Radiation safety in a nuclear medicine department

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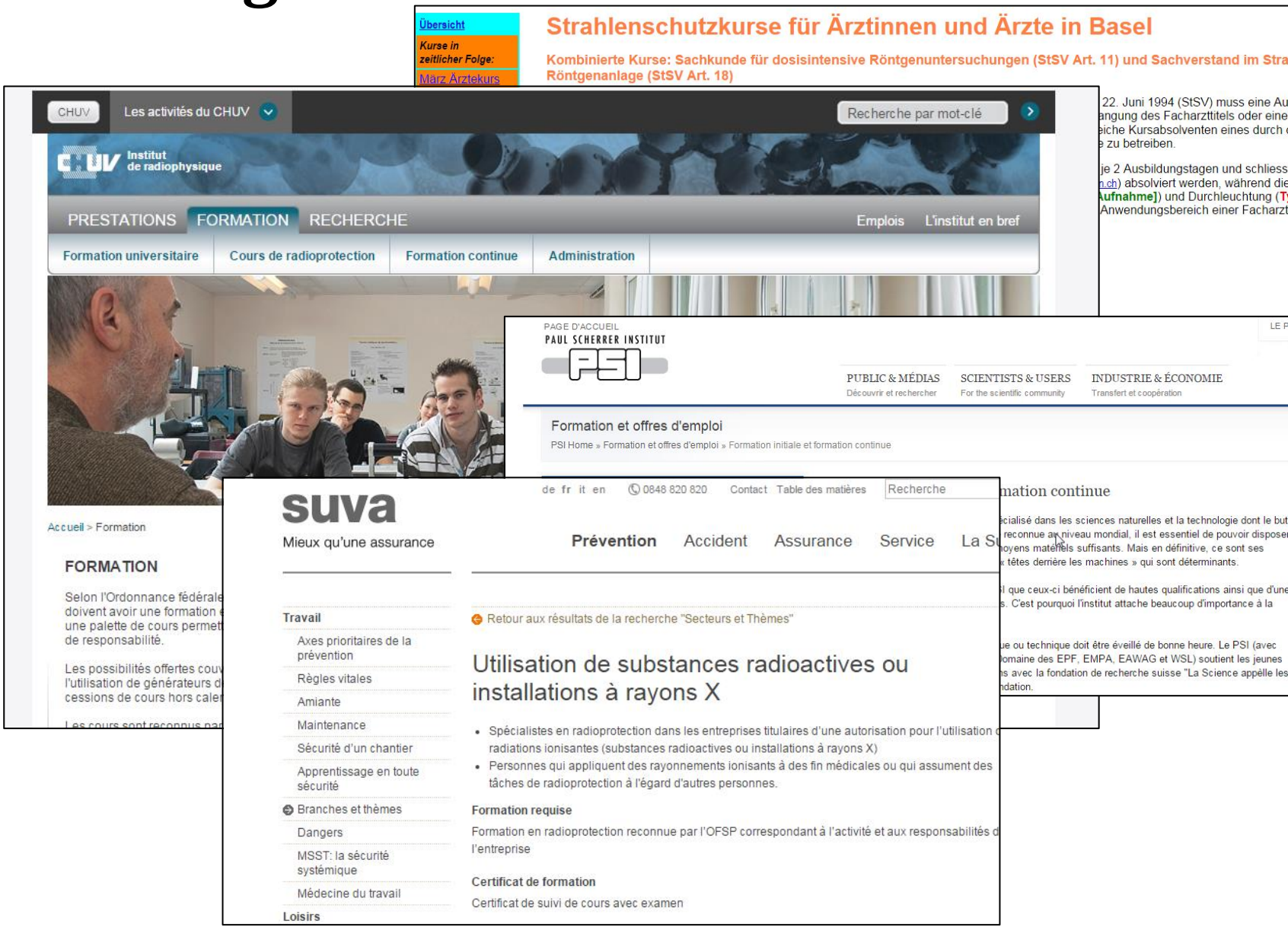
Key factors for maintaining the neccessary level of radiation safety…

- Training
- Design and construction of the facilities
- Local radiation safety rules and procedures
- Prepardness
- Equipment
- Monitoring

Training…


Übersicht
Kurse in zeitlicher Folge:
März Ärztekurs
Strahlenschutzkurse für Ärztinnen und Ärzte in Basel
Kombinierte Kurse: Sachkunde für dosisintensive Röntgenuntersuchungen (StSV Art. 11) und Sachverstand im Stra
Röntgenanlage (StSV Art. 18)
CHUV
Les activités du CHUV
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Institut de radiophysique
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FORMATION
RECHERCHE
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L'institut en bref
Formation universitaire
Cours de radioprotection
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Maintenance
Sécurité d'un chantier
Apprentissage en toute sécurité
Branches et thèmes
Dangers
MSST: la sécurité systémique
Médecine du travail
Loisirs
Retour aux résultats de la recherche "Secteurs et Thèmes"
Utilisation de substances radioactives ou installations à rayons X
Spécialistes en radioprotection dans les entreprises titulaires d'une autorisation pour l'utilisation
radiations ionisantes (substances radioactives ou installations à rayons X)
Personnes qui appliquent des rayonnements ionisants à des fin médicales ou qui assument des tâches de radioprotection à l'égard d'autres personnes.
Formation requise
Formation en radioprotection reconnue par l'OFSP correspondant à l'activité et aux responsabilités d
l'entreprise
Certificat de formation
Certificat de suivi de cours avec examen

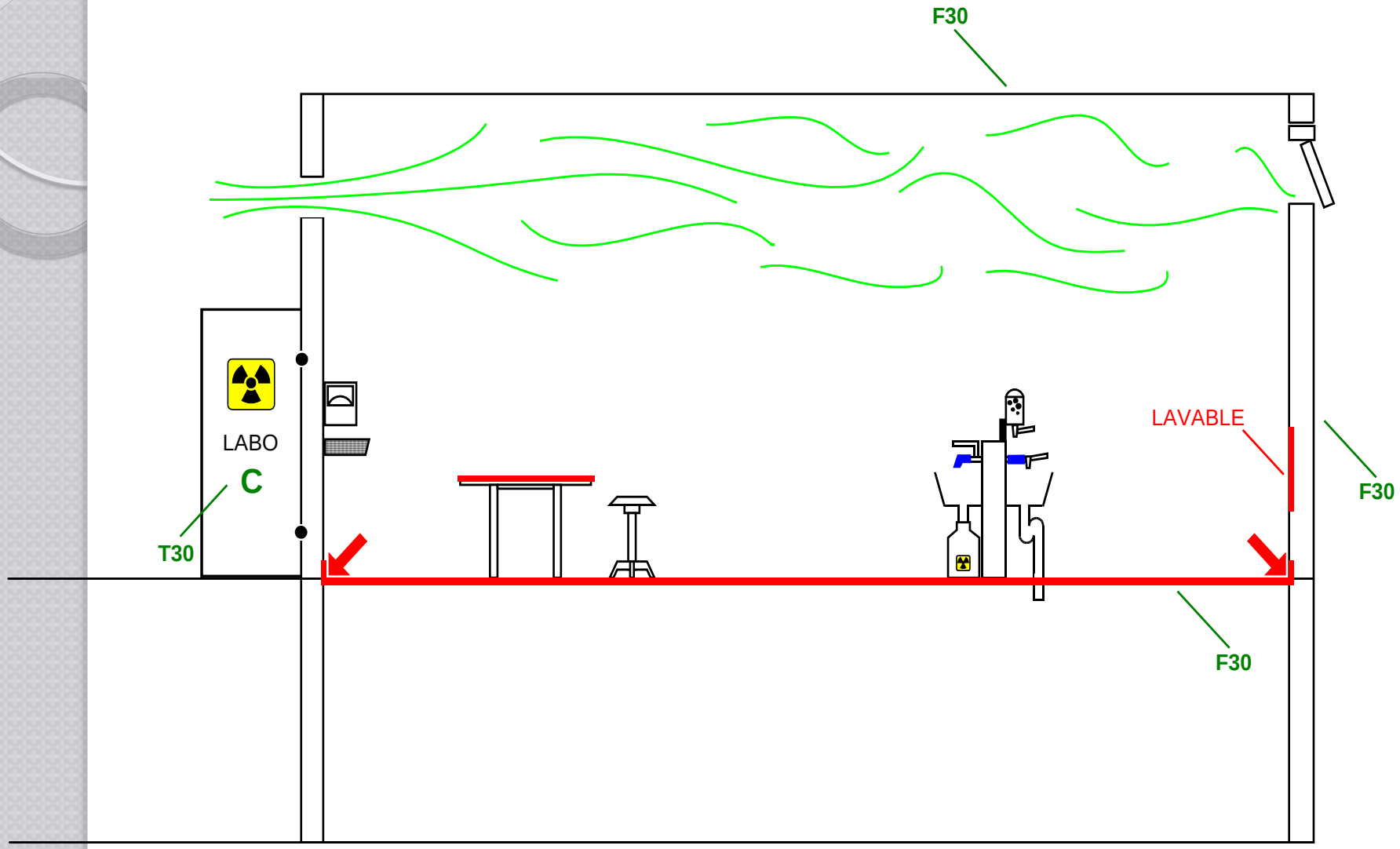
Design and construction of the facilities…

- **Laboratory type C**
- **Laboratory type B**
- **Laboratory type A**

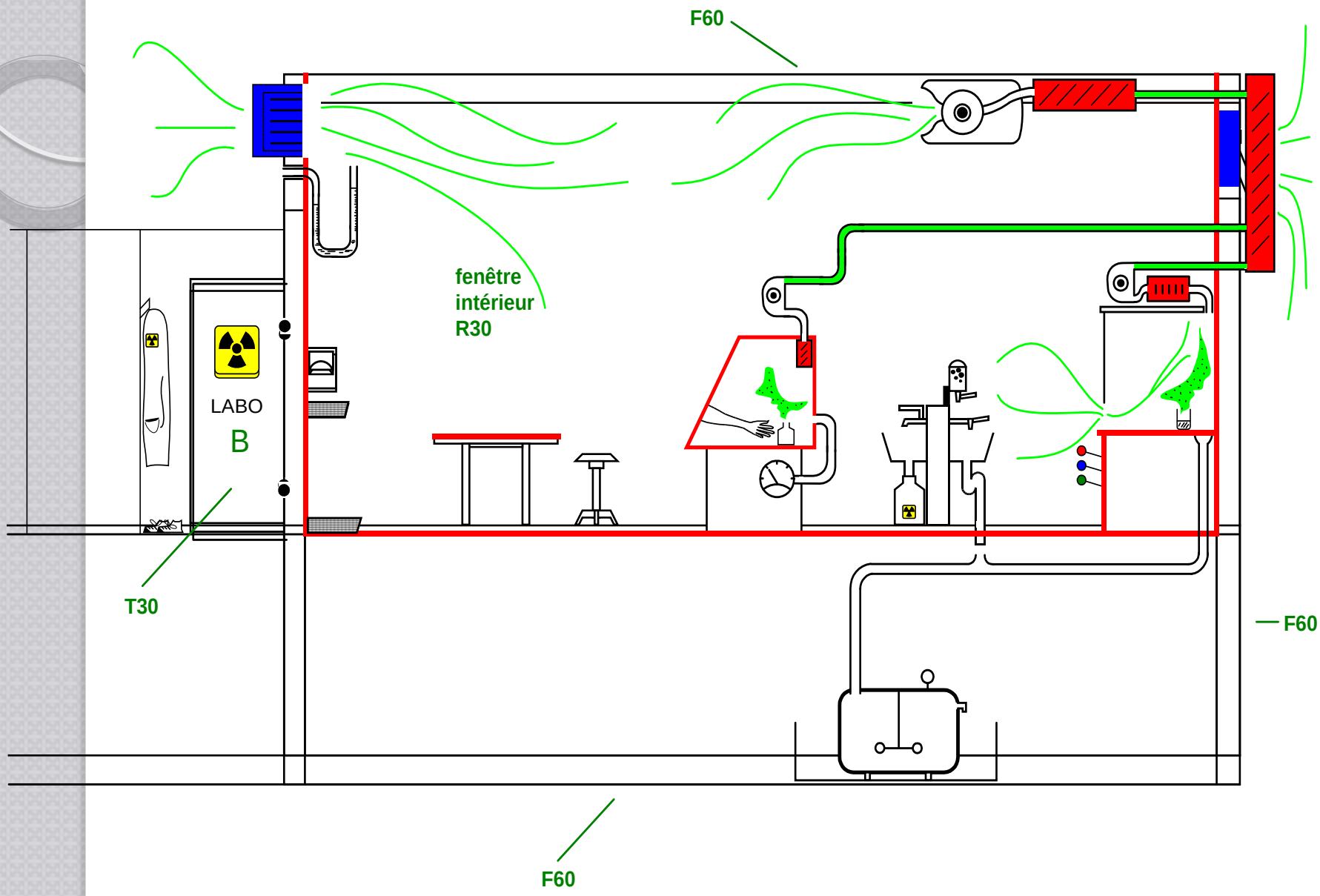
What are their characteristics?

Type	Max Activity
Normal	L_A (Limit Authorisation)
Type C	100 x L_A
Type B	10 000 x L_A
Type A	> 10 000 L_A, based on authorisation

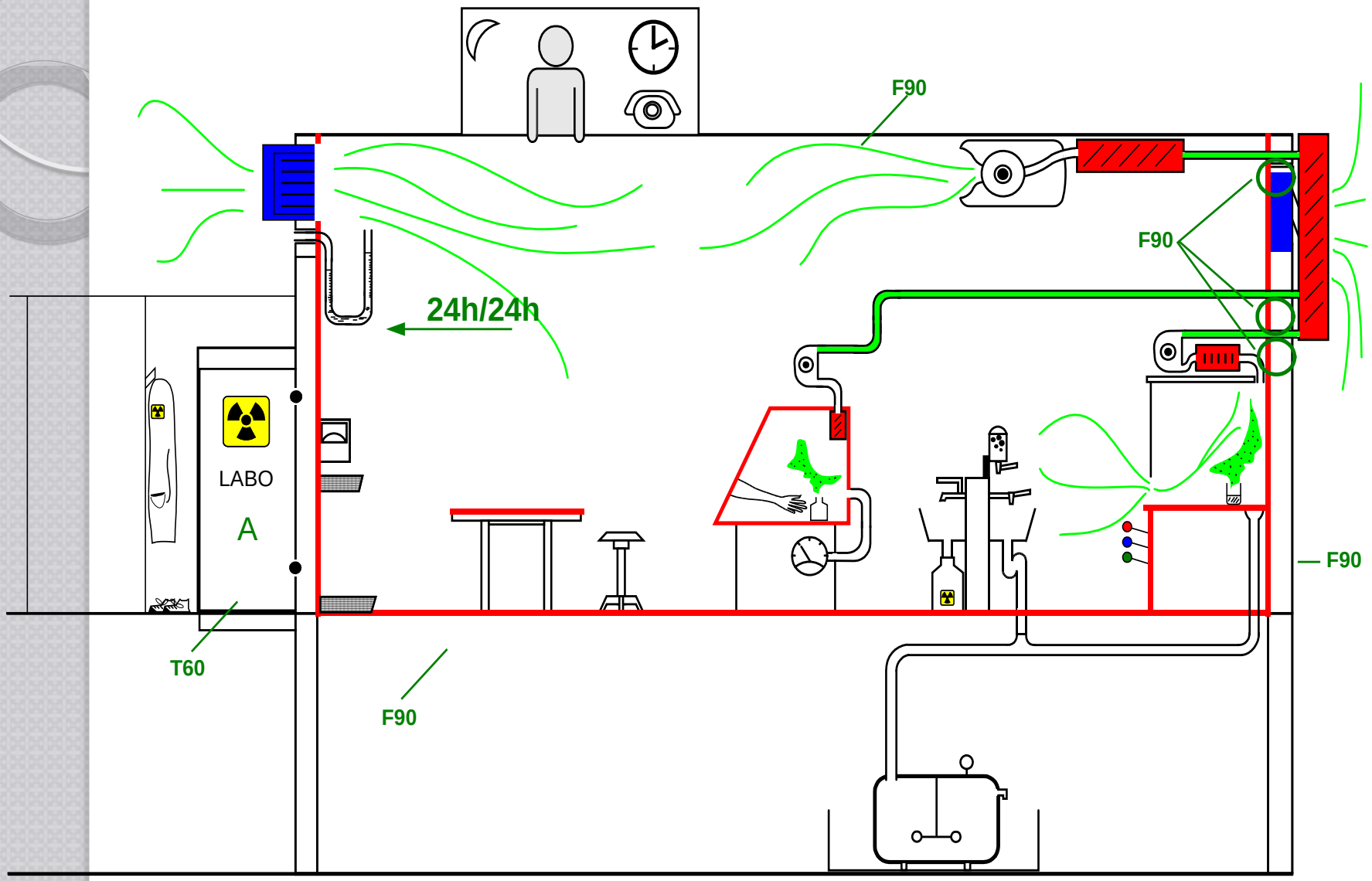
Type C / Arbeitsbereich des Typs C



Type B / Arbeitsbereich des Typs B



Type A / Arbeitsbereich des Typs A



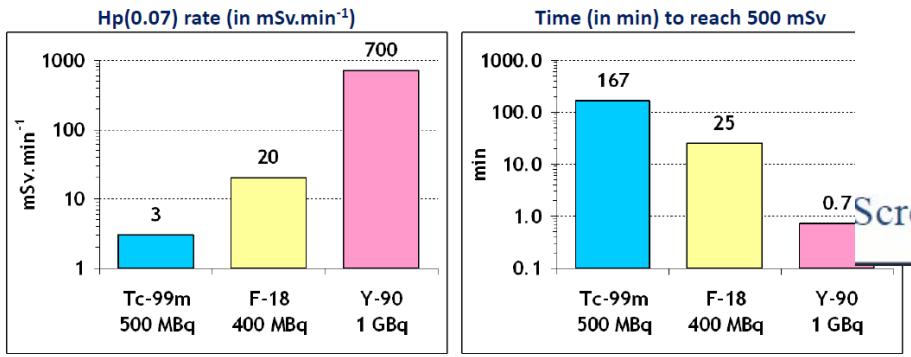
Local radiation safety rules & procedures…

- Follow the radiation safety rules defined by the authorities
- Internal protocols how to monitor contamination
- Clearly defined procedures how to treat the radioactive waste
- Internal instructions how to react in case of an accident

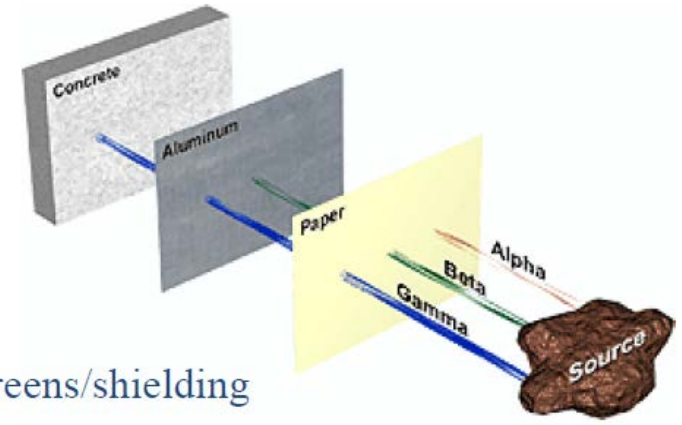
Preparedness: Understand the nature of the hazard - know your isotope and its radiations…

Dose rate at contact

Contact of an unshielded (5 ml) syringe



- ✓ Dose rates are VERY different
- ✓ For Y-90 the annual limit can be reached in less than 1 minute
  - ➔ Shielding is essential
- ✓ However, the frequencies of use are VERY different



Screens/shielding

Characteristics of some isotopes used in nuclear medicine…

Isotope	**I-131**	**Y-90**	**Lu-177**	**Ra-223**
Période	8.04 j	64.0 h	6.65 j	11.43 j
Emission	β- max 606 keV γ 364 keV	β- max 2280 keV	β- max 498 keV γ 113 & 208 keV	α 5716 keV
h10 (mSv/h et /Gbq à 1m)	0.062	0.007	0.006	0.024
h0.07 (mSv/h et /Gbq à 10 cm)	1000	1000	1000	600

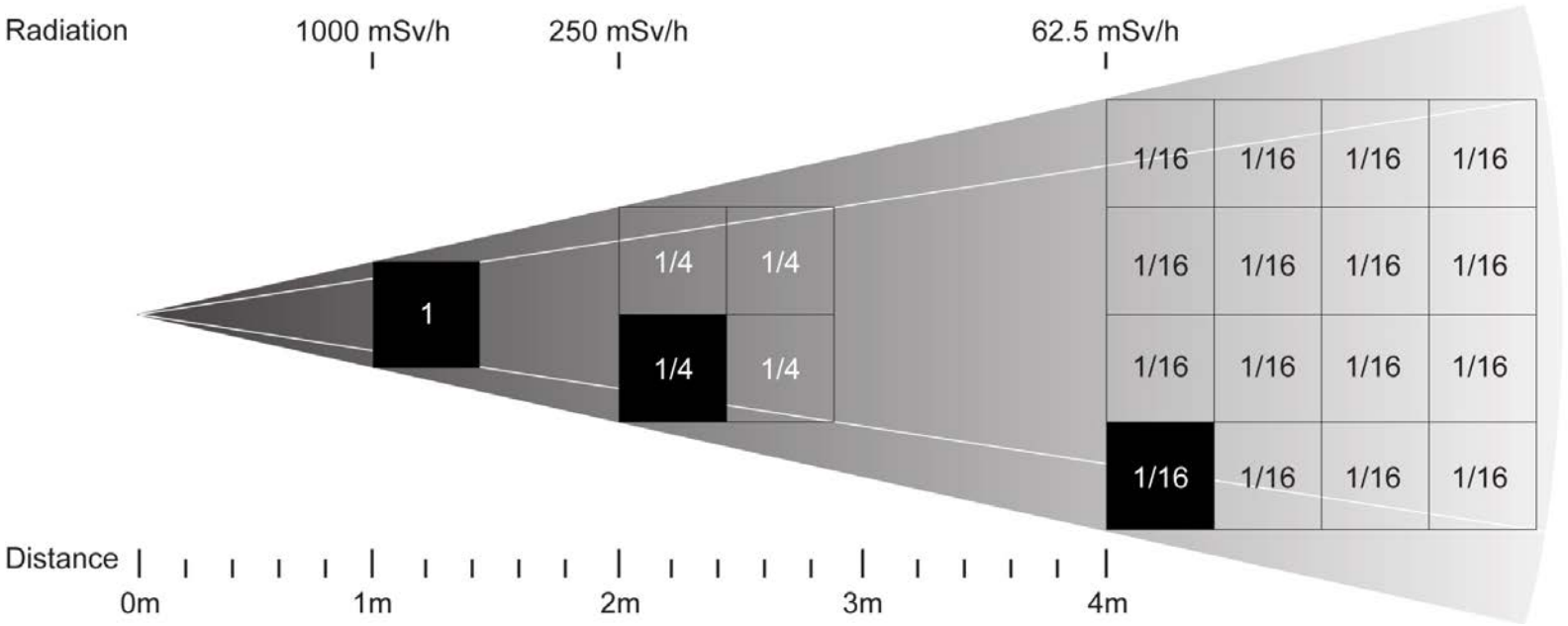
Plan ahead to minimise the handling time…

- Characteristics of your nuclides (decay type, energie…)
- Inform yourself in advance on appropriate radioprotection
- Physical form (liquid, solid, volatile (MASK!)
- Prepare all the material before start working
- Go through manipulation without radioactivity (e.g. with colorants, simulating radioactive material)

Distance yourself appropriately from the source of radiation…

- Employ tweezers whenever possible
- Remove unneccessary radioactive sources from your working area
- Apply protective shieldings

Distance…


Radiation
1000 mSv/h
250 mSv/h
62.5 mSv/h
1
1/4
1/4
1/4
1/4
1/16
1/16
1/16
1/16
1/16
1/16
1/16
1/16
1/16
1/16
1/16
1/16
1/16
1/16
1/16
Distance
0m
1m
2m
3m
4m

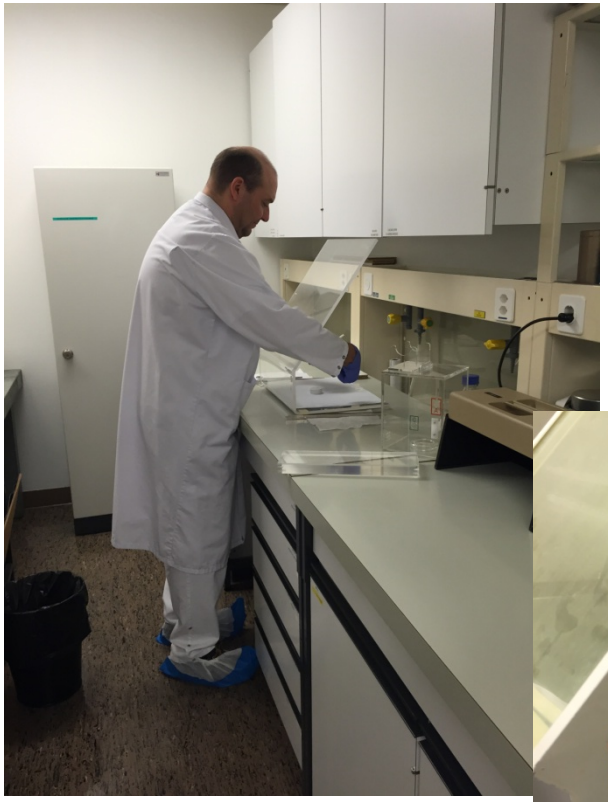
« time » , « distance » , « shielding »

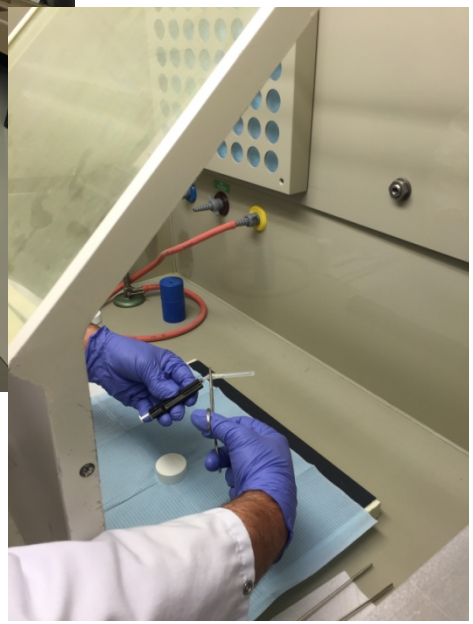
- Keep the distance as far as feasable
- Try to limit the time of exposure
- Employ shielding
- Work with the lowest activity possible
- Choose your source carefully (lowest energy possible, etc…)

TIME	- Plan ahead - Avoid uneccessary manipulations - Elongate yourself from the source when not working
DISTANCE	- Distance x 3 → dose : 10 - Distance is very important at the small scale - Employ tweezers
SHIELDING	- α : Paper, 5 cm air - β : 1 cm water, aluminium, plastic - γ : 5 cm led or 25 cm concrete → dose rate: 1/10

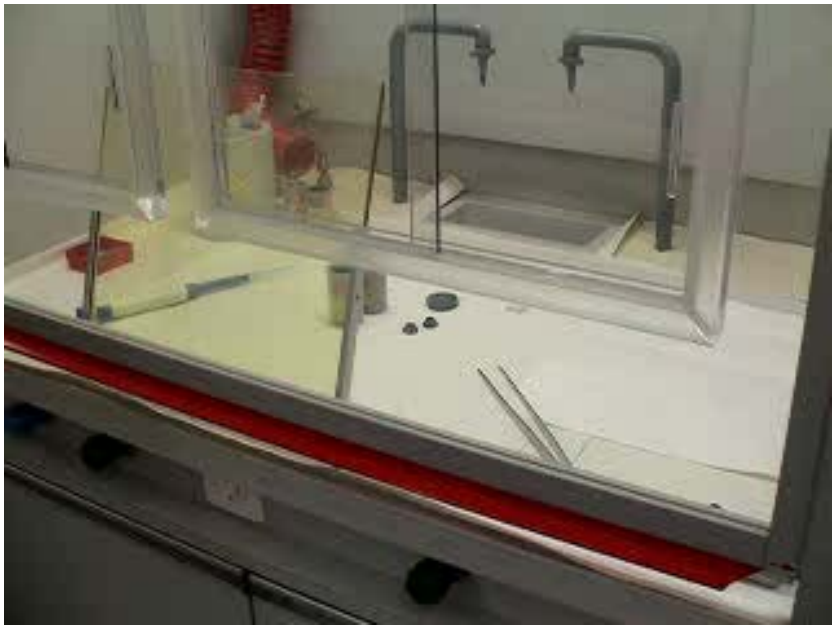
Contain radioactive material within a defined working area…

Wear appropriate clothing…





Monitoring: Check the material and yourself to ensure contamination control…



Monitoring: Check the material and yourself to ensure contamination control…

Minimize the accumulation of waste and dispose of it by appropriate routes

- Separate radioactive waste from non radioactive waste
- Do not mix different nuclides
- Identify each radioactive waste, label with the information necessary (date, activity, nuclide)
- Create an inventory liste of your radioactive waste to handle the disposal

Radioactive Waste → Storage

I-131
1.5 MBq
19.04.2015
R. Dupont
Waste
solide

Minimize the accumulation of waste and dispose of it by appropriate routes

Try to avoid…

Reasons for contamination…

In a nuclear medicine facility, there are three major causes of spillage of liquid radioactive material:

- From a source container
- Leakage during an dose preparation or injection procedure
- From patient excretions such as urine, faeces, sweat, saliva and vomit

Example for a decontamination kit…

- Disposable gloves, masks and overshoes
- Bottles and/or spray canes of decontaminant
- Small scrubbing brushes
- Disposable and absorbent towels
- Felt tip marking pens (water soluble ink) or radioactive scotch for marking the contaminated area
- Plastic bags of different sizes
- Alcohol wipes
- Radiation warning signs, adhesive tape and labels
- Disposable masks

What to do in case of contamination of an working surface, area…

- For personal protection use gloves and forceps. If dry powder spills are involved an appropriate face mask should also be used.

- For minor spills use absorbent paper tissues or other absorbent material to mop up the spill,working inwards towards the centre of the spill.

- Place contaminated swabbing material in plastic bags and store in a suitable shielded enclosure for latter disposal.

- For larger spills it may be necessary to set up radiation shields to give protection to those carrying out the decontamination procedure.

- Advice should be sought from the expert in radioprotection.

- Wash the affected area with water or Decon solution until monitoring shows that all traces of contamination have been removed.

What to do in case of contamination of a person…

- Persons carrying out decontamination of a colleague should use gloves and take care to avoid contaminating themselves or transferring contamination to other areas.

- Use appropriate radiation monitors to determine the extent of any contamination.

- Remove clothing as necessary and place them in plastic bag in a suitable shielded waste receptacle.

- Those areas of skin where contamination is indicated should be washed with soap and water or Decon solution. Use a shower if one is available but take care not to wash contamination into the eyes or mouth.

What to do in case of contamination of a person…

- If necessary irrigate the eyes using an eye wash bottle and wash the mouth several times.
- Monitor again. If contamination persists wash again.
- Continue this process until no contamination can be detected.
- Report the incident immediately to the expert in radioprotection.
- If ingestion of radioactive material is suspected then a medical examination should be sought.

Movie : Radiological protection in nuclear medicine (BAG)

References:

http://www.bag.admin.ch/themen/strahlung/10467/12712/index.html?lang=en

https://www.keele.ac.uk/dohs/radiation/workingwithunsealedsources/

http://www-pub.iaea.org/mtcd/publications/pdf/pub1198_web.pdf

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