Radiation Protection and Safety of Radiation Sources

An Overview of Industrial Radiography

Introduced by

Dr.medhat Shaban El Sayed Mansour

Lecture in Radiation Physics

Atomic Energy Authority

Radiation Protection Expert

level II RT

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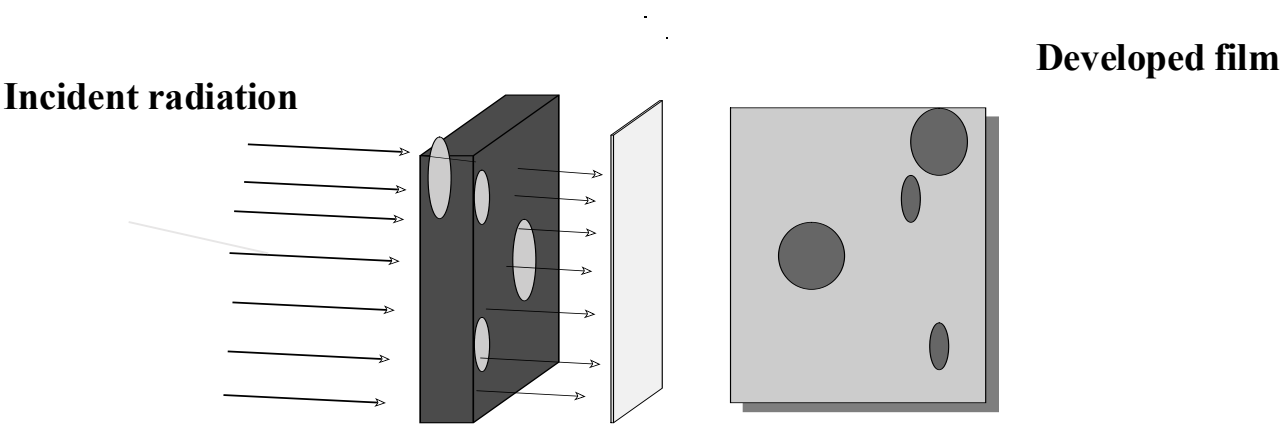
Industrial Radiography

- Key tool in non-destructive testing (NDT)
- Widespread application



Typical Uses

Non Destructive Inspection of :

Welds

Joints in pipework (pipe crawler equipment) & storage tanks

Castings (valves, engine components)

Tyre structure

Screening of baggage, parcels and food products

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Industrial Radiography : X-ray

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Baggage Inspection

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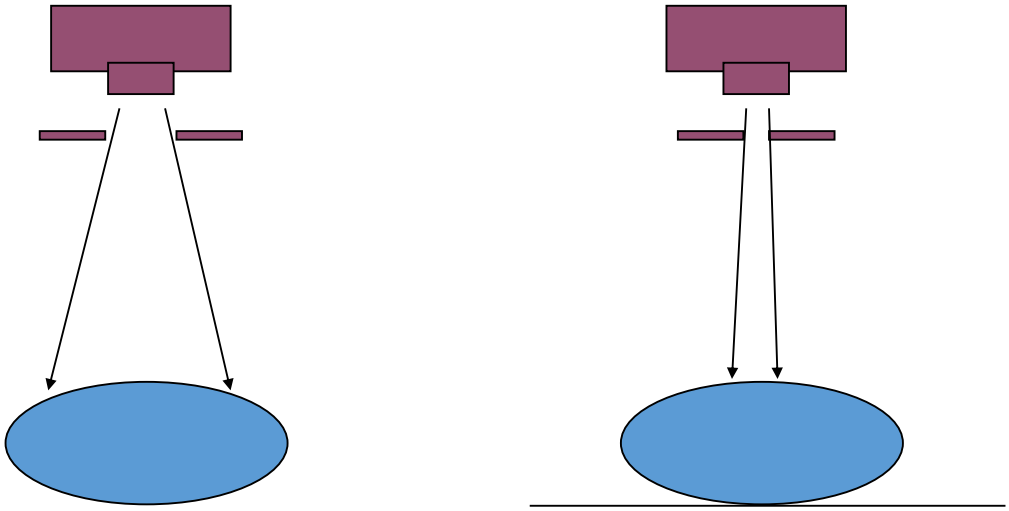
X-Ray Equipment

Conventional (150 kV to 400 kV)
Accelerators
high energy (up to 5 MeV)
static, mobile, portable
real-time X-radiography

Collimation



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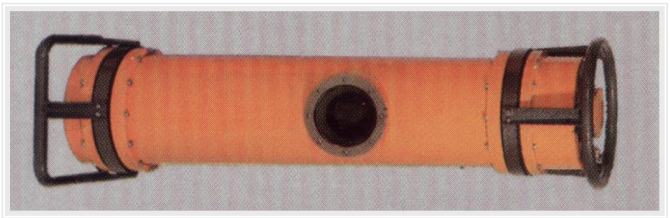
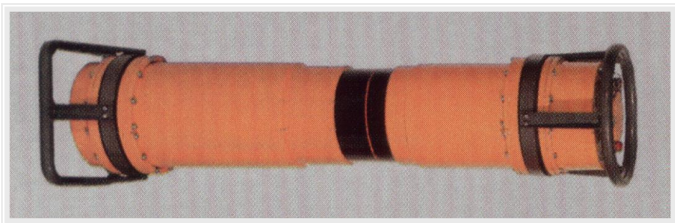
X-Ray Equipment

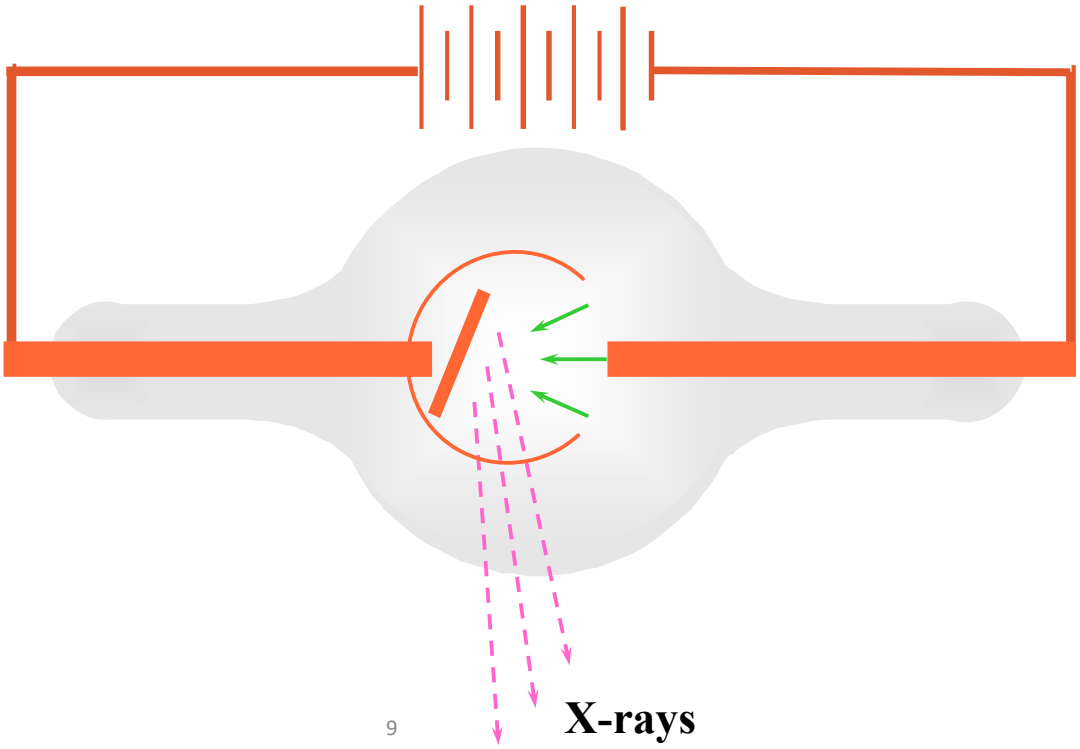


Directional



Panoramic

X-ray Tube



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Gamma Radiography

Typical gamma sources- Activities between 100 GBq to 1 TBq

Radionuclide	Gamma energy (MeV)	Optimum steel thickness (mm)
Cobalt-60	1.17 & 1.33	50-150
Iridium-192	0.2-1.4	10-70
Caesium-137	0.662	50-100
Thulium-170	0.08	2.5-12.5

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Gamma Source Containers

Classified according to mobility:

Class P (portable, carried)

Class M (Mobile, e.g. by trolley)

Class F (Fixed, installed in an enclosure)

ISO 3999 specifies dose rate limits for Class P,M and F containers

Aims and Objectives

To provide an overview of industrial radiography

Applications

Radiations used

Equipment used

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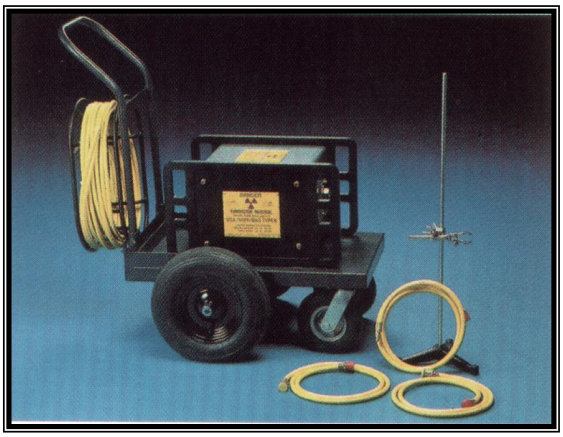
Maximum External dose rate from containers

Container	Max Dose rate (μSv/h)		
Surface	50mm	1 m	
Class P	2000	500	20
Class M	2000	1000	50
Class F	2000	1000	100

Gamma Exposure Devices

Mobile



Portable

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Gamma Exposure Devices

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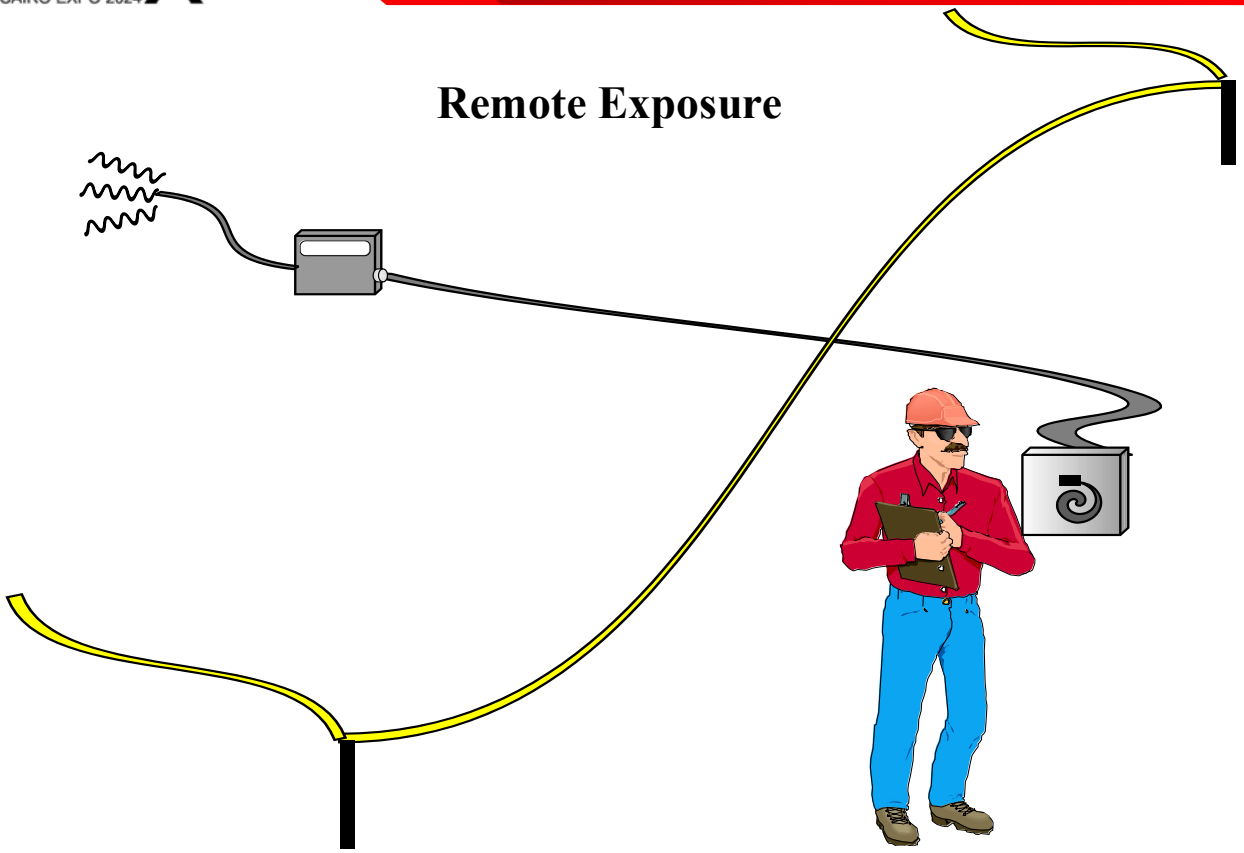
Remote Exposure



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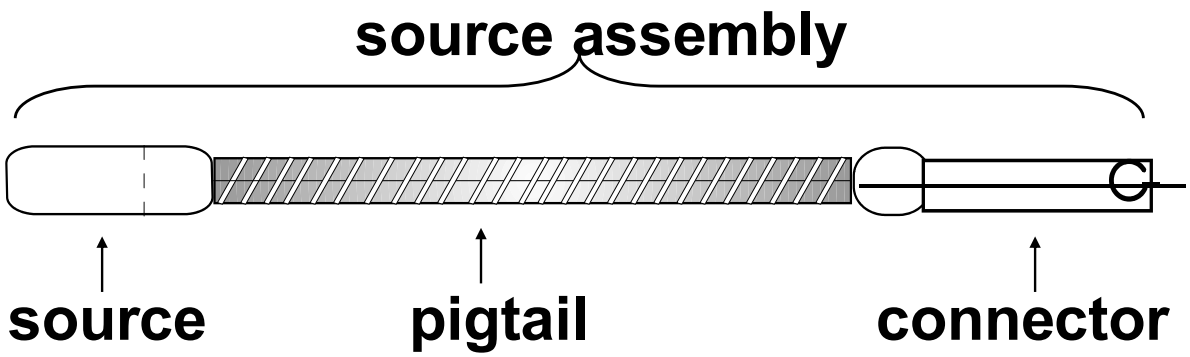
Gamma Equipment



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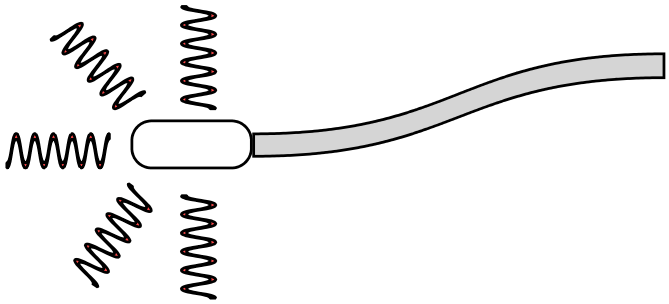
Collimation

uncollated **collimated**



(panoramic) **(directional)**

Shielded enclosure radiography

- Purpose built enclosure
- Effective engineering controls
- Adequate shielding

Shielded enclosure radiography

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Shielded enclosure radiography

Radiography ‘on location’

Requires managerial control to ensure safety

Site radiography

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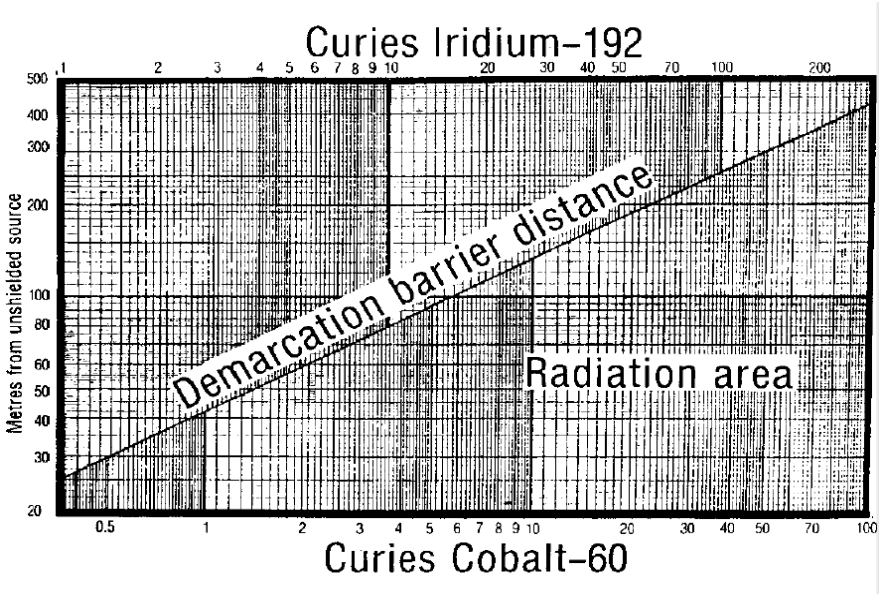
Safe Use Of Radiation- Safety Controls

Since X-ray and gamma radiation are not detectable by the human senses and the resulting damage to the body is not immediately apparent, a variety of safety controls are used to limit exposure. The two basic types of radiation safety controls used to provide a safe working environment are engineered and administrative controls.

- **Engineered controls include shielding, interlocks, alarms, warning signals, and material containment.**
- **Administrative controls include postings, procedures, dosimetry, and training**

Safe Use Of Radiation- Demarcation Distance



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Safe Use Of Radiation- Survey Techniques

Survey Meter

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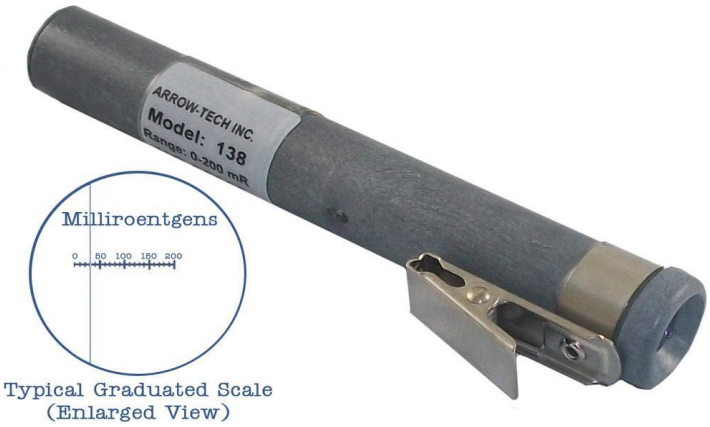
Safe Use Of Radiation- Survey Techniques

Dosimeter



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Safe Use Of Radiation- Survey Techniques

Film Badge

How Radiation Can Be Checked

Radiation Alarm

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