DESIR Safety requirements and operation rules

Context:

Within the SPIRAL2-Phase2 safety study, we have to define the safety requirements associated with the operation of DESIR and to explain how we intend to fulfil them. In the following, the preliminary safety requirements and proposed solution are presented. They are being discussed with SPIRAL2 safety representatives and have to be discussed within the collaboration.

Deadline:

End of 2010

Safety requirements and proposed solutions:

i) Allowed and controlled access to the DESIR main building at any time
   -> access using nominative badges, required also for the truck access

ii) Forbidden access to the DESIR beam transport sections during operation, allowed and controlled otherwise
   -> access with keys or badges (UGA control system)

iii) Restricted access to the DESIR SPR lab and gas storage area
   -> access with keys

iv) Dose rate < 25 µSv/h at any accessible place
   -> beam monitoring after the 1+ identification station of the production building: 10 % of the beam is deflected towards a catcher simulating a beam loss location + real time dose rate measurement
   -> UGB control system: dose rate monitoring system using a beacon network; beacons are located at defined positions and are coupled to fast beam stopper devices located at the beginning of the beam transport sections.

<- at TRIUMF an alarm is triggered if DeD > 10 µSv/h at 1m from the beam loss spot, and the beam delivery is stopped if the level exceeds 20 µSv/h

v) Dose rate < 7,5 µSv/h at any permanent working area (e.g. acquisition room/desk, etc.)

-> UGB control system: dose rate monitoring system using a beacon network; beacons are located at a given distance with respect to identified beam loss positions and they trigger warning signals.

<- DeD < 1 µSv/h at TRIUMF

vi) Dose rate < 10 µSv/h at any temporary working area (e.g. experimental area, crates locations, etc.)

-> users equipped with active dosimeters emitting a warning signal if the dose rate exceeds 10 µSv/h

-> availability of portative active dosimeter at the entrance of any working area

<- any place with a DeD > 10 µSv/h is "protected" at TRIUMF

NB: TRIUMF figures (Operational dosimetry objectives)

- Worker
  - 24 h: < 500 µSv
  - 30 d: < 3 mSv
  - 90 d: < 5 mSv
  - 1 year : < 10 mSv // < 2 mSv at GANIL
- Public
  - 90 d: < 300 µSv
  - 1 year: < 1 mSv

vii) Dose rate < 2 mSv/h locally, in area users cannot access

-> implementation of fences to prevent access to the area

-> ALARA procedure: implementation of radiological protections to reduce as much as possible the dose rate

viii) Dose rate < 0,5 µSv/h outside the DESIR buildings (public area)

-> UGB control system: dose rate monitoring system using a beacon network; beacons are located at defined positions outside the building and are coupled to fast beam stopper devices located at the beginning of the beam transport sections.

-> ALARA procedure: building walls located 3 m away to any identified hot spot: at 3 m distance with respect to a hot spot of 25 µSv/h, the dose rate is attenuated

by a factor ~3^2 ~ 10 + wall structure allowing to reduce a dose rate of 3 µSv/h down to 0.5 µSV/h

ix) Environmental impact in accidental scenario < 50 µSv
-> simulation of accidental scenarios inducing an activity release outside the building; beam intensity limitation accordingly

x) Cumulative dose rate per individual << 2 mSv/an (individual operational dosimetry objective)
-> ALARA procedures:
* relevant choice of the "permanent working areas"
* study of the operational conditions -> who, where, how long
* dose rate cartography
->> evaluation of the individual and collective operational dose rates
->> redefinition of the working areas and operational conditions, local radiological protections
* implementation of "ALARA green locations": dedicated areas where to perform operations in safe conditions
* implementation of permanent fences around the fish bone and of permanent or temporary fences around the beam loss locations of experimental areas (at 1m, the dose rate is divided by ~10 with respect to the dose rate at 30 cm)


xi) Surface contamination inside the DESIR buildings << 4 Bq/cm^2 (e.g. 0,4 Bq/cm^2)
xii) Upper limit for an aerial accidental release of activity : **1 LDCA** (for a given air volume between 100 and 1000 m^3)
xiii) Activity confinement at any time inside vacuum chambers
-> during operation, collection of the pumped gas in a gas storage unit the activity of which is monitored in real time (SPR control before any release of the stored gas)
-> gas collection pipes connected to a pump to avoid the deposition of the activity inside the pipes
-> any equipment where some activity may be lost should be equipped with 2 inlets allowing the circulation of an inert gas to be collected and controlled by SPR (implantation chamber, beam diagnostic chamber, etc.).
-> double-valve system separating the beam line arm and the implantation chamber of the experimental setup

-> whenever the implanted beam or its decay products is volatile, opening of the chamber in the SPR lab glove box (small size chamber) or below a radioprotection tent (large size chamber)