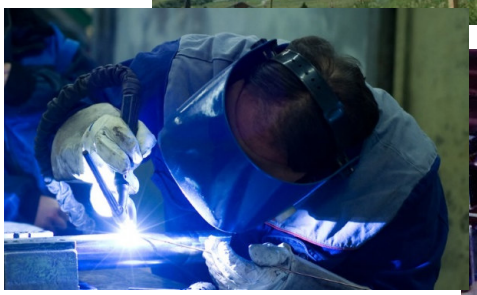
Justification in the industry



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Mehr als eine Versicherung

Michel Hammans
KSR Workshop, April 7, 2017

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Requirements

ICRP 103: Justification

The process of determining whether either (1) a planned activity involving radiation is, overall, beneficial, i.e. whether the benefits to individuals and to society from introducing or continuing the activity outweigh the harm (including radiation detriment) resulting from the activity; or (2) a proposed remedial action in an emergency or existing exposure situation is likely, overall, to be beneficial, i.e., whether the benefits to individuals and to society (including the reduction in radiation detriment) from introducing or continuing the remedial action outweigh its cost and any harm or damage it causes.

Requirements

Radiological Protection Ordinance (1994): Justification (Art. 5)

[1] An activity is justified within the meaning of Article 8 of the Radiological Protection Act (RPA) if the associated benefits clearly outweigh the radiation-related drawbacks and no alternative not involving radiation exposure is available which would be more favourable overall for humans and the environment.

[2] Activities involving ionising radiation that give rise to an effective dose of less than 10 µSv per year for the persons concerned are deemed to be justified in any event.

Requirements

Draft of the new Radiological Protection Ordinance (external hearing): Justification (Art. 3)

An activity is justified within the meaning of Article 8 of the Radiological Protection Act (RPA) if the associated benefits clearly outweigh the radiation-related drawbacks and no alternative not involving radiation exposure or with less radiation exposure is available.

Applications in the industry

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How to evaluate the justification of an application?

- During the processing of applications for a licence
- New applications:
  - The applicant has to show the justification
- Existing applications:
  - Periodic review
- Support:
  - Foreign authorities
  - HERCA WG on Justification & Optimisation of non-medical sources and practices
  - Expert associations
  - Producers

Factors to be considered

- Exposition of the workers
- Exposition of the population
- Exposition of the environment
- Production – use – disposal of a radioactive source

What is going to be evaluated?

- Justification of the application of ionising radiation
- Justification of the application of radioactive sources
  → possibility to use ionizing radiation generators

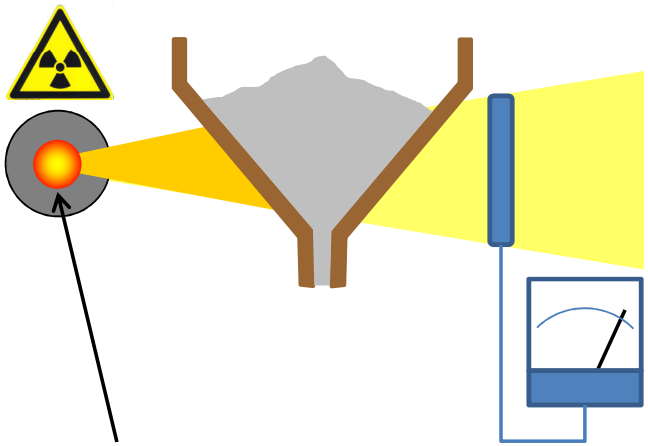
- Justification of a remedial action in an existing exposure situation (legacies)
  → in collaboration with FOPH which has the lead

Elements stimulating the search for alternatives

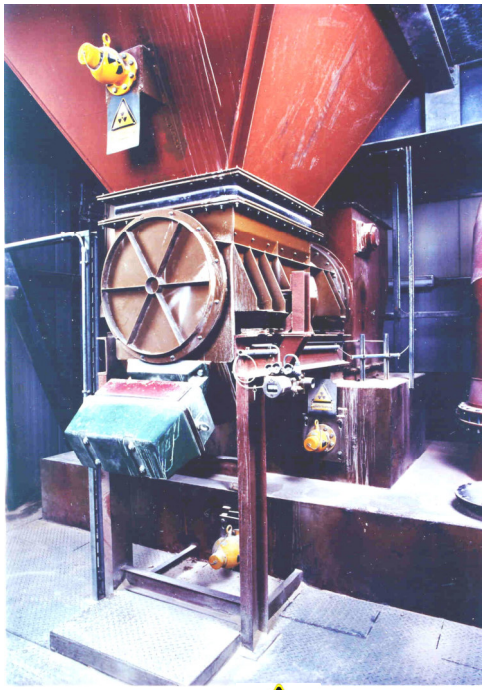
- Legislation
- Authorities
- Economic reasons
- Ethical motivation

Example: Measuring and control technology

Level gauging
Thickness gauging
Density gauging
Moisture gauging



γ: Co-60, Cs-137, Am-241
X-ray systems
β: Kr-85, Sr-90, Pm-147
n: Am-241/Be-7



Alternatives:
Radar
Ultrasonic
Differential pressure
Hydrostatic
…

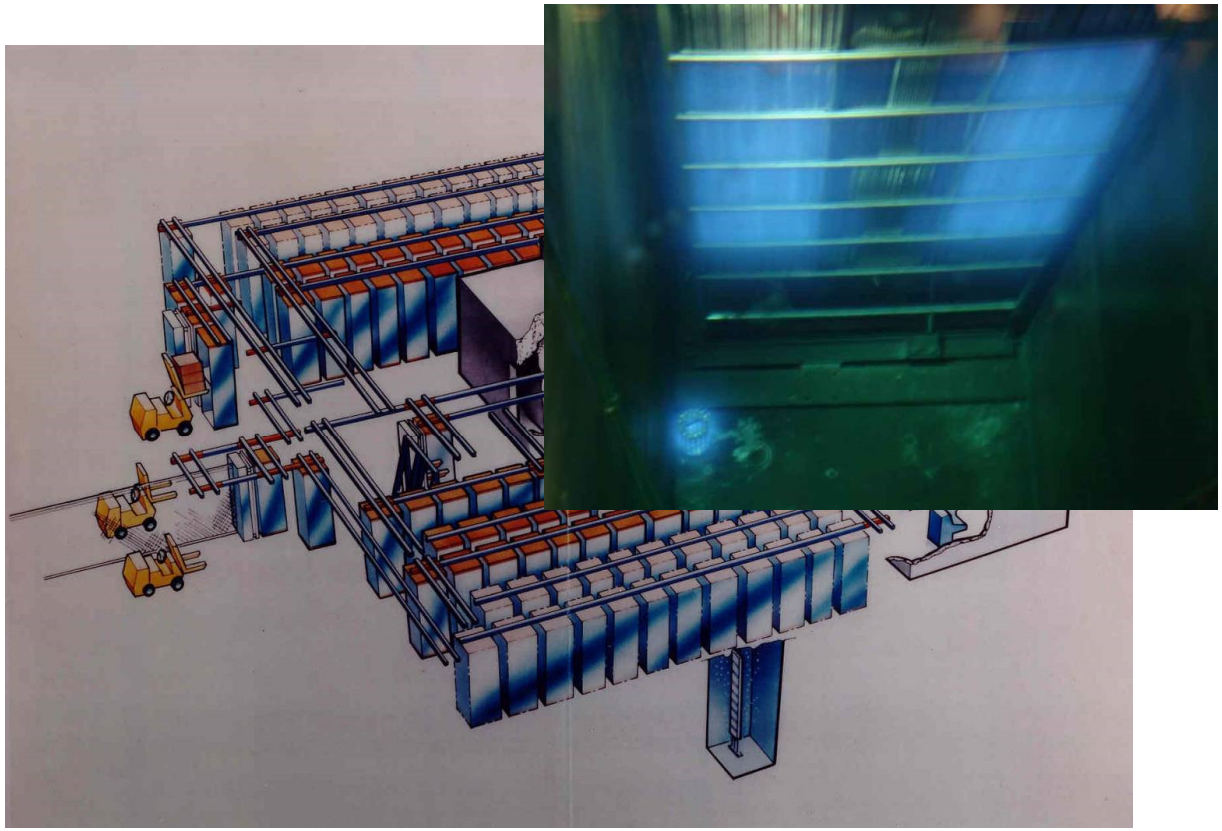
Benefits:

- Non-contact measurement → reliable for extreme process and ambient conditions
- Continuous
- Precise

Example: Measuring and control technology Conclusion

- Producers/commercants of systems in the field of measuring and control technology generally are aware of the principle of justification
  → if an alternative is possible, it is offered.
- New alternative technologies are continuously developped. As supervisory authority we push the use of these technologies in the licensing procedure. Examples:
  - Density mesurement of tobacco in the production of cigarettes:
    Microwaves instead of Sr-90
  - Level gauging in the beverage industry:
    X-ray systems instead of Am-241
  - Moisture measurement:
    Microwaves instead of Am-241/Be-7

Example: Sterilisation of medical and pharmaceutical products



Co-60 (γ) 90 PBq

Dose > 10 kGy

Accelerator of electrons
(E ~ 100 - 7000 keV,
I ~ 9 - 100 mA)

Benefits:

- Reliable
- No heat damage
- No residues
- Sterilisation through final packing material

Alternatives:
Heat, steam, gas, chemical washes…

Example: Sterilisation of medical and pharmaceutical products, observations

- Development of new powerful accelerators makes it possible to use accelerators instead of Co-60.
- Difficulties in getting the confidence of the clients.

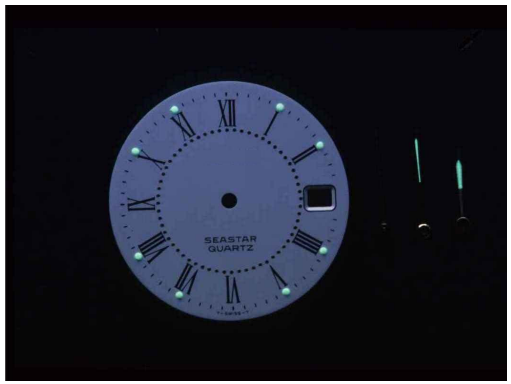
- Blood irradiators:
  Use of X-Ray systems instead of Cs-137

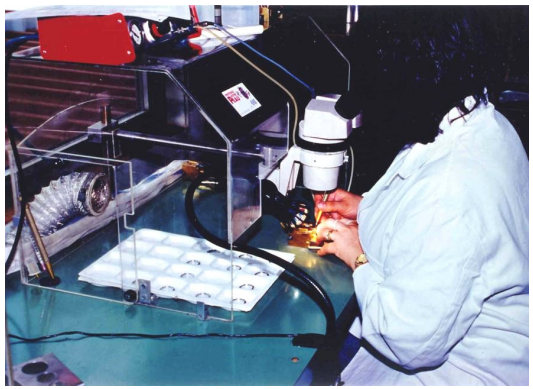
Example: Watches with radioluminescent paint

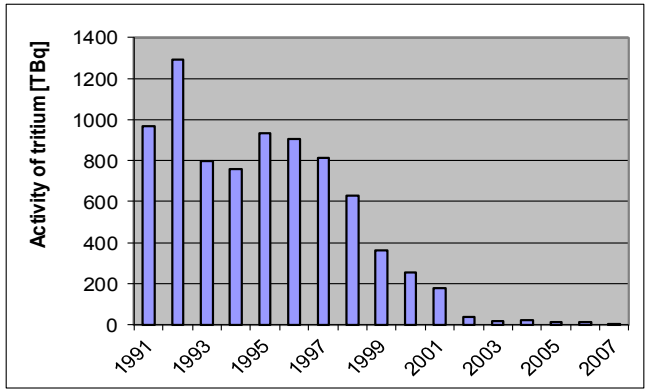
- Application of radioactive luminescent paint in watches has a long tradition:
  ~ 1910 - 1965 Luminescent paint with radium
  ~ 1963 - 2008 Luminescent paint with tritium
- High doses accumulated by the dial painters
- ~ Since 1990 alternative luminescent paint with sufficient performance came into the market
- Rethinking in the watch industry about the use of radioluminescent paint started "accompanied" by the authorities

  → No more radioluminescent **paint** is applied in watches

- Watches with gaseous tritium light sources are still produced







Example: Ionisation smoke detectors

- In Switzerland ~ 1.4 Mio. detectors with radioactive sources (2006)
- Am-241 (15 kBq – 5 MBq)
  older systems with Ra-226 (700 kBq – 1.3 MBq)
- Producer in Switzerland
- Homologation of ionisation smoke detectors in a fire alarm system
- Development of reliable detectors based on an optical principle
- Production stopped end of 2000, homologations not renewed
- Continuous replacement
- Difficulties in collecting detectors not used anymore

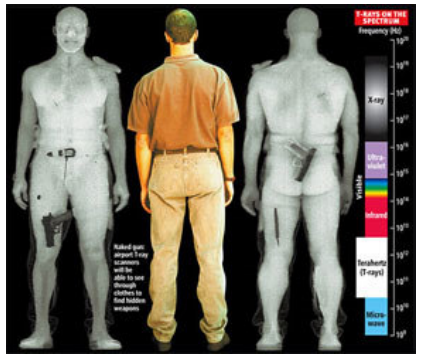
Example: Non destructive testing

- Radioactive sources with high activities (Se-75, Ir-192, Co-60: ~3.7 TBq)
- Irradiation rooms ⟷ Mobile applications
- Elevated risk on mobile applications with radioactive sources out of control
- Alternatives without ionising radiation:
  - Testing procedures for surfaces (visual inspection, penetrant testing, magnetic particle testing, eddy current testing)
  - Testing procedures for volumes (ultrasonic testing)
- Alternative radiation sources:
  - X-Ray Systems
  - Accelerators

Example : Non destructive testing, observations

- The different testing methods have different sensibilities, advantages and disadvantages. They are not concurring but supplementing.
- An alternative use of X-ray systems/accelerators is often not possible due to the location of the testing object.
- Non destructive testing with high activity sources is justified
- Due to the legal restrictions enterprises choose by themselves an option without ionising radiation if it is possible.

Example: Bodyscanner



- Growing need for a better security check on airports
- Controls with metal detectors and by body check are not sufficient
- Use of bodyscanners is taken into account
- Two principles of backscattering procedure:
  - X-ray radiation (dose per check ~ 0.2 µSv)
  - Terahertz radiation
- Bodyscanners are used in some countries
- Tests in Switzerland were not satisfactory → no bodyscanners are used
- Developement of the technology is going on
- Discussion of the justification will have to be resumed between different authorities
- Security and safety aspects, protection of data and harmonisation of security level have to be taken into account.

- Justifcation of bodyscanners in other critical places?

Conclusions

- Verification of the justification of applications with ionising radiation in the industry is an ongoing process
- Continuous effort and pressure is needed
- Inclusion of the manufacturer is more constructive than pure prohibitions

Thank you for your attention