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Licensing unconventional accelerator projects: a quest for the safest compromise.

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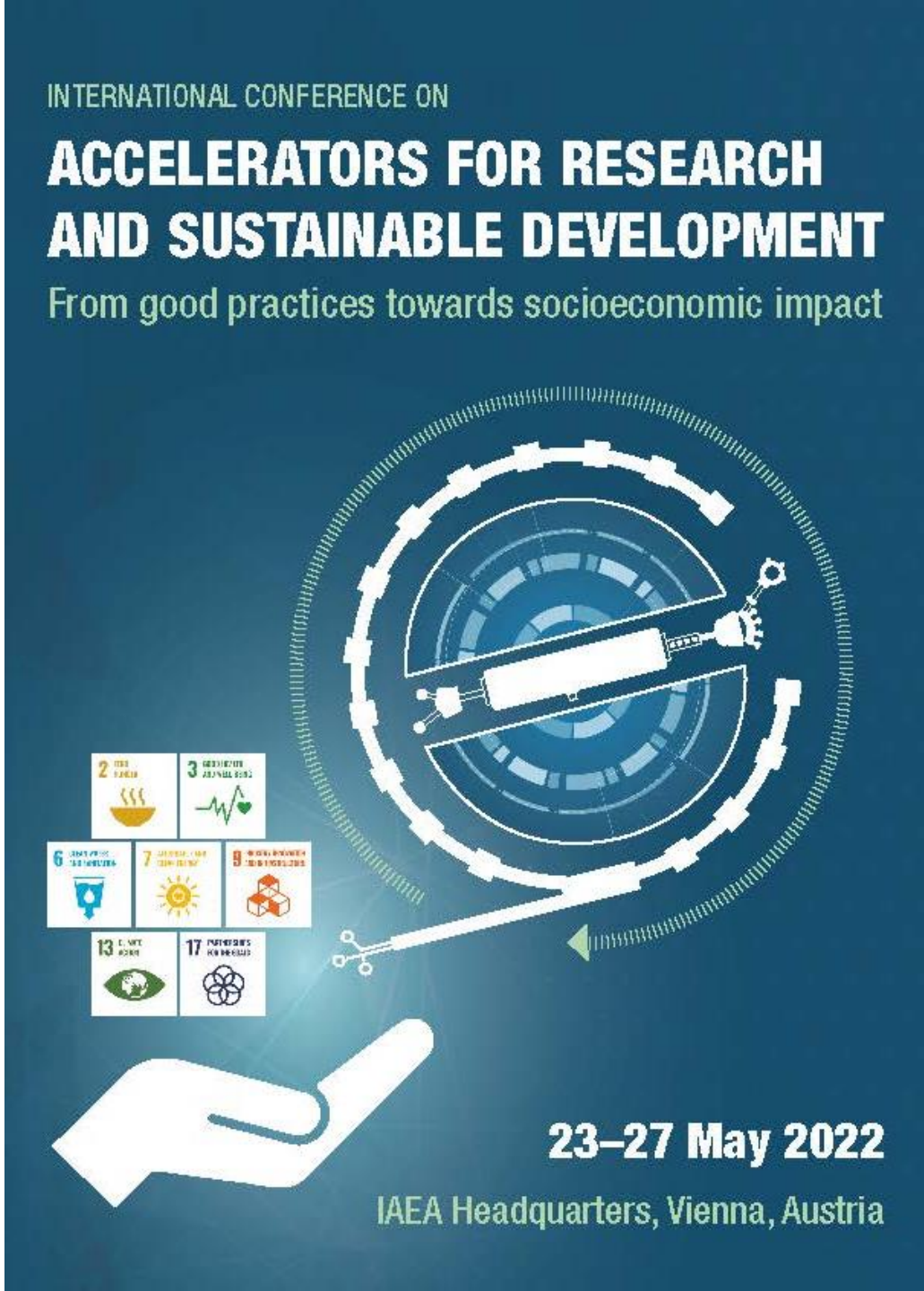

Content

Royal Decree of 20 july 2001

- Class I (certain amount of fissile material on licensee site)
- Class II :
  - facilities producing or conditioning radionuclides from irradiated fissile substances ;
  - particle accelerators ;
  - facilities containing high activity sources (irradiators, ...) ;
  - nuclear medicine department;
  - X-rays generators with nominal peak voltage > 200 kV ;
  - ...
- Class III > out of scope
- Class IV > out of scope

Class II facility definition covers an heterogeneous group :

- between irradiators giving lethal dose in fractions of seconds,
- and laboratories handling 50 MBq ^{131}I.

Evolution Class II > Class IIa

- Evolution of the regulatory framework for Class II facilities was in the air but this was the trigger to the improvement of the safety requirements of some installations
- The lawsuit conclusions of the Sterigenics accident speeded up the process
- Organize an internal Health Physics department ;
- Formalize in procedures approved by HPD and the regulatory body:
  - the facility modifications management ;
  - Periodic inspections of Bel V for class 2A;
  - the events declaration process to the authorities.

Class II > Class IIA License supported by a safety report

- Chapter I : Introduction
- Chapter II : Site characteristics
- Chapter III : Description of the installation and the process
- Chapter IV : Radiological impact
- Chapter V : Safety functions
- Chapter VI : Waste management
- Chapter VII : Radioprotection
- Chapter VIII : Organization
- Chapter IX : Technical specification
- Chapter X : Dismantling
- Chapter XI : Internal emergency planning

New technical challenge : is the regulatory framework still adapted ?

- Unusual applications of accelerators
  - Smart : https://www.ire.eu/en/media-room/smart-takes-critical-step-towards-the-production-of-medical-isotope-mo-99-without-uranium
  - Minerva/Myrrha:https://www.sckcen.be/en/our-scientific-projects/myrrha
  - Nura : https://www.sckcen.be/en/projects/nura
- Use of an accelerator as alternative to nuclear reactor “classical” radioisotopes production routes
- Use of an accelerator as a way to control the amount of the neutrons to drive nuclear fission
- Hybrid systems like Accelerator Driven Systems (ADS).

Illustration of the problems encountered by the regulator

- Scaling up of a R&D concept to an industrial production
- Calculation codes poorly benchmarked (e.g. activation of component)
- ADS
  - Class I or Class IIa ?
  - accidents considered minor on an accelerator alone can become major once this accelerator is coupled to a reactor
- Evolution of the design based on R&D results during licensing phase?
- Uncommon waste generation
- Dismantling is always a challenge for this type of new installations
- Poor REX because this type of project is rare
- External hazard usually not really taken into account for a « classical » accelerator
- …

Future and Conclusion

- 10 years ago, the heterogeneity of the authorized class II facilities led to define the subclass IIA (irradiators, particle accelerators, radionuclides producers, ...).
- Enhanced safety requirements were requested from these Licensees (internal HPD, SAR, approved procedures, ...).
- For unusual applications of accelerators, we don‘t have to apply guidances developped for Class I installation :
  - building follow-up;
  - guidance to estimate the impact of external hazard;
  - ...

References

Belgian class II nuclear facilities such as irradiators and accelerators: Regulatory Body attention points and operating experience feedback
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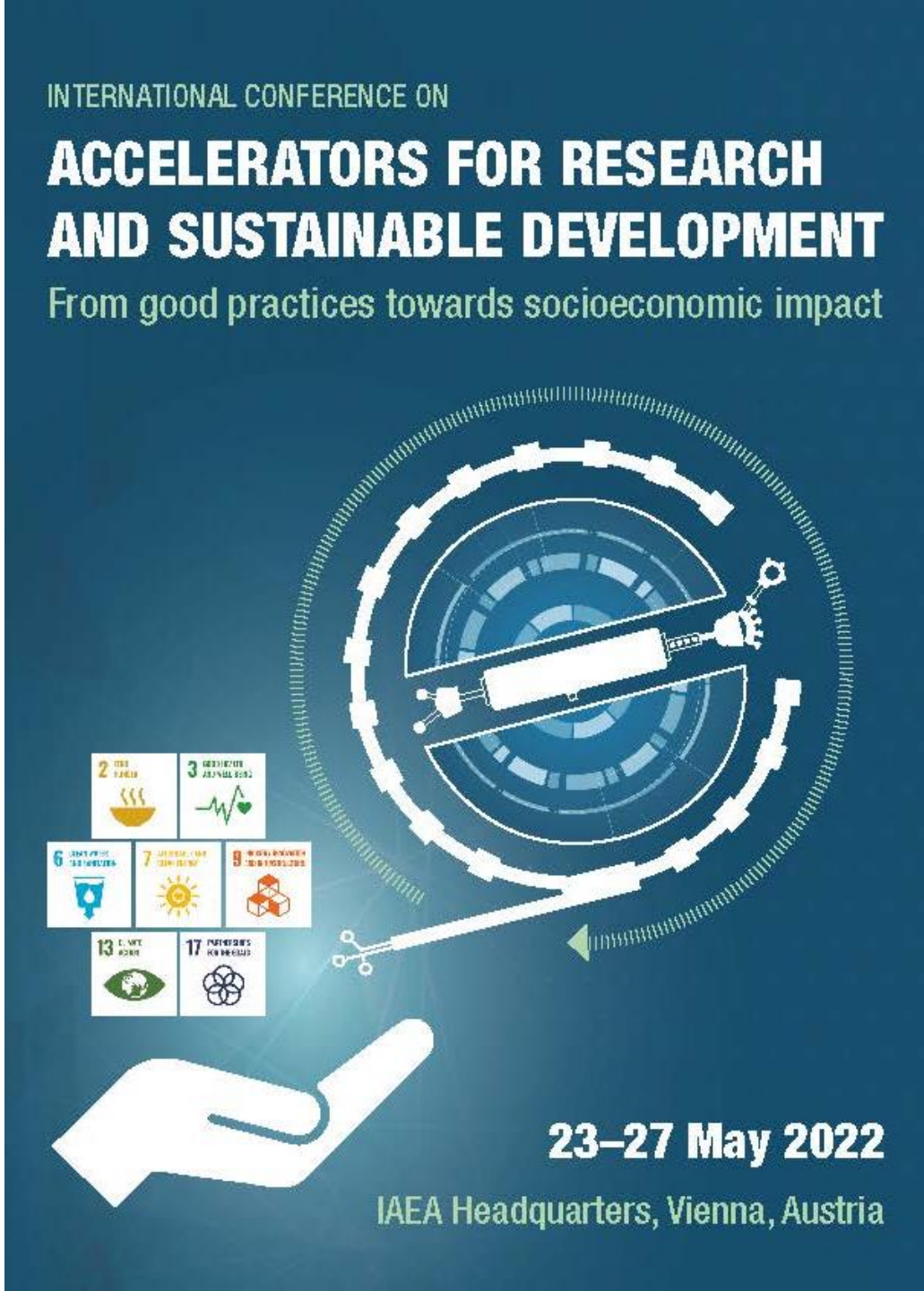
Thank you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