

LICENSING UNCONVENTIONAL ACCELERATOR PROJECTS: A QUEST FOR THE SAFEST COMPROMISE

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This In recent years, technical exchanges have taken place between operators and the Belgian regulator, FANC^[1] (Federal Agency for Nuclear Control) and its technical subsidiary Bel V^[2], concerning unusual applications of accelerators^{[3],[4],[5]}. These projects imply the use of an accelerator as alternative to classical radioisotopes production routes, or the use of an accelerator as a way to control the amount of the neutrons produced by nuclear fission. They have been designed for various reasons, including an insufficient production capacity for critical radioisotopes used in medicine for the therapy or an alternative production of well-established radioisotopes used for diagnostic in aging installations.

These special projects represent a challenge for the regulator who must find in the existing legislative corpus the best way to license them^[6]. This is particularly important on hybrid systems like Accelerator Driven Systems (ADS).

From a purely technical point of view, the regulator also has to overcome several issues.

The concepts and designs presented to the regulator are new and essentially based on small-scale research and development (R&D) projects. The scaling up of the results from this research has been done with calculation codes and models sometimes poorly benchmarked. Hence, the validation and verification of these models, sometimes developed internally by the operator, is a challenge. On the other hand, since the project is still in the design phase when the first discussions with the regulator take place, it is not uncommon that as the project evolves, major revisions of the basic design are proposed by the operator, rendering obsolete the safety analyses already performed.

There are also many questions, for instance about the definition of reference accidents. Again, this is particularly the case with ADS, where accidents considered minor on an accelerator alone can become major once this accelerator is coupled to a reactor.

The intensive irradiation of targets of unusual design also raised many questions regarding their cooling and the final management of the radioactive waste that will be generated. A thorough characterization of the irradiation parameters as well as the introduction of appropriate interlocks in the machine control system must be evaluated. In terms of decommissioning, the legislator wants these unusual accelerator applications to incorporate, wherever possible, the improvements that have been made by "traditional" industrial accelerators suppliers to reduce facility activation.

Finally, the external feedback (return of experience = REX) from accelerators similar to the project that has to be licensed is often weak and poorly documented. It may be useful to establish relations with regulators in foreign countries that have already licensed similar facilities.

Because of the above issues and the uncertainties that characterize such type of project, the regulator needs to develop a flexible and graded approach to licensing. This approach implies making trade-offs with the licensee in which operational and nuclear safety always remain the priority.

REFERENCES

- [1] <https://fanc.fgov.be>
- [2] <https://www.belv.be>

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- [6] Belgium Royal Decree of 21.07.2001.