

GROWTH OF RADIATION APPLICATION IN MEDICINE AND INDUSTRY: THE REGULATORY PERSPECTIVE



MEDICINE



INDUSTRY

DR. PANKAJ TANDON

HEAD, RISES / DRA&ER

ATOMIC ENERGY REGULATORY BOARD

MUMBAI



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"Science makes us wonder"



Madam Curie



Henry Becquerel



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Production of Radioisotopes

- ❖ Production with Reactors
- ❖ Production via accelerators
- ❖ Production via chemical separation
- ❖ Electromagnetic Enrichment and Purification



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Applications of Radiation



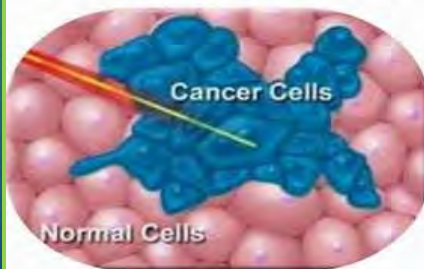
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Radiation therapy in cancer treatment

- ❖ Radiation therapy is commonly applied to the cancerous tumor.
- ❖ Systemic radioisotope therapy is a form of **TARGETED THERAPY**.
- ❖ **Radiation Oncology** (study of tumors) is medical speciality concerned with radiation.



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Nuclear medicine :

Scintigraphic diagnostics

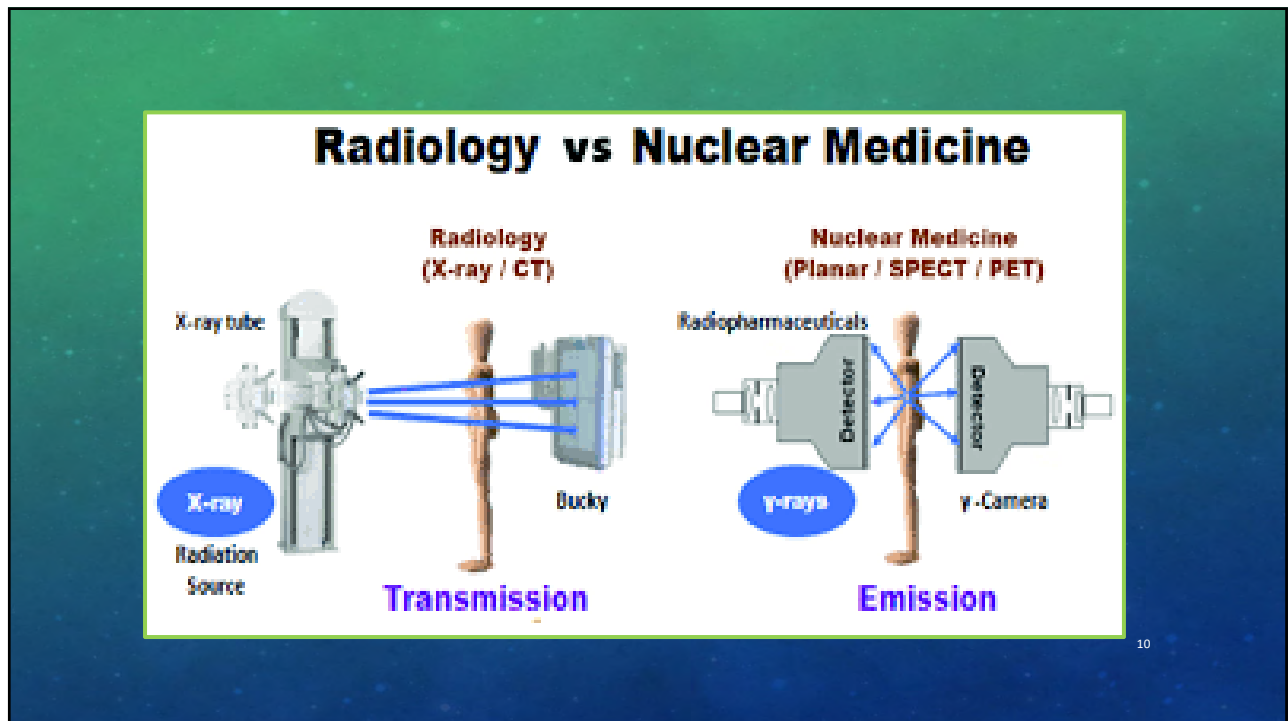
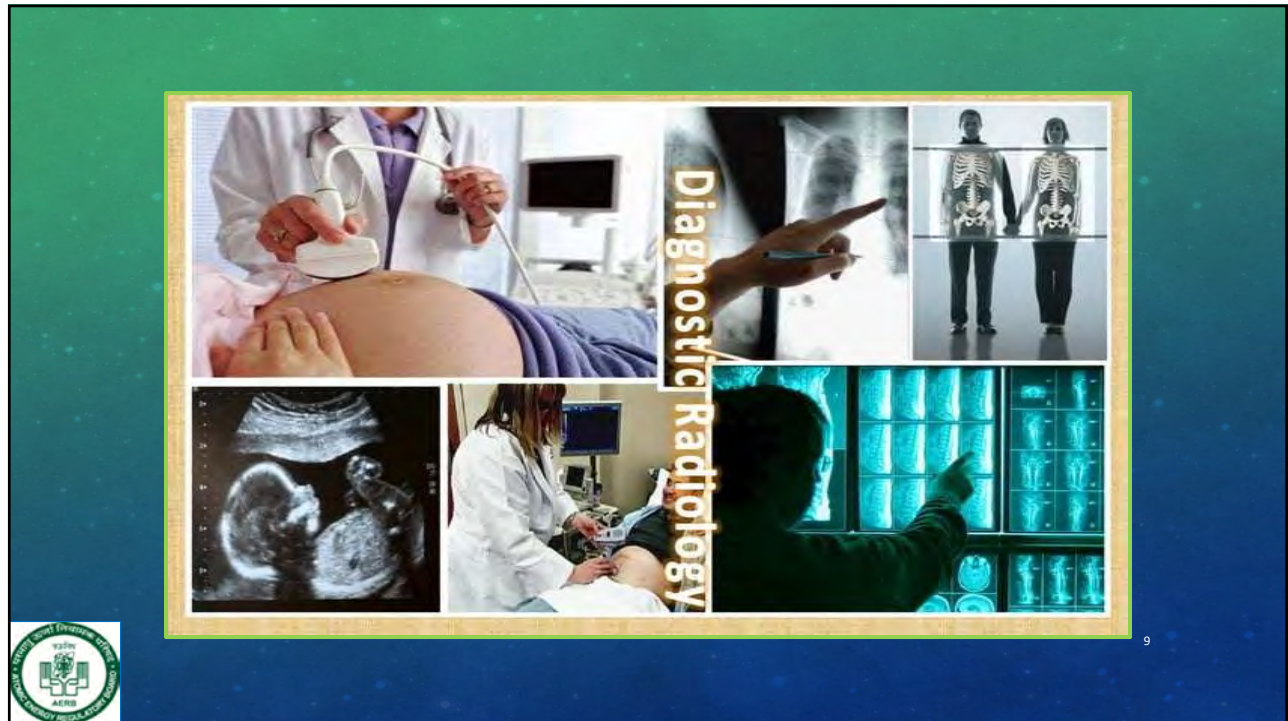
Biologically targeted therapy

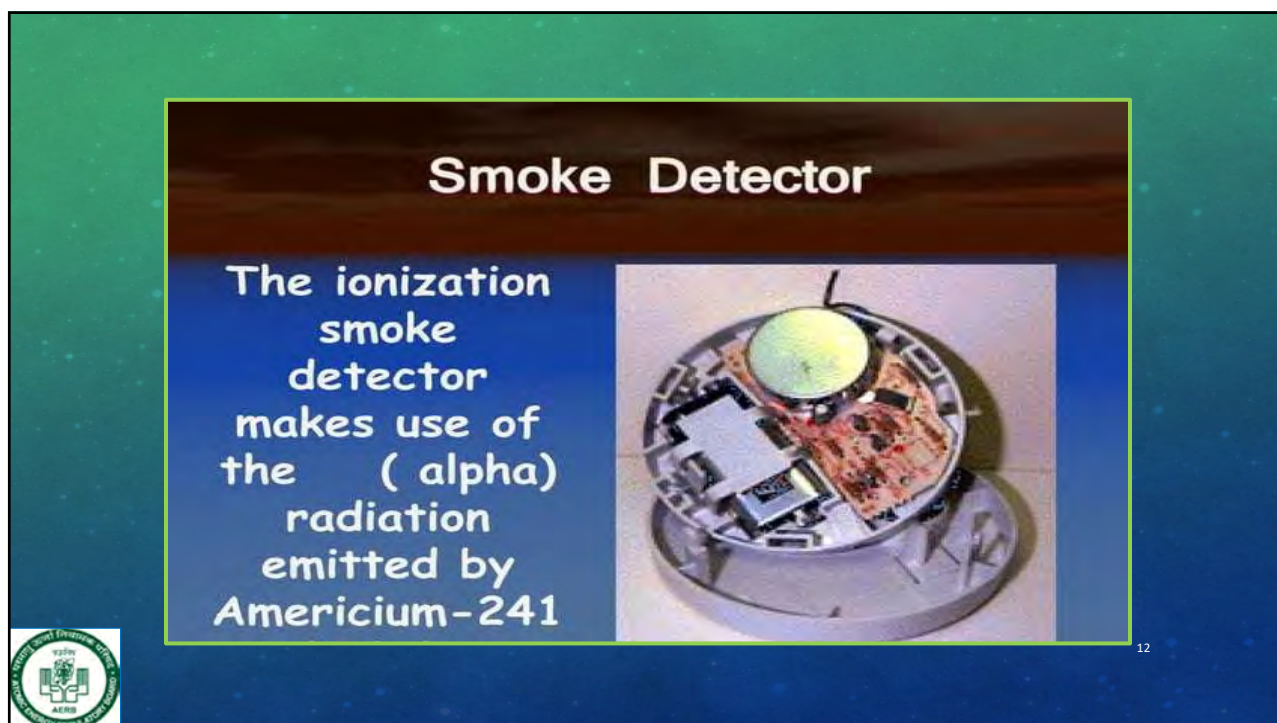
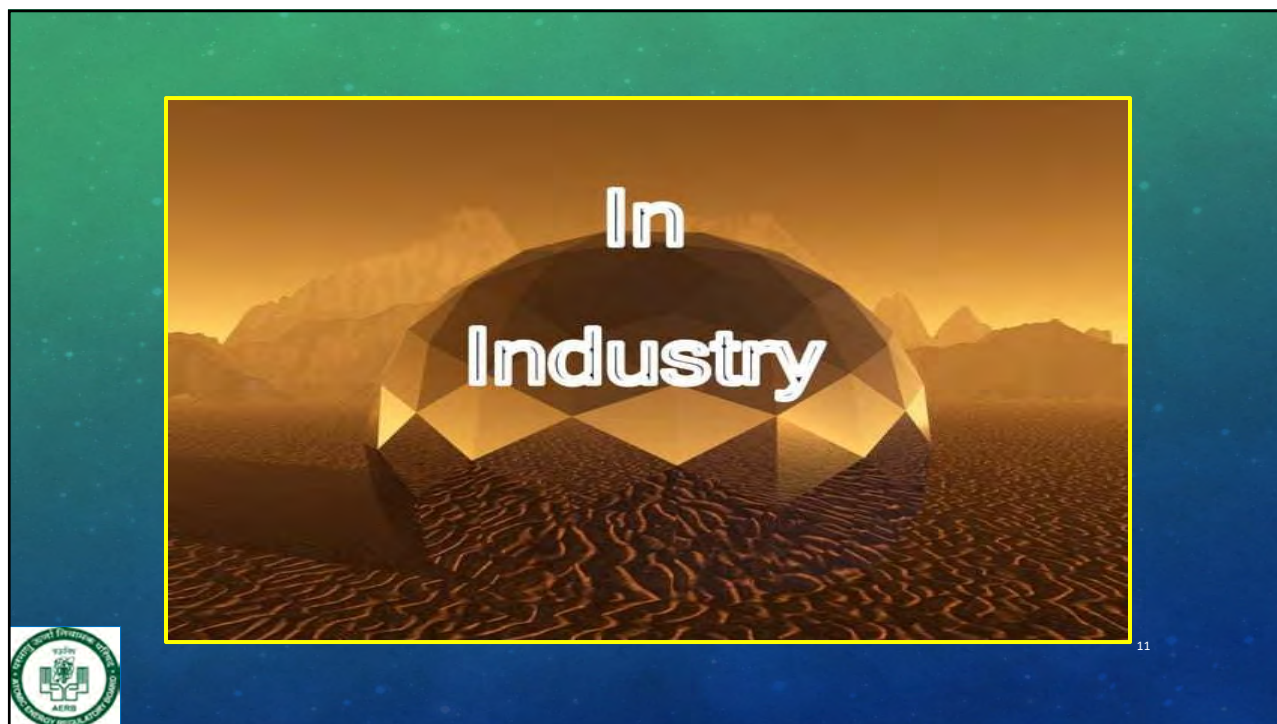
With using radionuclide-labeled substances
- radiopharmaceuticals -

γ, β^+ radionuclides

radionuclides β^-, α

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Thickness Gauge

This makes use of the penetrating property of beta radiation and helps to control the thickness of papers or tyres in factories. The piece of paper (or tyre) is put between a beta source and a detector.



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Sterilization

Food Irradiation- Certain types of food are exposed to beta radiation or [gamma rays] to kill the microbes and bacteria on them. Potatoes, onions and garlic are irradiated to prevent sprouting; the shelf life of strawberries, mangoes and papayas can be increased by irradiation; Salmonella and Listeria, which are infectious bacteria, can be reduced to harmless level in meat, fish and poultry by food irradiation.



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Surgical sterilization

Delicate surgical instruments such as cardiac pacemakers cannot be sterilized by heat. They are either treated by ethylene oxide or by radiation. Disposable items such as scalpels, gloves and syringes are also treated in bulk.



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Detection of Leakage

Leakages of underground pipes can be detected by putting certain radioactive material into the pipe and detecting the radiation with a detector. Area in which excess radiation is detected



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❖ Gamma Radiography

- Technique of examining industrial castings and machine parts for micro cracks is well known.
- Diesel locomotive works, Varanasi are using (^{192}Ir) for testing by gammography steel plates in manufacture of locomotives.
- The metal casting are tested for cracks by putting in **radioactive salt baths**. Absence of salt-penetration obviously indicates absence of cracks.



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Isotopes in hydrology and water resources management

Isotope Hydrology is a field of hydrology that uses isotopic dating to estimate the age and origin of water.

Carbon 14 dating is also used in isotope hydrology since all natural water contains dissolved *carbon dioxide*.



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Application of isotope in hydrology

❖ Determining the age of snow and ice:

Use of stable isotope can indicate the conditions of the climate in the past:

- ✓ Higher average global temperature indicates the increase in atmospheric (^{18}O) water.
- ✓ While lower than normal (^{18}O) in groundwater or an ice layer would imply the cooler climatic or ice ages.



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In Agriculture



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Radiotracers application in industry

Optimum use of fertilizers-Agricultural industry

- **Ca (45)** as a tracer, it has been found that the uptake by plants of Ca from the soil is nearly same for CaO and CaCO₃.
- Adding (NH₄)₃PO₄ labeled with **p(32)** of known specific activity the uptake of phosphorous is measured.

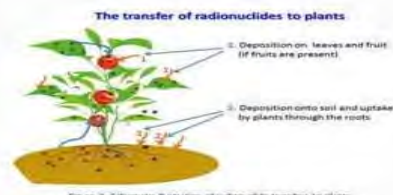


Figure 2. Schematic illustration of radionuclides transfers to plants

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➤ Genetic engineering for crop improvement

Frequency of mutation can be enhanced by exposing the plants to high dose of gamma radiation. Usually **10-100KCi of (60) Co** sources are used.

Other gamma - induced reaction:

- ❑ Preparation of silicon lubricants, ergo sterol from yeast, ethylene glycol from methanol.
- ❑ Polymer of **MMA** i.e. **PMMA**

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Crop Improvement Through Mutation Breeding



- development of crop mutants with desirable agronomic traits and good eating quality (low to intermediate amylose content)



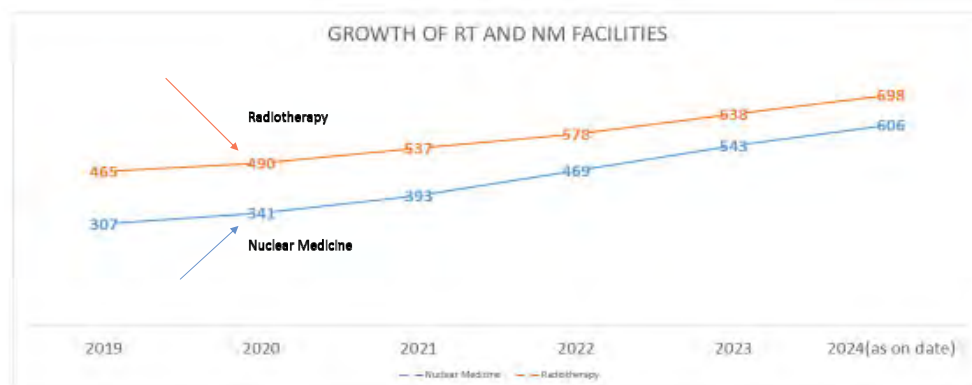
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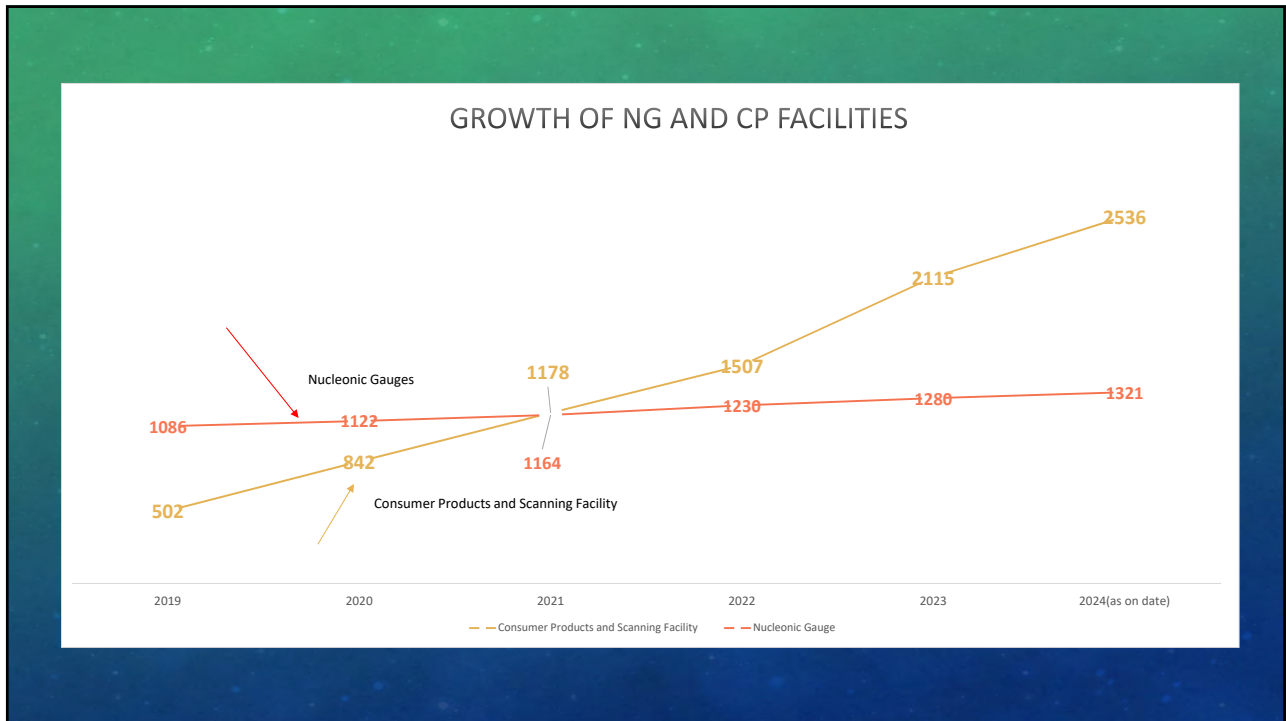
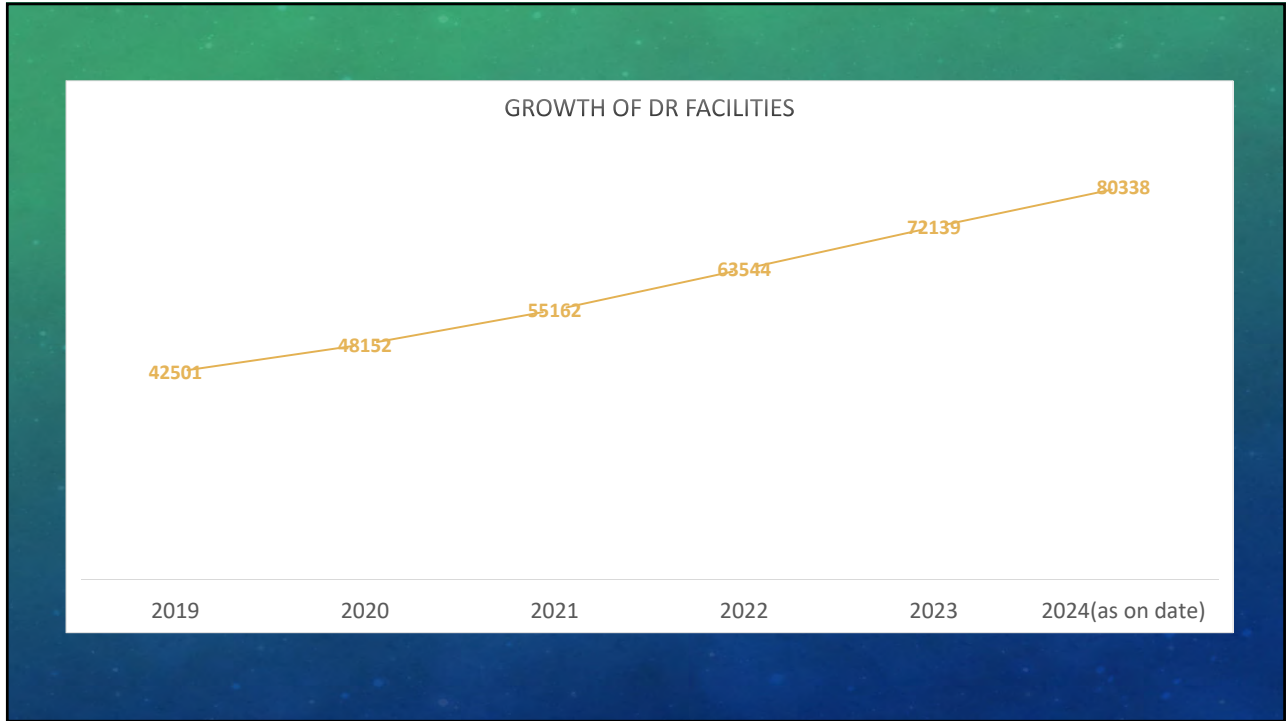


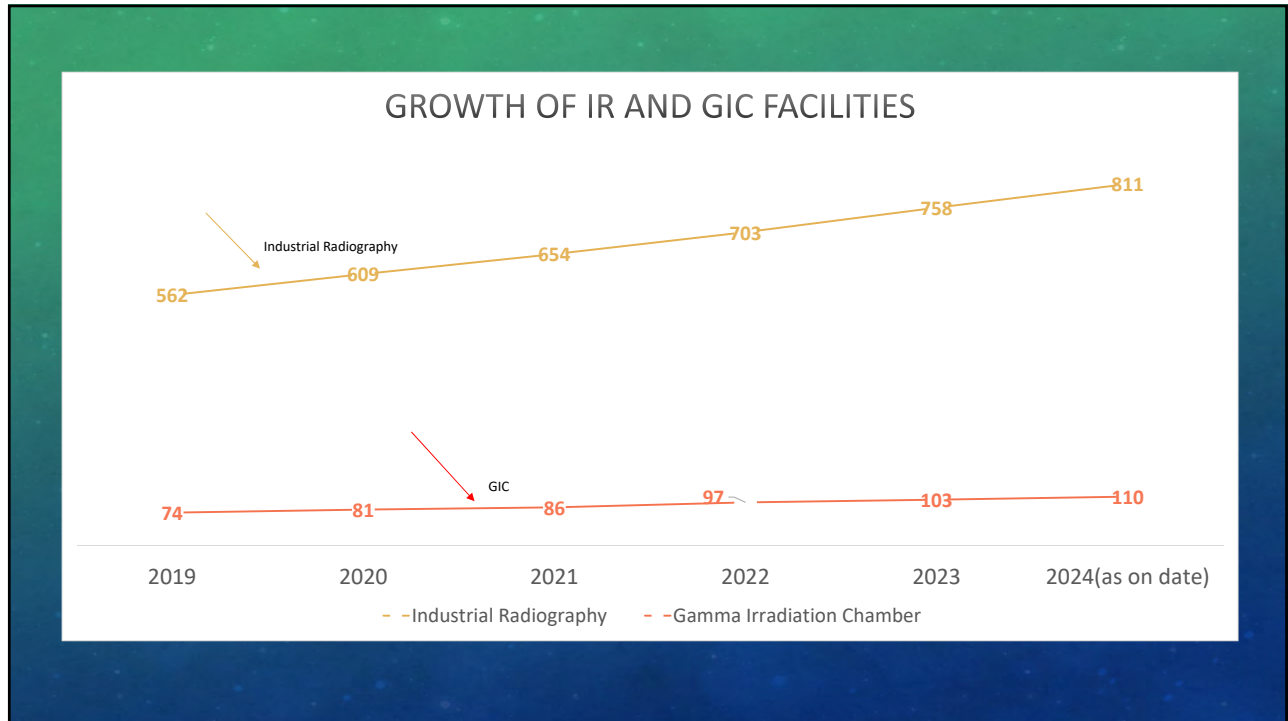
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GROWTH IN LAST FIVE YEARS

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THE REGULATORY PERSPECTIVE



FEW EXAMPLES :

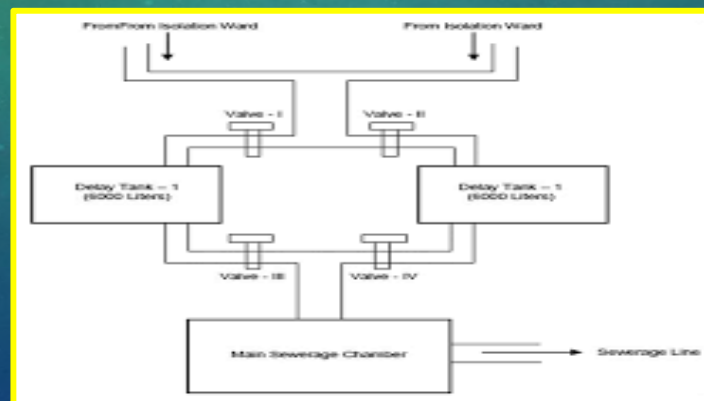
Case 1: First Proton Therapy in the Country

Are regulation there to give necessary permission ?
If not then how to go about it ?



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**Case 2: Whether delay and decay tank can be replaced
with dilute and dispense technique ?**



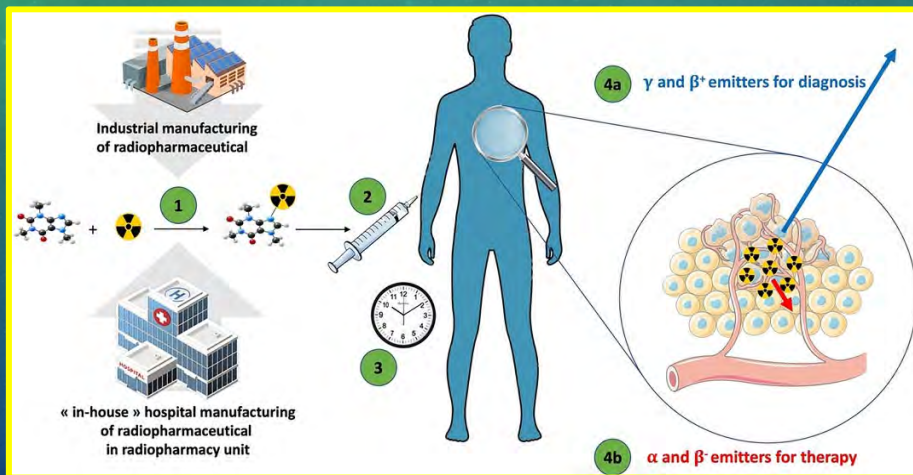
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CASE 3: WHETHER Lu-177 CAN BE USED FOR TREATMENT ON OPD BASIS ?



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CASE 4: HOW ABOUT PERMITTING THE COMMERCIAL RADIOPHARMACY FACILITY IN OUR COUNTRY ?



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CASE 5: HUMAN SCANNER FOR NON-IMAGING PURPOSES ?



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CASE 7: CONTAINER SCANNER – DRIVE THROUGH OR DRIVE BY



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CASE 8: HAND HELD X-RAY DEVICE



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CASE 8: BETATRON- FOR NDT



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CASE 9: ZAPP X-RAY



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EFFECT ON THE ECONOMY

- 1) Early Diagnosis
- 2) The Quality of the Product will improve
- 3) The needs of people will be provided
- 4) More Food Supply
- 5) The health of labour force is assured.



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