Radiation has many beneficial uses. It is used in industry for a range of purposes, including:

- Measuring and controlling the thickness of materials on production lines
- Checking fill levels in kilns and containers
- Measuring density and moisture in materials
- Eliminating static electricity where dust causes a problem
- Detecting smoke (as used in household and industrial smoke detectors)
- Producing images of welds in piping, turbines, engine parts and other components
- Sterilising single-use medical equipment, such as syringes, scalpels and dressings
- Security scanning using X-ray units.

Radiation is also commonly used in medicine in diagnostic examinations, such as:

- X-ray scans to detect injury or the presence of foreign objects in patients
- CT scans to create a computer-generated 3D image of cross-sections of the body
- Nuclear medicine procedures, where a patient is injected with radioactive material. This is used in conjunction with a radiation detection instrument to locate tumours and assess the health of organs.
Radiation is also used in radiotherapy where higher doses of radiation are used to kill cancerous cells during the treatment of tumours in:

- **Teletherapy**, which involves irradiating tumours using beams of high-energy radiation, focused specifically on the tumour to minimise damage to surrounding tissue.
- **Brachytherapy**, which provides a highly localised dose by one of two methods: either the insertion of sealed radioactive sources in the form of rods, wires or through hollow tubes into or close to the tumour, or the swallowing by the patient of a radioactive liquid that is selectively absorbed by the tumour.
- **Afterloading**, in which a surgeon places a hollow tube in or close to the tumour. The tube is then connected, following surgery, to a machine which loads a sealed source into the tube.

Radiation is also commonly used in research and education for a range of purposes including:

- Labelling pharmaceuticals
- Labeling in molecular biology
- Geological testing
- Demonstrations aids for teaching purposes
- Non destructive analysis of samples
- Biological and medical research