Radiation protection areas: Practical aspects and technical implementation

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- Types of radiation protection areas
- Access to radiation protection areas
- Dose control
- Measurement systems

- Types of radiation protection areas (§ 36 radiation protection ordinance)

- Checklist:
  - Is a license required for the work to be done?
  - What´s the expected effective dose per year (2000 hours)?
  - What´s the expected organ dose for the eye lenses?

- What´s the expected organ dose for skin, hands, forearm, feet and ankle per year?
- How high is the dose rate in the working area?

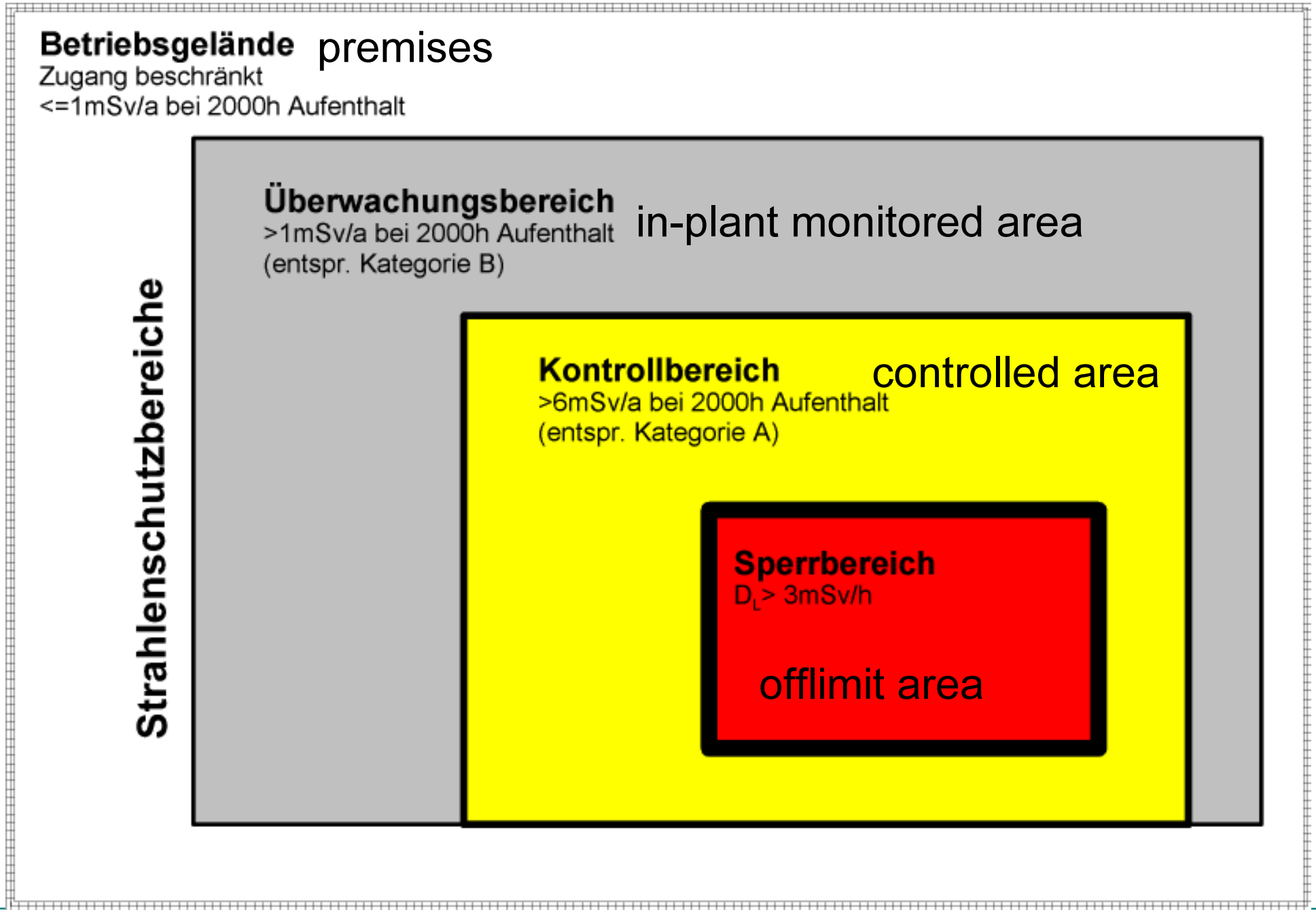
- a) Premises:
  - effective dose per year < 1 mSv
  - organ dose für the eye lenses per year < 15 mSv
  - organ dose for skin, hands, forearm, feet and ankle per year < 50 mSv

- b) Monitored in-plant area:
  - effective dose per year > 1 mSv
  - organ dose für the eye lenses per year > 15 mSv
  - organ dose for skin, hands, forearm, feet and ankle per year > 50 mSv

- c) Controlled area:
  - effective dose per year > 6 mSv
  - organ dose für the eye lenses per year > 45 mSv
  - organ dose for skin, hands, forearm, feet and ankle per year > 150 mSv

- d) Off-limits area:
  - part of a controlled area
  - dose rate > 3 mSv/h


SPERRBEREICH
Kein Zutritt
Radioaktiv
Vorsicht Strahlung
Kontamination


Betriebsgelände premises
Zugang beschränkt
<=1mSv/a bei 2000h Aufenthalt
Überwachungsbereich
>1mSv/a bei 2000h Aufenthalt
(entspr. Kategorie B)
in-plant monitored area
Kontrollbereich
>6mSv/a bei 2000h Aufenthalt
(entspr. Kategorie A)
controlled area
Sperrbereich
D_L> 3mSv/h
offlimit area
Strahlenschutzbereiche

- Clothing and zone regulatory at the research center

- Zone I:
  - premise („grey/blue“)
    - activity < exemption level
    - maximum surface contamination (10 x α + β) < 1 Bq/cm²
    - clothing: workwear


KONTROLLBEREICH
Radioaktiv
Vorsicht Strahlung
Zone grau
Betreten mit
grauer Dienstkleidung und
grauen Schuhen
oder mit
Privatkleidung mit
grauem Mantel und
Überschuhen
Brandschutztür
verkeilen, verstellen, festbinden o. ä.
verboten!


LDX

- Zone II:
  - monitored in-plant area and controlled area with low contamination risk („green/yellow“)
    - activity < 100 x exemption level
    - maximum surface contamination (10 x a + b) < 10 Bq/cm²
    - clothing: workwear with identification


Der Betriebsleiter
KONTROLLBEREICH
Radioaktiv
Vorsicht Strahlung
Kontamination
Zone gelb
Betreten mit
gelber Dienstkleidung und
gelben Schuhen
oder mit
grauer Dienstkleidung mit
gelbem Mantel und Überschuhen
oder mit
Privatkleidung mit gelbem
Mantel und Überschuhen

- Zone III:
  - controlled area („yellow“)
    - activity < 100 x exemption level and < licensed activity
    - maximum surface contamination (10 x a + b) < 100 Bq/cm²
    - clothing: yellow protective clothing

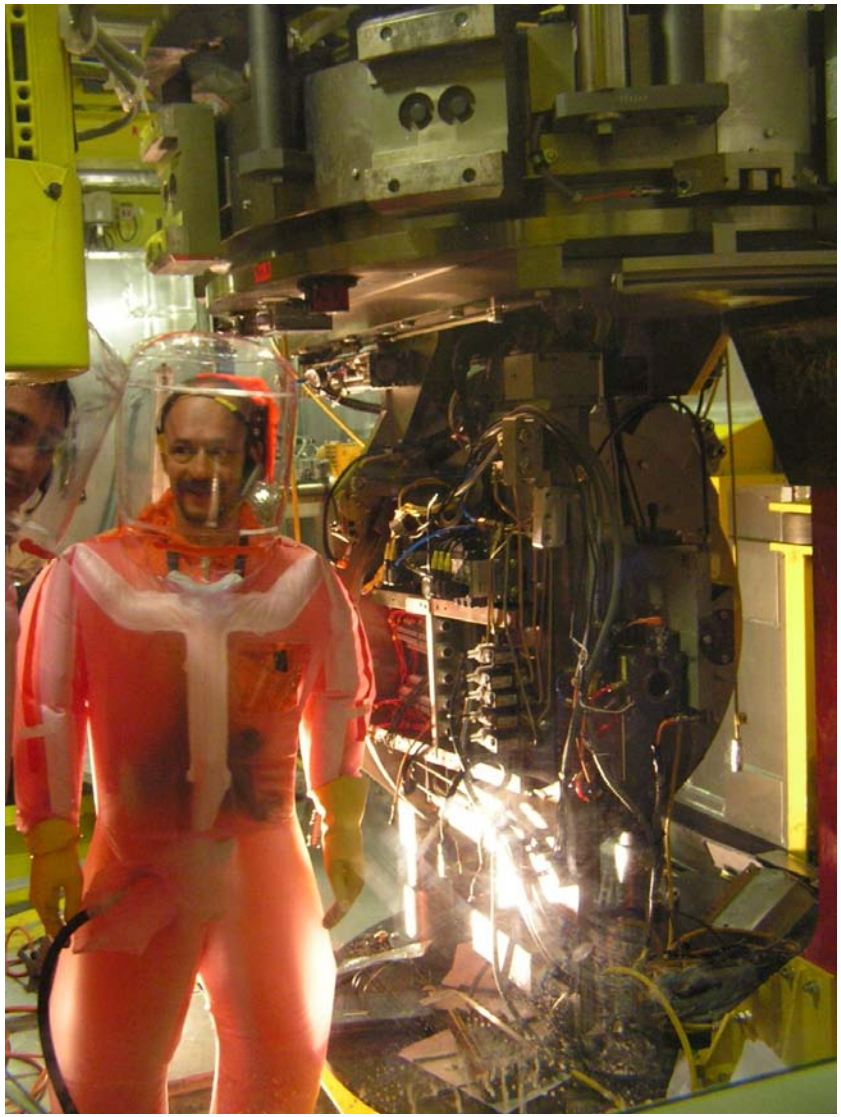

Brennbare
Abfälle
Vorsicht !
Kontamination
Radionuklid
Oberfl.-Kont.
Bq / cm²
Datum
Name
Vorsicht !
Erhöhte Strahlung
maximal
900
µ Sv / h
Datum
28.11.02
Name
HS/DM


ALZ
SPERRBEREICH
Kein Zutritt
KNK

- Zone IV:
  - contamination area inside a controlled area („red“)
    - activity < licensed activity
    - maximum surface contamination (10 x a + b) > 100 Bq/cm²
    - clothing: yellow protective clothing, overshoes, gloves or even more


TUERE
Vorsicht !
Kontamination
Radionuklid
Oberfl.-Kont.
Bq / cm²
Datum
Name


NATRIUM
3000 kg



- Categorization for free release

- Category 1: contamination is or was existent
- Category 2: contamination is possible
- Category 3: contamination is improbable
- Category 4: no contamination

- Access to radiation protection areas

- medical checkup (generally once a year)
- accumulated dose in the current year < 20 mSv
- accumulated live dose < 400 mSv
- personal dosimeter (official and non-official)

- in general: personal is „occupationally exposed to radiation“
- exception at the research center : „K-Person“
  - maximum dose per year: 1 mSv
  - only non-official personal dosimeter

- Dose control

official dosimeter

Personal non-official dosimeter


RADOS
ADR-1000 Lesegerät
220001
DOSIMETER EINSTECKEN

- Measurement systems

- Contamination control
- Dose monitoring
- Periodic inspection

- Direct and indirect contamination control

• Instruments for direct detection

Gas-flushed contamination monitor

Measurement area 166 cm²

Averaging area 166 cm²

2 versions:

butane-flow-type counter tubes with refillable gas reservoir

argon-methane counter tube to be filled in stations

- principle of measurement:
  - proportional counting tube
  - counting conductor (copper)
  - counting gas
  - high voltage

Contamination monitor with plastic scintillator

Measurement area 170 or 300 cm²

Averaging area 170 or 300 cm²

- principle of measurement:
  - scintillation counter
  - flash of light because of ionisiation
  - photomultiplier


CONTAMAT
C.FH.557
FHT 111M
FAG

- indirect detection

-characterization of a workplace

-only non-adhesive contamination

-smear factor about 10 %

-analysis by low-level measurement

- Dose monitoring

-so-called „brick“

-Geiger-Müller-counter

-measuring range !

-speaker

- Teletector

measuring range: 0,5 µSv/h - 9,99 Sv/h


Vorsicht
Erhöhte Strahlung
R20
MS 3016641/0

- scintillation tube

easuring range: 50 nSv/h -
9,99 µSv/h

- Periodic inspection

- a) visual inspection
  - control of battery voltage
  - background measurement
  - inspection of the foil

- b) measurement check
  - comparison of demand value and actual value
  - cross-sensitivity (effect in beta channel when measuring alpha source)

Thank you for your attention!