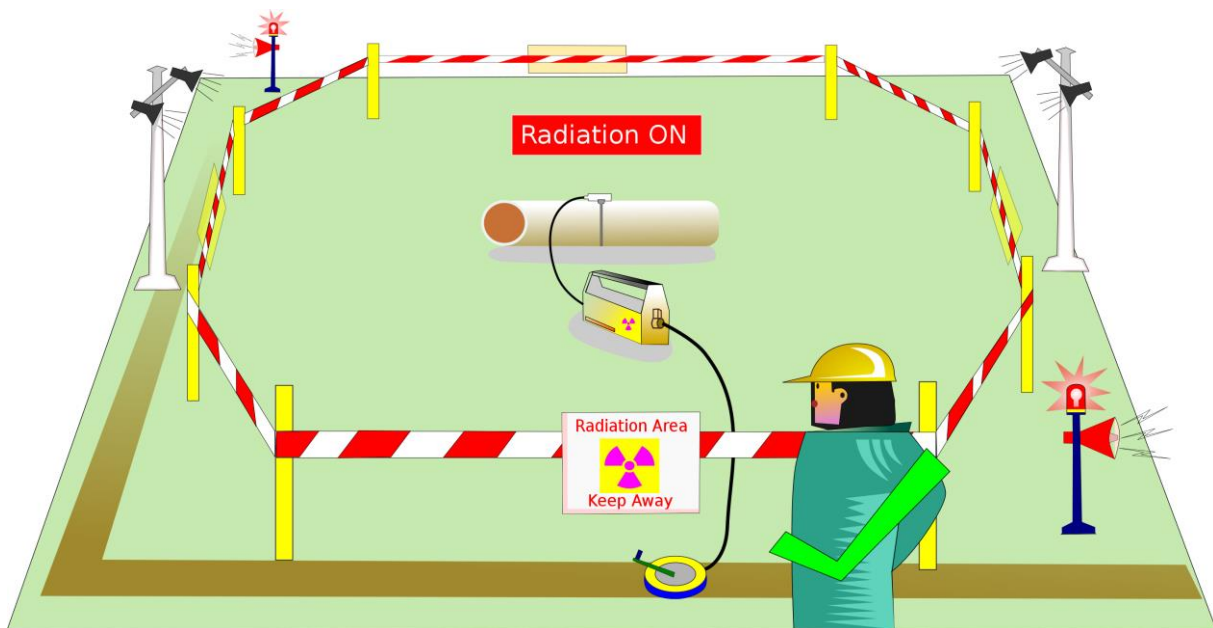




### 3.2 Never enter the cordon-off area and always stay outside

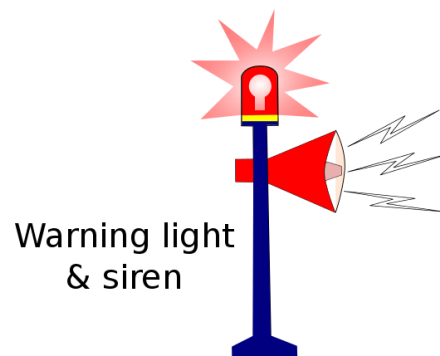


Do not enter radiation area

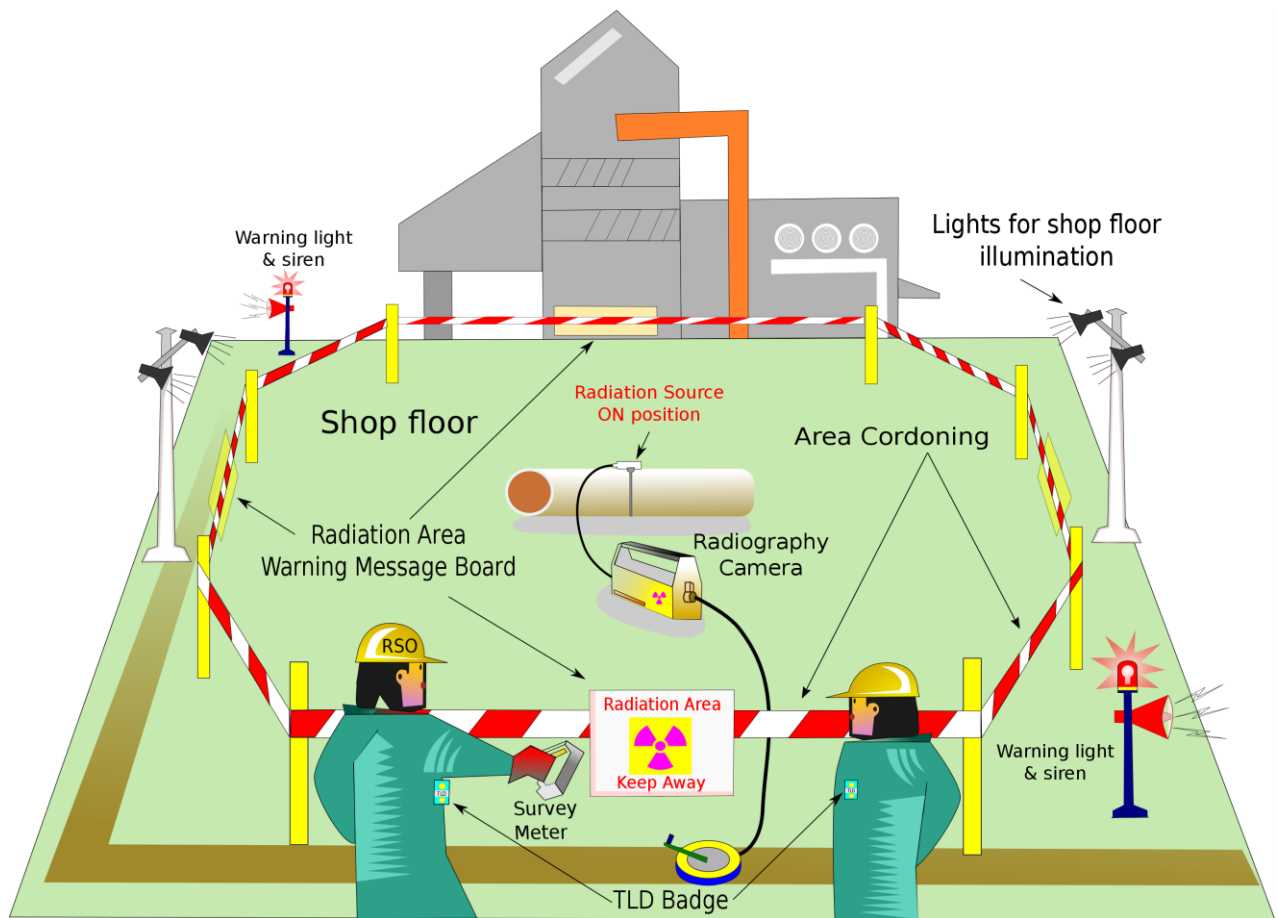


Stay outside radiation area

### 3.3 Always be alert to the warning lights/alarms when the source is out for taking images.



3.4. Do not come near the camera without instructions from certified radiographer / RSO.



Industrial Radiography on shop floor

#### 4. UNDERSTAND THE DO'S AND DON'T'S

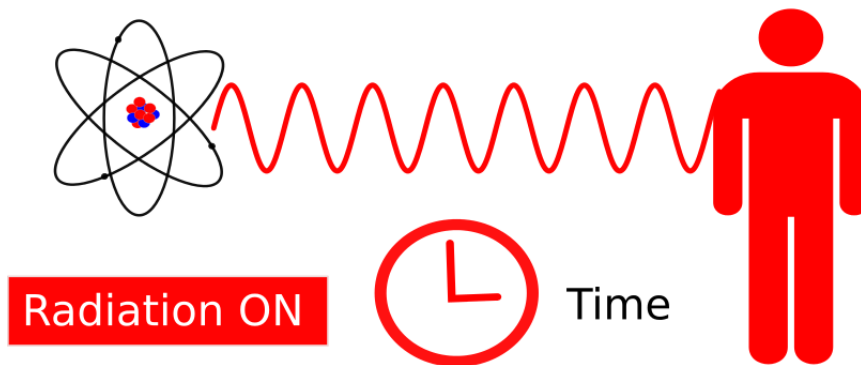
- Never operate the camera by yourself.
- Do not place the camera where it is likely to get stolen or lost.
- Do not handle the camera without instructions from certified radiographers.
- Report to RSO if the camera falls from the height /scaffolding, etc.
- If the pigtail comes out or falls from the camera, keep safe distance/run away from the pigtail and inform your RSO/Employer.

#### 5. UNDERSTAND SAFETY PRINCIPLES TO AVOID UNNECESSARY RADIATION

Time, Distance and Shielding (TDS) are the basic safety principles of Radiation Safety.

Time: Spend less time in the vicinity of camera when radiation is 'ON'

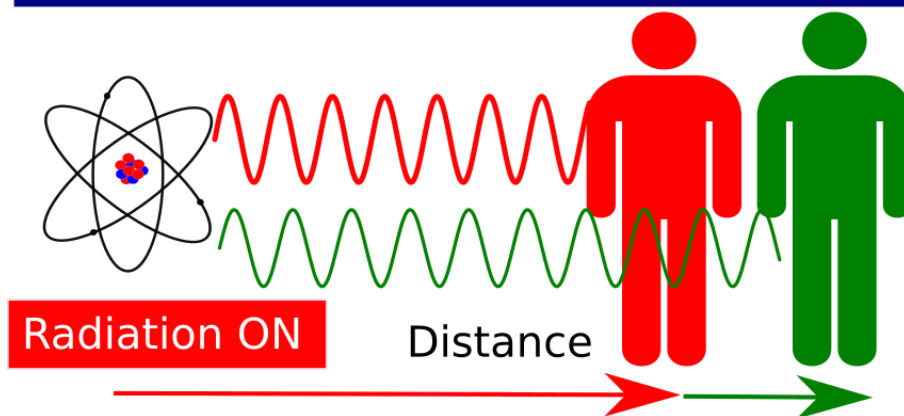
Less Time => Less Radiation Dose



If Radiation Level is 10 micro Sv/hr → Person remains in this field for 1 hr will receive dose of 10 micro Sv and in 30 min (i.e. in half time), dose received will be 5 micro Sv.

Distance: Be away from the camera when radiation is 'ON'

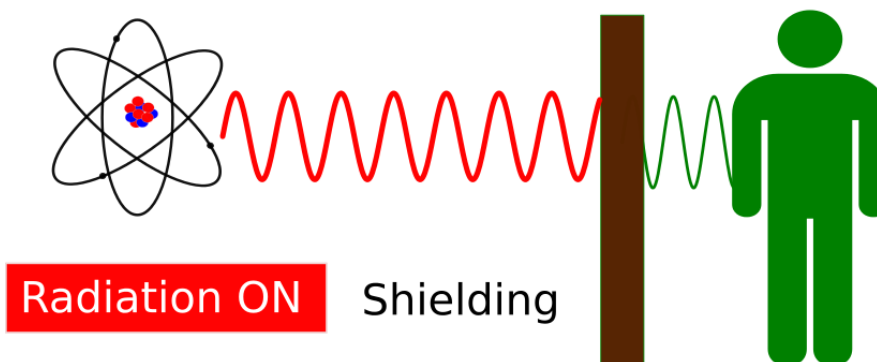
More Distance => Less Radiation Dose



If Radiation Level is 10 micro Sv/hr at 1 meter → at 2 meters, the radiation level will be 2.5 micro Sv/hr i.e. double the distance, the radiation level decreases by four times.

Shielding: Stand behind shielding (e.g. thick concrete wall) when radiation is 'ON'

Behind Shielding => Less Radiation Dose



Radiation Level decreases significantly behind dense and thick material (e.g. thick concrete wall).

## 6. UNDERSTAND DOSIMETERS

If required, the RSO might give you a DRD or TLD:

### 6.1 DRD (Direct Reading Dosimeter)



- 1) Do not drop the DRD.
- 2) Return DRD to RSO
- 3) Do not take the DRD home. Return it to the RSO after the day's work
- 4) Do not leave the DRD in the radiation area.

### 6.2 TLD: (Thermo luminescent Dosimeter)



- 1) Do not use somebody else's TLD
- 2) TLD should be placed at the Chest level
- 3) Do not open the TLD.
- 4) Do not take the TLD home. Return it to the RSO after the day's work
- 5) Do not leave the TLD in the radiation area.

## RADIATION SAFETY- Questions & Answers

Q1. Does TLD / DRD protect me from radiation?

Ans: No. TLD / DRD does not protect you from radiation. It only measures the radiation dose you might have received.

Q2. Does Radiation will cause cancer?

Ans: When we talk of cancer with respect to radiation, we talk only of the RISK involved. The risk of cancer on exposure to radiation, within limits, is very small and not distinguishable among other possible causes of cancer.

Q3. Now that I know about the equipment, Can I can operate it?

Ans: No. You cannot. The camera shall be operated only by certified radiographer.

Q4. Is the X-ray in an X-ray clinic and from Radiography camera same?

Ans: No. The X-ray strength in a clinic are much lower. The X-ray (or Gamma ray) from a Radiography camera are of much higher strength and can cause severe burns even with seconds of exposures in case of accidental situation.



## ABOUT AERB

Atomic Energy Regulatory Board (AERB) regulates the use of ionising radiation and radiation sources in India. You can approach AERB for any issues relating to safety of Radiation sources. For more information, visit AERB website [www.aerb.gov.in](http://www.aerb.gov.in)

The screenshot shows the AERB website interface. At the top, there is a navigation bar with links for Home, Careers@AERB, Tenders, FAQ, Feedback, Index A-Z, Site Help, and Accessibility Options. The mission statement is displayed: "The mission of the AERB is to ensure the use of ionising radiation and nuclear energy in India does not cause undue risk to the health of people and the environment." Below this, there are several service categories: e-Licensing of Radiation Applications (eLORA), Latest News, and National Conference on Regulatory Interface (NCRI-2017). The eLORA section includes links for "I am an Applicant", "I am a Radiological Medical Practitioner", "I am a Patient", "I am a Supplier/Manufacturer", "I am a Radiographer", "Report a Safety Concern", "What to do in an Emergency", "Contact for Nuclear or Radiological Emergency in Public Domain", and "Safety Research Programmes". The Latest News section lists recent events such as the International Co-operation Arrangement of Atomic Energy Regulatory Board (AERB) with the Office for Nuclear Regulation of Great Britain (ONR) and the inauguration of the Radiation Safety Awareness campaign.

This block shows a close-up of the "e-Licensing of Radiation Applications (eLORA)" menu. The menu items are: "I am an Applicant", "I am a Radiological Medical Practitioner", "I am a Patient", "I am a Supplier/Manufacturer", "I am a Radiographer", "Report a Safety Concern", "What to do in an Emergency", "Contact for Nuclear or Radiological Emergency in Public Domain", and "Safety Research Programmes". A callout box with a black border and white background points to the "Report a Safety Concern" option, containing the text: "You may report any Safety Concern on AERB website."

Refer AERB website [www.aerb.gov.in](http://www.aerb.gov.in) for safety posters to put up in your work place



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You can provide feedback to: [head.drac@aerb.gov.in](mailto:head.drac@aerb.gov.in)