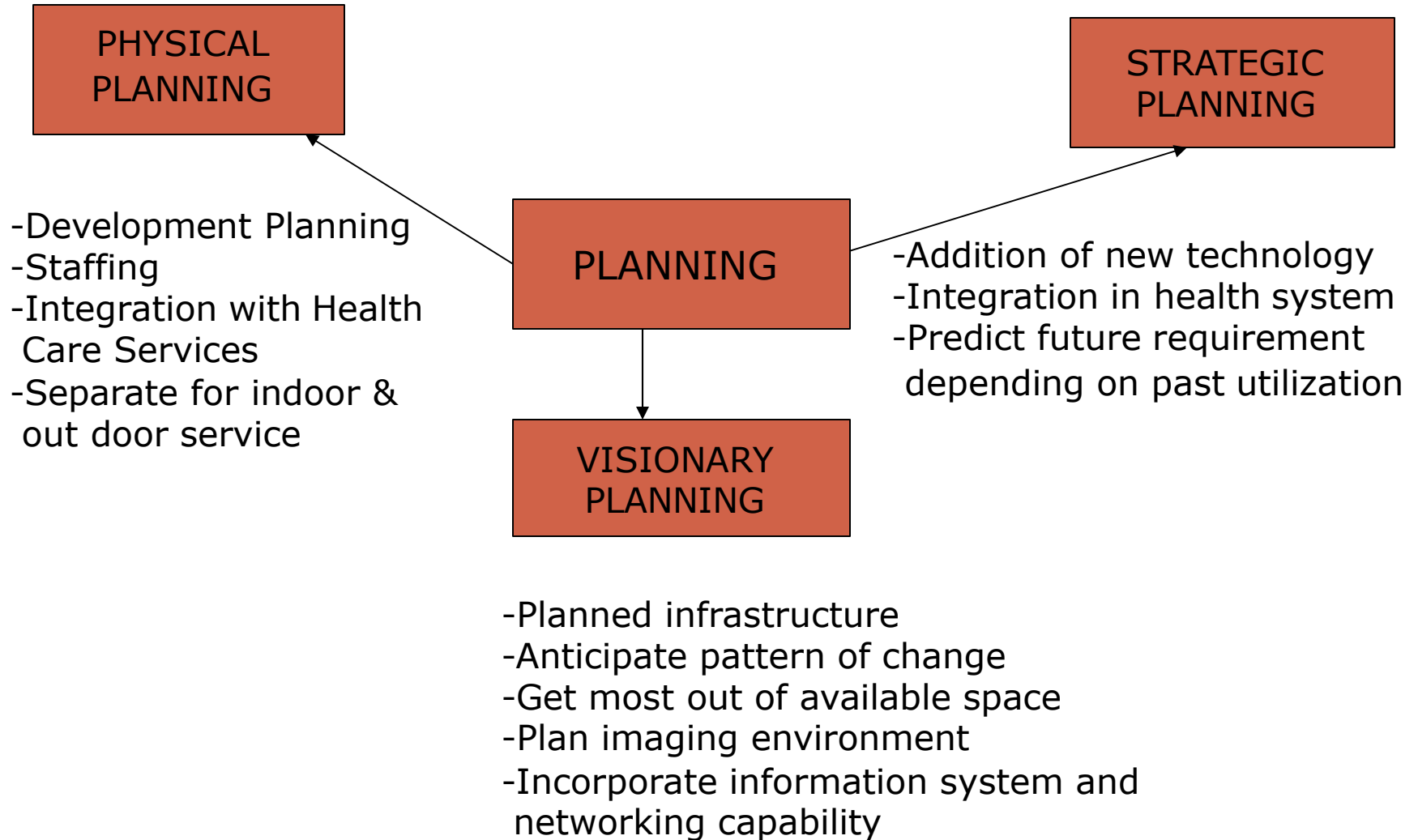


# PLANNING AND ORGANIZATION OF RADIOLOGY DEPARTMENT

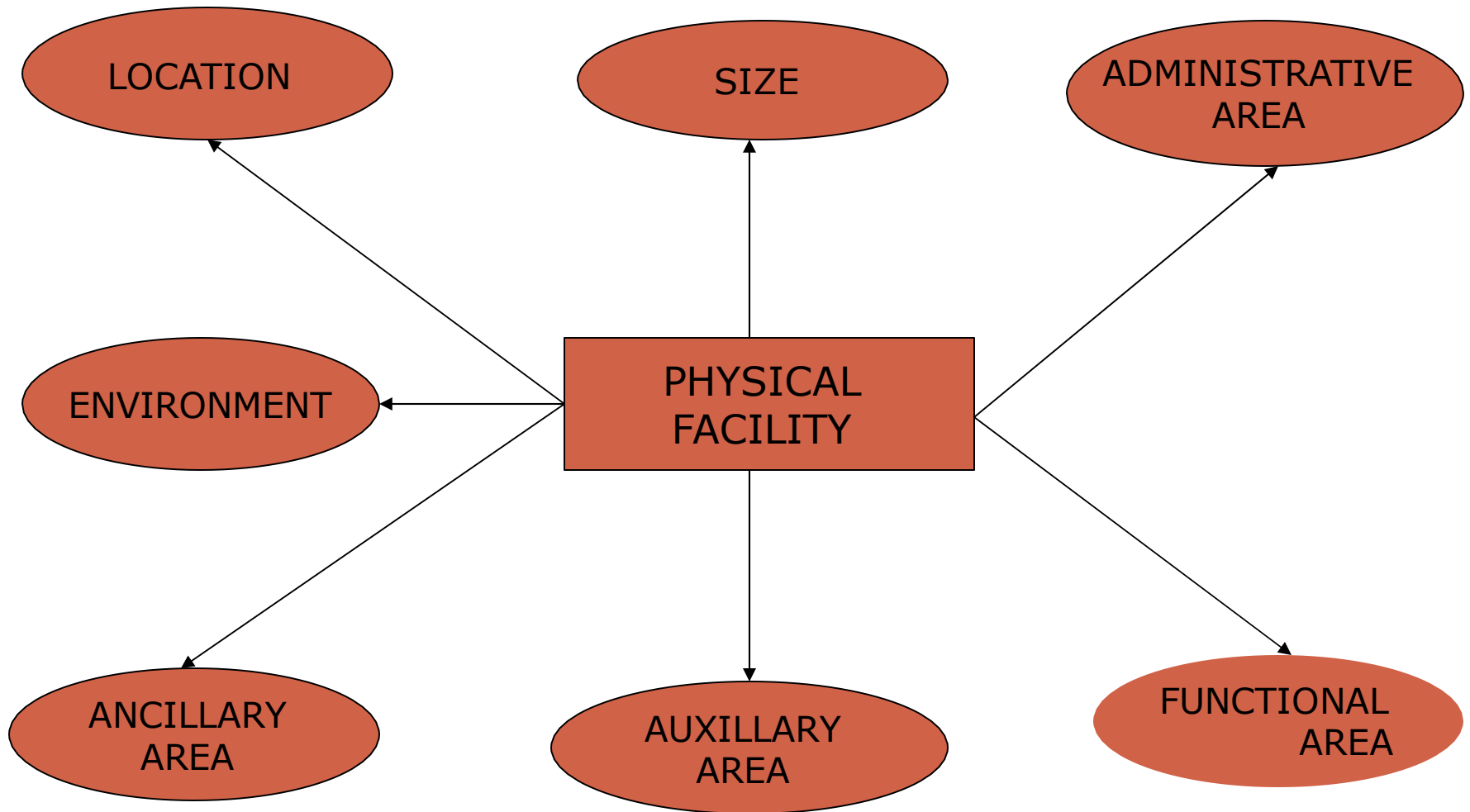
## PLANNING AND ORGANIZATION

- With rapid change in investigation technology, there is a continuous changing demand in the field of radio diagnosis and imaging service.
- Resulting in an advanced, and detailed systematic planning and organizing
- Having a foresight into future developments and requirements.

# PLANNING CONSIDERATIONS



# PLANNING OF PHYSICAL FACILITIES



## LOCATION

- Preferably in ground floor
- Away from main traffic
- Easy access to OPD, emergency and indoor

## SIZE

- Depends on the hospital size
- Types of services provided
- No. of machines to be installed

## ADMINISTRATIVE AREA

- Patient waiting area, reception
- Registration Counter
- Office of HOD
- Office of Nursing & technical staff
- Store for supplies
- Circulation space for movement of patients, staff, trolley and stretcher

# SAFETY CONSIDERATION

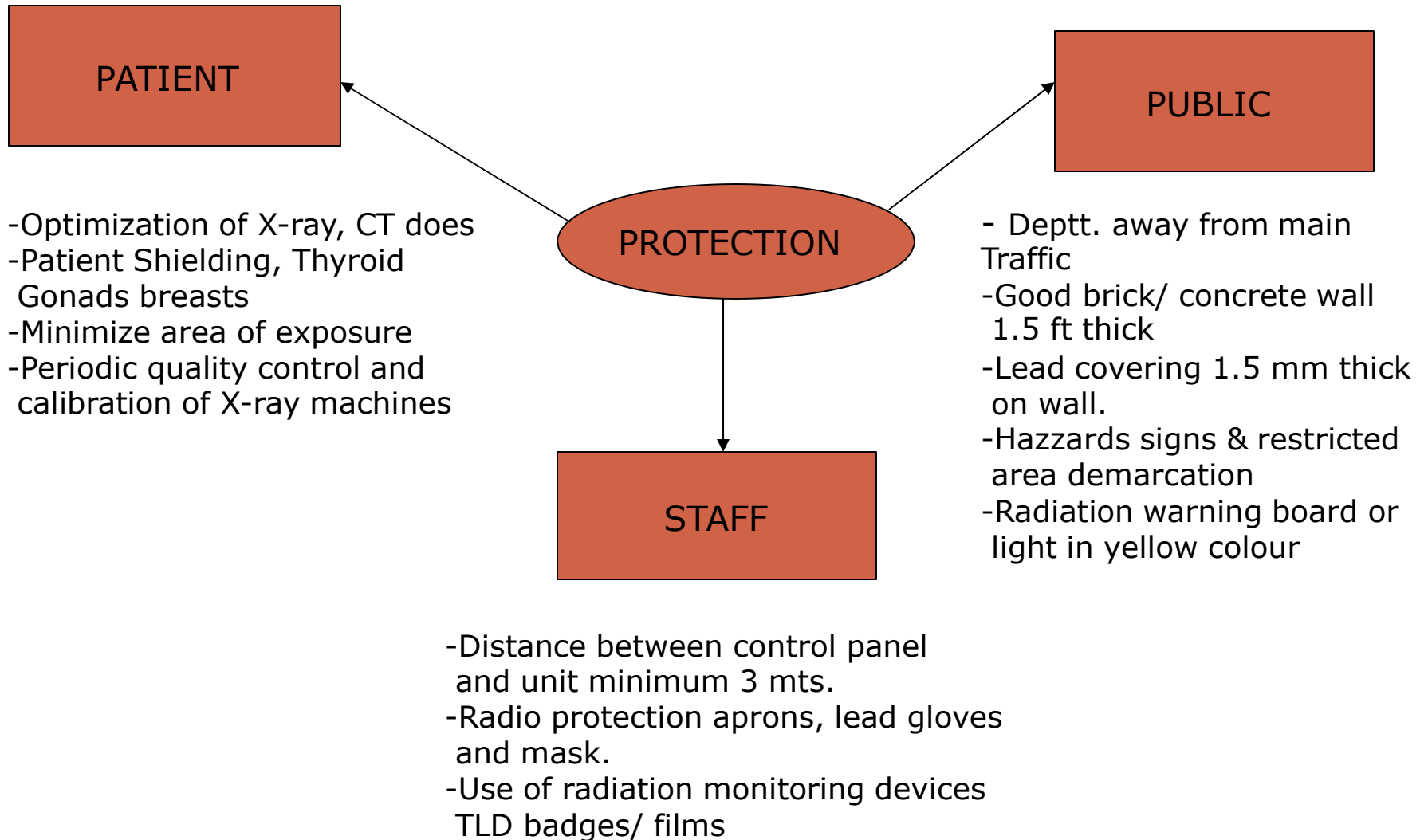
For Radiation Protection ALARA concept is used

(As Low As Reasonably Achievable )

- Plan Radio protection prior to construction.
- Promote awareness among doctors and staff.
- Awareness among patient and public,
- Demarcation of restricted areas to prevent radiation hazards like:-

- i)Acute and Chronic Skin
- ii)Somatic and Genetic
- iii)Deterministic (Not depending on does)
- iv)Stochastic (Depending on does of exposure)

# PLAN RADIATION PROTECTION



# PROTECTIVE MEASURES FOR RADIATION EMISSION

Radiation is an energy emitted in the form of a beam of X-rays which are risk involved to life, health or property when exposures is high.

Radiation danger in X-Ray room is sweltered /scattered radiation.

Radiation decreases in proportion to square of distance.

Distance is important protection in X-Ray room.

Metal cones and adjustable shutters are used to prevent sealtered radiation.



# X-RAY ROOMS :

- ❑ Must be large enough for the equipment
- ❑ Should have at least one patient change cubicle accessible from outside the room
- ❑ Must locate the operator's console where the primary beam will NEVER be directed towards it, but where the patient can be easily observed
- ❑ Must be able to accommodate large beds/trolleys, and any anaesthetic equipment likely to be used
- ❑ Must locate holes in floors for cables away from radiation beams, or be shielded
- ❑ Must have radiation warning signs on all doors
- ❑ Should have radiation warning lights outside for fluoroscopy, angiography and CT

# DARK ROOM

## SAID TO BE THE LIFELINE OF A RADIOLOGY DEPARTMENT

- ii. Minimal floor area of 100 sq ft
  - iii. Ceiling 11 ft high
  - iv. Cassette loading area
  - v. Cassette unloading area
  - vi. Developing and film processing area
  - vii. Water tap
  - viii. Safe light (0 watt, 3ft distance, color-red/amber/green)
    - Ventilation, exhaust fan
  - viii) Double door/self closing doors.
  - ix) Pass boxes (light & x-ray proof)
  - x) Walls lined with 1.6 mm lead equivalent.
  - xi) Walls and roof painted black.
  - xii) Floor-chemical/stain resistant.
  - xiii) Equipments (benches, racks, hangers, tanks, immersion heaters)
2. Drying room
  3. Record room
  4. Patient preparation room
  5. Reporting room

(Can be modified as per dry film processing unit or digital imaging )

# X-RAY ROOM CONSTRUCTION

1. Shielding of wall of X-Ray room with lead equivalent of 1 mm.
2. Concrete Wall - 8-12 cm thick
3. Brick Wall - 12 to 15 cm thick
4. Two important areas must be looked into
  - e) Wall behind chest stand
  - f) Wall of dark room
7. Lead glass window between operator and X-ray tube
8. Distance between X-ray table and control table should be as far as possible between 10 ft to 15ft.

# PRINCIPLE OF MACHINE INSTALLATION

- X- Ray tube should never point towards the control unit.
- It should not point towards dark room.
- It should not point towards, door, window or towards corridor wall.
- Lead lying up to 4 ½ of wall of patient waiting space.

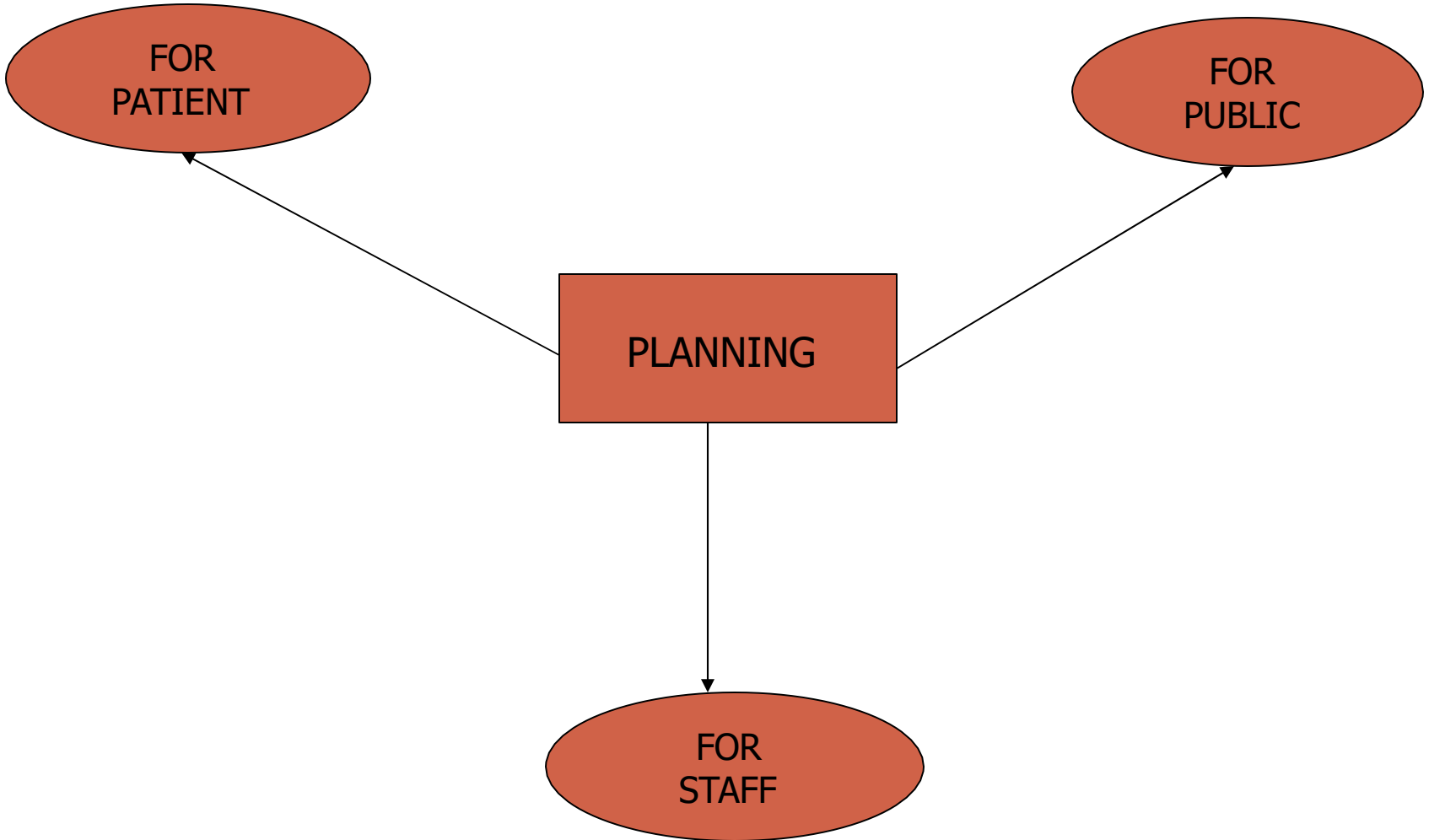
# REGULATORY BODY

- Radiation protection rule 1971, under Atomic Energy Act 1962.
- Safety and protection body of the hospital and atomic energy regulatory board.
- Bhaba Atomic Research Centre.
- Disposal of Radio wastes as per norm.
- Radio monitoring equipments.
- Film/ TLD badges and monthly monitoring.

# MRI AND C.T. ROOM

- Patient must not have any metals on body even dental fixtures, pace makers.
- No metal fixtures in the MRI Room. Non magnetic tables and trolley.
- Away from public passage, screen between control room and machine.

# NUCLEAR IMAGING AREA



## HOT AREA

- This area include receiving, diluting, holding, counting and issuing of radio isotopes.
- Floor and work surface should be non- porous
- All work to be done in glove box or under hood box
- Radio active level needs to be monitored
- Inter locking lead brick
- Lead gloves to be used while handling
- Separate toilet for radio active used patients



## DIAGNOSTIC AREA

- All walls and doors to be painted with good quality washable paints.
- A portable contamination monitor with aural alarms to be used.
- Minimum furniture to be kept
- Adequate number of lead containers and inter locking lead bricks to be used.
- Ventilation fume hoods to be provided
- Drainage pipe should be directly connected to sewerage

## SUPPORTING AREA

- Waiting area away from circulatory corridor
- Toilets separate for radio active and non radio active patients.

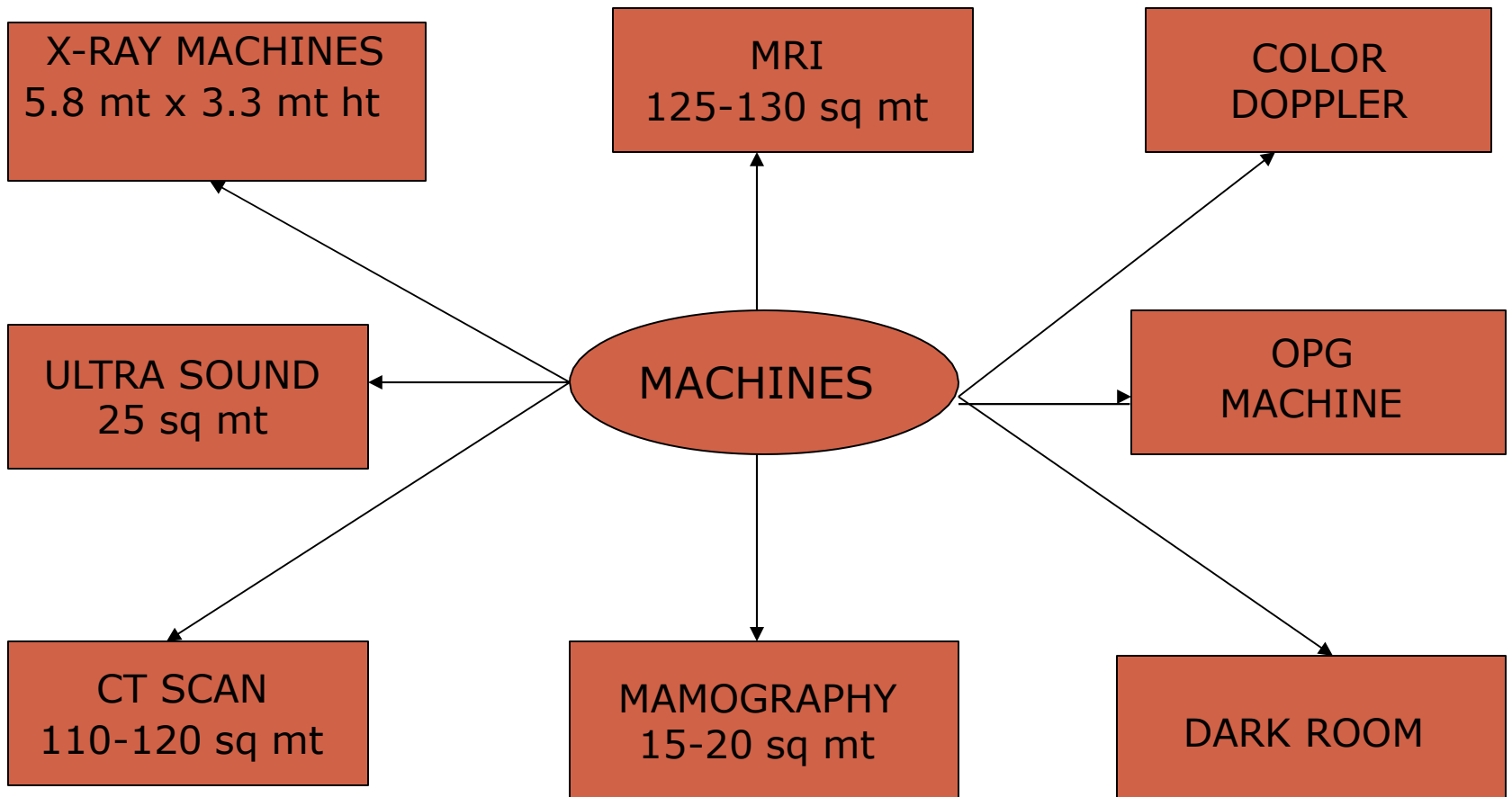
# ELECTRICAL SUPPLY

- **3Phase electric supply**
- **Separate connections from main**
- **Generators/backup facilities-CPU**

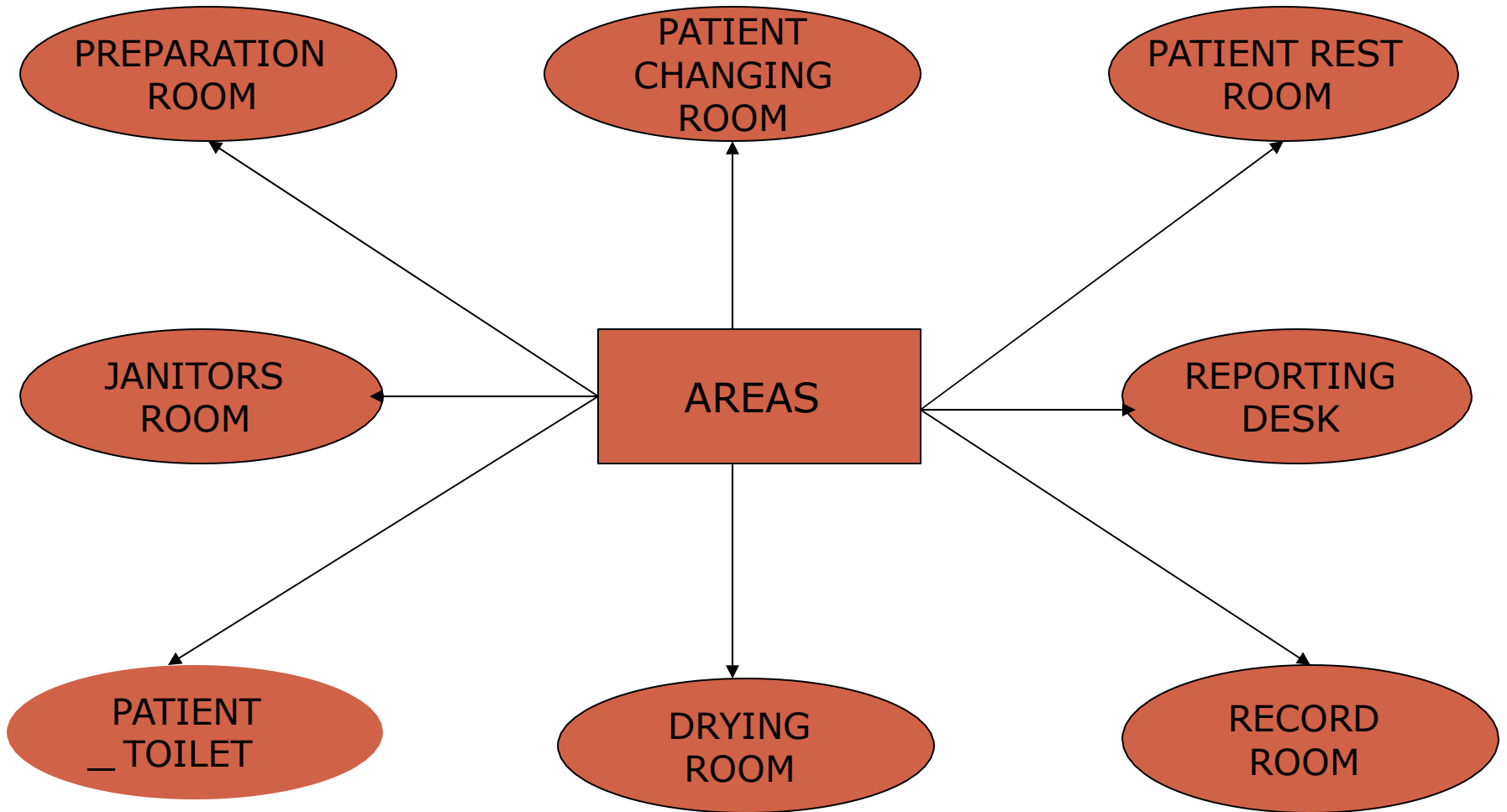
**WATER SUPPLY-continuous with heating equipments**

# FUNCTIONAL AREA

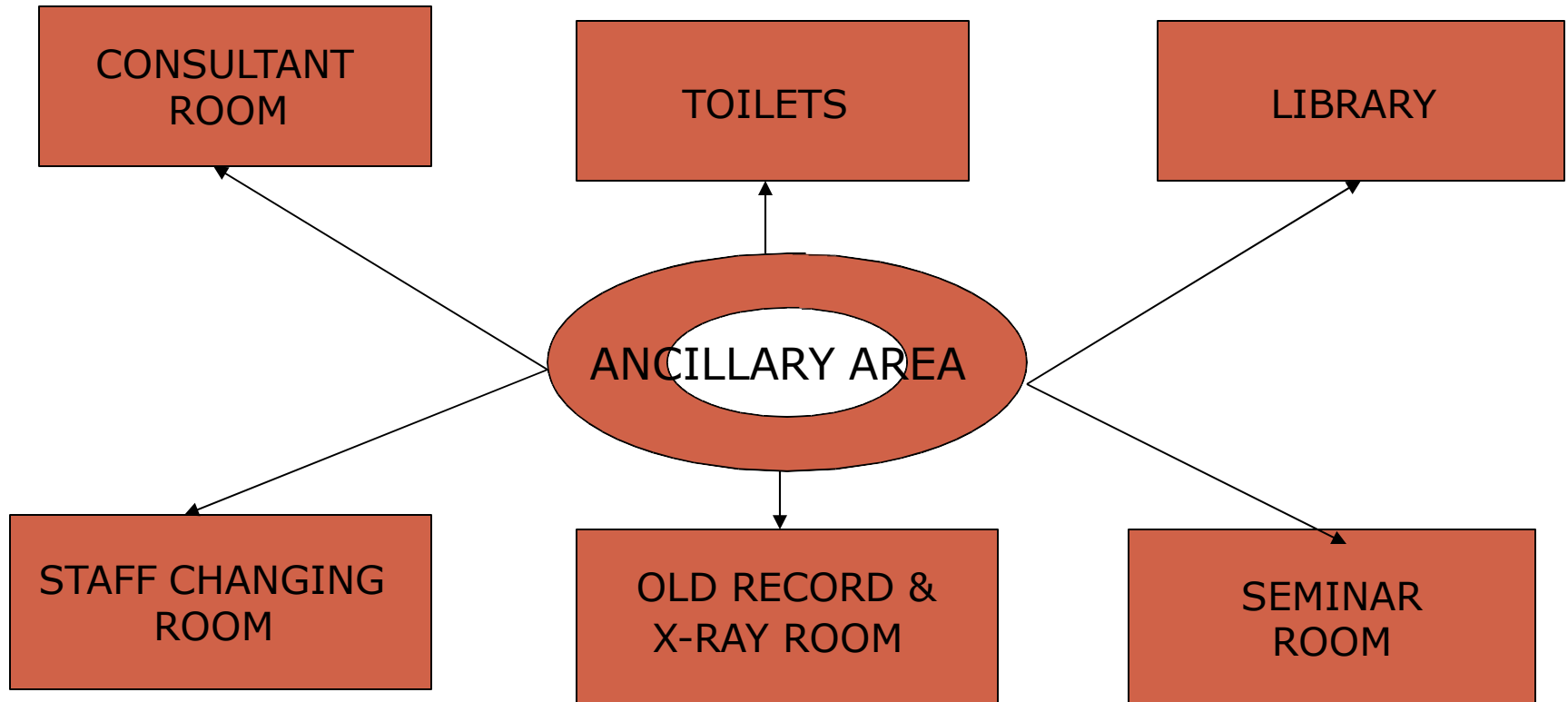
The functional area have installation of all machines like



# AUXILLARY AREA



## ANCILLARY AREA



## ENVIRONMENT

- There should be public address system
- Back up electricity supply
- Proper ventilation and air change
- Air conditioning of machine rooms

# ORGANIZATION AND STAFFING

## Manpower planning depends on

- Work load
- Type of Service
- Timing of Service

There should be a standard operating procedure for all category of staff for smooth organizational functioning.

## STAFFING

The category of staff required for Radiology Services are

### DOCTORS

- Head of Radiology
- Sr. Consultant
- Jr. Consultant
- Sr. Resident
- Jr. Resident

### NURSING

- ANS
- Sister In charge
- Staff Nurse

### OTHERS

### TECHNICAL STAFF

- Tech. Supervisor
- Sr. Technician
- Technician
- Jr. Radiographer
- Dark Room Assistant
- Dark Room Attendant

- Receptionist
- Clerks
- Store keeper
- Helper
- Nursing Attendant
- SafaiKaramchari

# ORGANOGRAM

MEDICAL SUPERINTENDENT



HOD (RADIOLOGY)



ADMN.

OFFICE OF HOD



UDC/PA



REGISTRATION  
CERK



RECORD CLERK



STORE KEEPER

CLINICAL



HEAD

X-RAY UNIT

TECH. ASSTT.

DARK ROOM  
ASSITT.

GROUP 'D'

HEAD  
CTVS

TECH. STAFF

NURSING STAFF

GROUP 'D'

HEAD  
MRI

TECH.  
STAFF

NURSING  
STAFF



HEAD  
RADIOTHERAPY

TECH. STAFF

NURSING STAFF



HEAD  
NUCLEARMED

TECH. STAFF

GROUP 'D'



HEAD  
NURSING

SISTER I/C

STAFF NURSE

GROUP 'D'



ATTENDANT

# EQUIPMENTS

Procurement → Installation → Maintenance

## PROCUREMENT

- All the equipments in the radiology department are technically very advance, sophisticated, sensitive and expensive but critical to patient care.
- Hence a detail specification be made prior to purchase and installation.

## INSTALLATION

- Before installation the structure of the building and environmental aspect to be looked into.
- The images are obtained either by transmission of rays or emission of does of radio isotopes through the organ to be viewed, which reflects gamma rays picked by camera.



The various equipments in use are-

1. X- ray Machines
2. Ultrasound Machine
3. Doppler Machine
4. Computer assisted Tomography (CAT Scan)
5. Magnetic Resources Imaging (MRI)
6. Position Emission Tomography (PET)
7. Mammography
8. Nuclear Imaging System

## ACCESSORIES

- Cassettes
- X-ray, CT, MRI films
- Dyes, Apron, Gloves
- Hangers, Clips etc



FLUROSCOPY



ULTRA SOUND



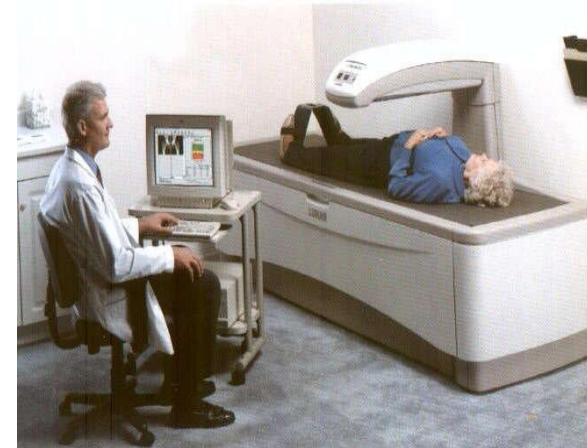
MAMO GRAPHY



CT\_SCAN



MRI



BONE DENSITO METER

# EQUIPMENTS MAINTENANCE

- Daily Maintenance - Tech. staff
- Preventive Maintenance (AMC) Supplier
- Comprehensive Maintenance (CMC)
- Warranty and Guarantee
- Breakdown Maintenance
- Emergency Maintenance

## Maintenance helps in:-

- Reduction in down time
- Safety of equipment and man
- Credible cost effective service
- Increase equipment life

# MANAGERIAL ISSUES (CONCEPT)

Application of managerial tools to ensure effective and efficient running or functioning of the department.

The concept of management is

- P – Planning - Infrastructure, manpower, equipments
- O – Organizing - Organ hierarchy, manpower, job responsibility
- L – Leading - Standard Operating Procedure
- I – Integrating - With other health care services
- C – Controlling - Maintenance, staff discipline, pilferage
- E – Evaluation - Level of staff and patient satisfaction and change in policy required.

# MANAGEMENT ISSUES



## A. ISSUES AT INPUT

- Registration Timing
- Any restriction in number
- Prior appointment
- Reception and information

## A. OUTPUT

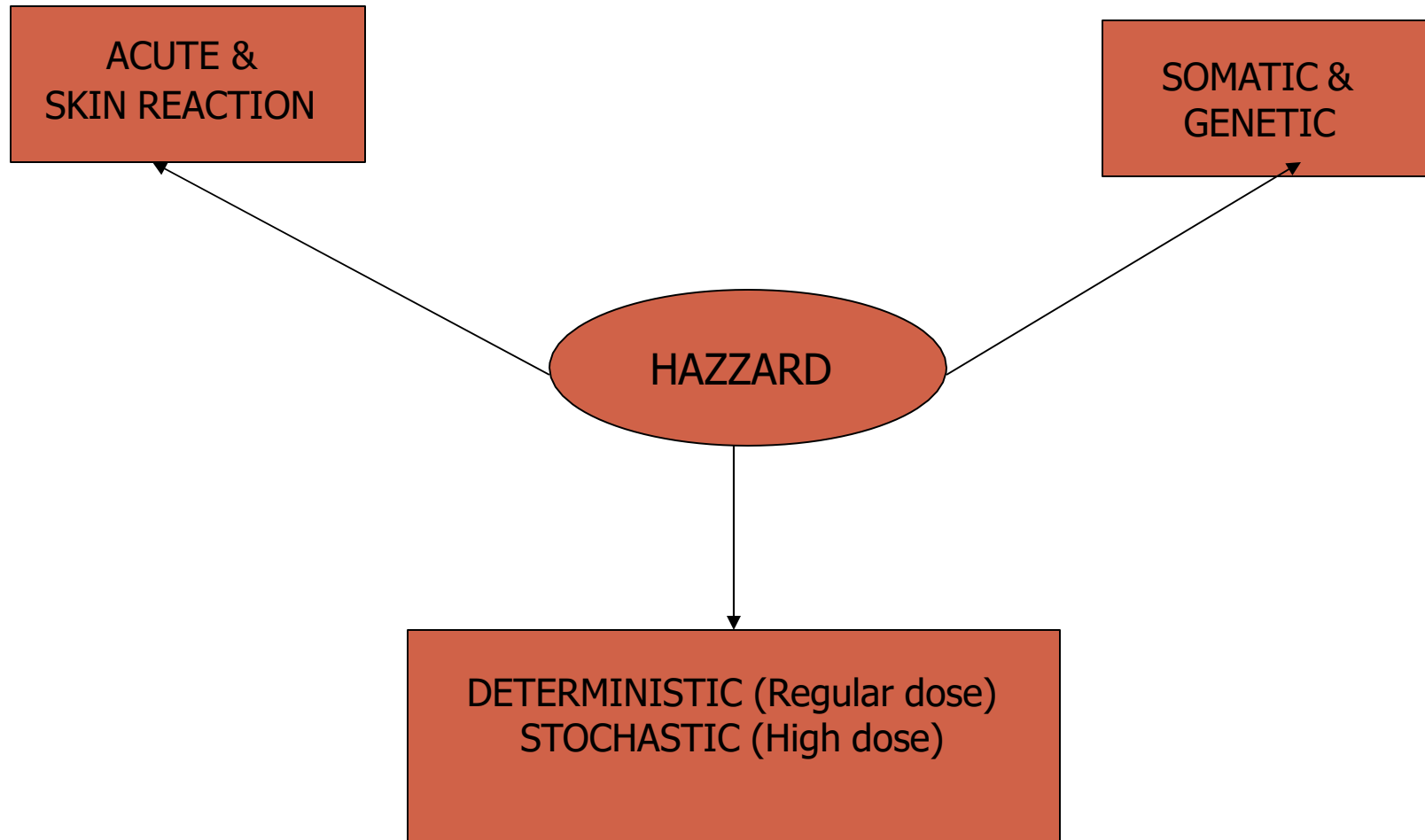
- Quality of films
- Correct reporting, misinterpretation of report.
- Matching number in film and record
- Level of patient satisfaction

## A. PROCESS

- Ensure trained manpower at machines
- Ensure functional status
- Correction of processing status
- Ensure part to be exposed
- Prevent mal practices and pilferage
- Training of staff
- Follow safety protocol for patient and staff
- Developing solutions & cassettes

The ultimate aim of any service is to achieve its desired objective with full satisfaction of both consumer and provider.

# TYPES OF RADIATION HAZZARD



# RADIATION HAZARDS



## 1. ACUTE EFFECT –

Heavy dose in short period of time

Cerebral-convulsions, blurring, headache

Gastric-nausea, vomiting, colicky abdominal pain

Blood- a plastic anemia, blood dyscrasias, marrow depression

## 2. CHRONIC EFFECT –

Due to continuous short exposure

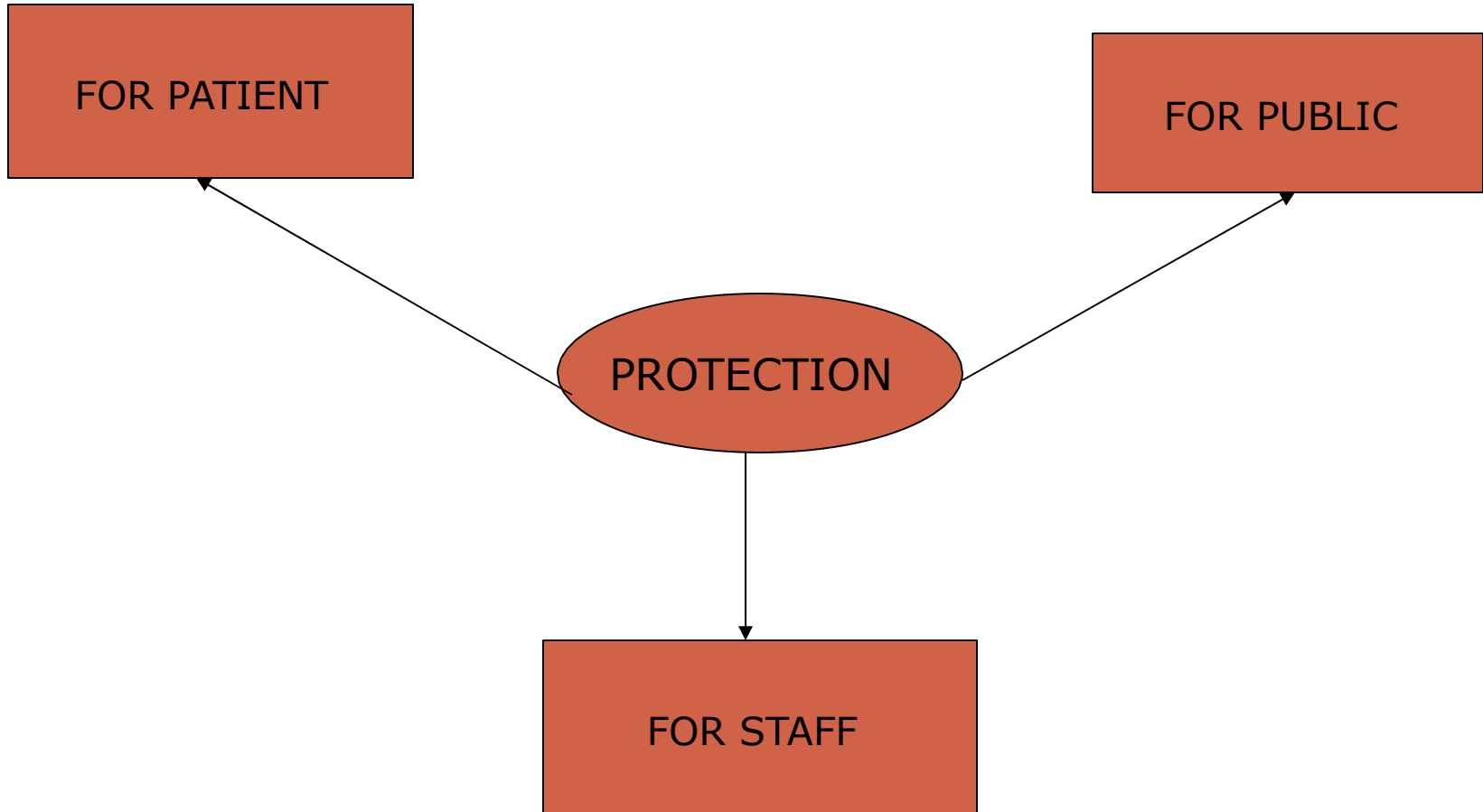
Skin-loss of hair, burns, brittle nails, amputation fingers.

Blood-anemia, leukemia, leucopenia.

Eye-cataract, irido cyclitis.

Others-Sterility, obesity, cancer.

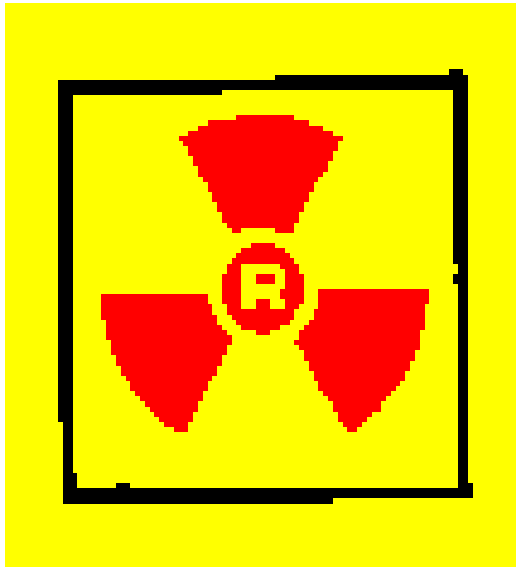
# RADIO PROTECTION





## FOR PATIENT:

- Optimization of X-Ray/ CT dose.
- Shielding of patient parts (thyroid, breast, gonads)
- Lead aprons, gloves and goggles to be used while handling and positioning
- Unnecessary exposure to be avoided
- Periodic quality control and calibration of machines



# FOR PUBLIC:



- Away from general traffic
- 4 ½ ft high lead covering of 10 mm thick on wall
- Warning board to be used (Restricted area)
- Yellow glow signs for radiation area



# FOR STAFF:



- Adequate distance (3 mt) between machine and control panel
- Lead apron lead equivalent of 0.5 mm thick
- Gloves and goggles while positioning the patient
- Film/ TLD badges to be used
- Monitoring of radiation exposure every month



# NEW DEVELOPMENTS

## 1. Picture archiving and Communication System

- A. More than 15 years ago, the idea of Picture archiving and Communication System and a filmless Radiology department was conceived.
- B. In PACS, the images are acquired, read, communicated and stored digitally.
- C. HIS: PACS gets incorporated in HIS (Hospital Information system) so that other departments can access the images sitting in their work place.
- D. Computers or networks dedicated to :
  - Storage
  - Retrieval
  - Distribution
  - Presentation of images.
- E. Images are stored in an independent format.
  - The most common format for image storage is [DICOM \(Digital Imaging and Communications in Medicine\)](#).

# NEW DEVELOPMENTS



## TELE RADIOLOGY

1. Hospitals like Narayan Hridayalay have managed to reach out to the remotest villages of Karnataka and Maharashtra through telemedicine and tele radiology.
2. Infact, a radiologist sitting in any part of the world can access the images of a patient in any other part of the world through PACS.
3. Implementation of PACS in a Radiology Department is not far away.
4. Era of Tele radiology is fast approaching.!