

Solution

Master's degree in environmental science and engineering

Occupational and environmental health

3.3 Physical hazards - radiation

Consider the Suva reference values in your exercise: <https://www.suva.ch/fr-ch/prevention/themes-specialises/radioprotection-et-radioactivite>

1) Wavelengths

A medical research laboratory wishes to install an MRI (Magnetic Resonance Imaging) for experimental purposes. The device emits a permanent main magnetic field of 1.5 Teslas (300 mT at the tunnel exit and 5 mT at the control console located in the control room). It also emits a radiation of 6 V/m at 42 MHz during the examination.

What risks should the laboratory manager think about (direct and indirect) when planning the layout of the room and the organization of the work?

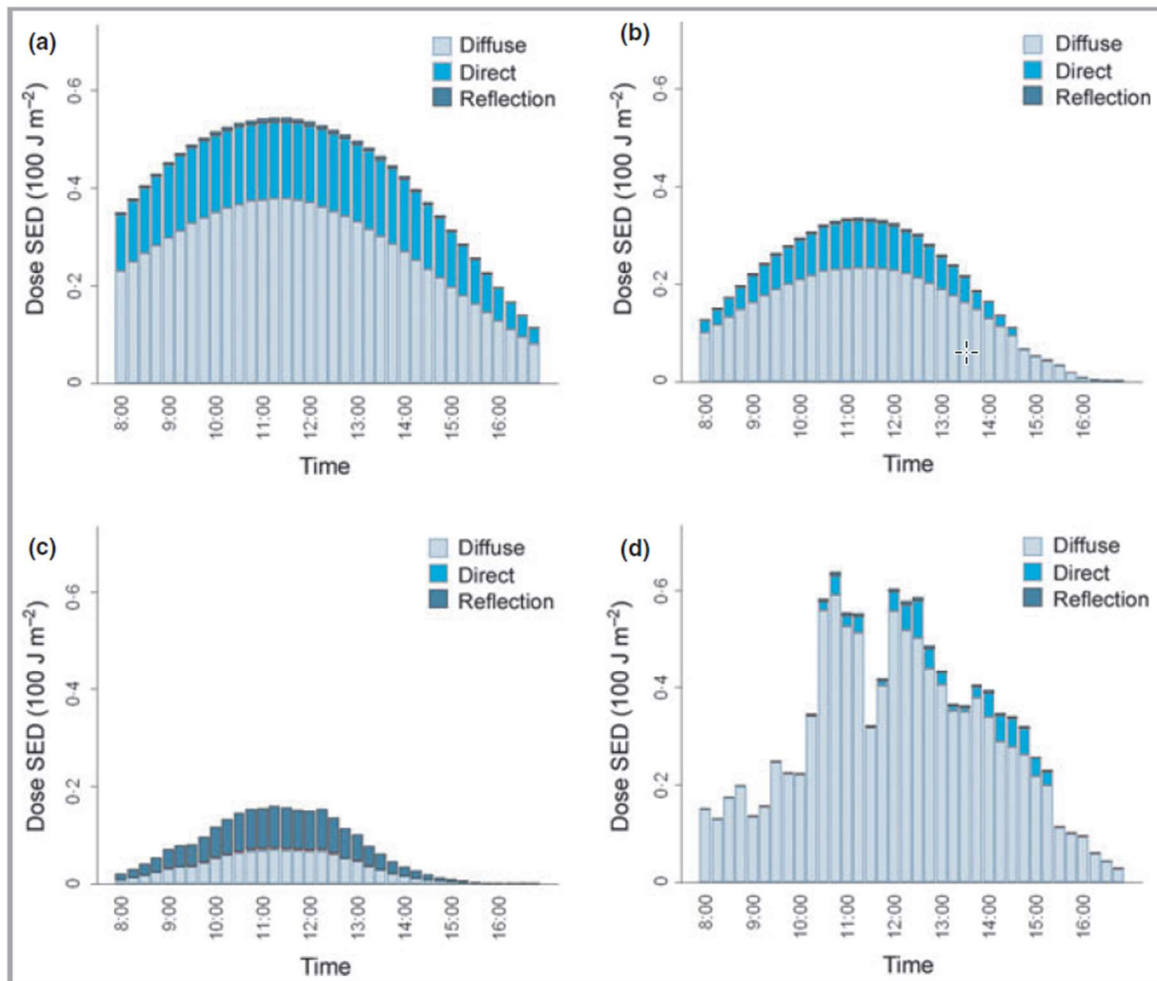
According to the occupational exposure limit values valid in Switzerland, the exposure level in the control room is quite acceptable (limit value 200 mT) and permanent workplaces can be installed in this room. This is not the case for the examination room, whose use must be limited to occasional interventions by personnel. If necessary, floor markings should be placed to indicate the areas where exposure is most intense. The 42 MHz radiation does not present any particular risk for the personnel (in good health).

The room will probably have to be closed to people with pacemakers or metal implants because of the strong static field.

In the same way, the introduction of metallic objects is to be prescribed to avoid mechanical risks.

2) Exposure profile

An exposure simulation was used to estimate the daily UV-erythema dose to the face of a construction worker on 4 different (typical) days of the year.



- What periods of the year and conditions correspond to Figures 1-4?
 - What are the chronic risks of such exposure?
 - Can you explain the reason for the small contribution of direct irradiation to the total dose?
 - What phenomena are responsible for the "reflected" exposure peaks in situation 3? What are the associated risks?
- 1 - sunny summer day, sunny autumn or spring day, 3 - winter day, 4 - cloudy summer day.
 - The estimated doses during the summer period generally exceed the thresholds recommended by the ICNIRP ($30 \text{ J/m}^2 = 0.3 \text{ SED}$). Chronic exposure, in the absence of adequate protection, can therefore lead to the development of carcinomas (BCC and SCC).
 - The diffuse component contributes largely to the ambient irradiance, so it is normal to find this tendency at the level of anatomical exposure. The face being a vertical surface, the importance of direct irradiation is attenuated because of the angle of incidence of radiation. This is even more pronounced outside the summer period.
 - This is due to the reflection from the snow surface. It poses a particular risk of eye damage because the radiation arrives from the ground (poorly protected eye).

3) Summer Grill

What prevention messages would be appropriate to protect these workers from solar radiation (construction work on a concrete slab)?



- a) Wear long-sleeved protective clothing and headgear.
- b) Work, as far as possible, on the ground and not on the concrete slab (soil reflection).
- c) Sunscreen could be used to protect parts of the body that are still exposed, but its use in a dusty environment is sometimes problematic.