

Translation from Czech

SUJB

Prague, January 27, 2022

Further to your request for background research on the development of small modular reactors (SMRs), I would like to inform you of the following.

The State Office for Nuclear Safety SUJB in its capacity as a central governmental body, is actively involved in the international development of small modular reactors. For example, it is currently applying for membership in the SMR's Forum, in working groups under the auspices of the IAEA, is involved in the activities of the European Commission in this field (in particular, the establishment of a steering committee on this matter is under consideration), and cooperates with national authorities, e.g. the MPO, the Ministry of Trade and Industry. Involved in the Assessment of technical issues is SUJB, SURO - State Institute for Radiation Protection. Bilateral international cooperation in this field has been initiated by SUJB e.g. with Canada, but it also uses older bilateral platforms, e.g. with the USA, Finland, etc.

However, the amount of information and the depth of the information is currently very limited. Small modular reactor manufacturers have not yet reached the production stage (only 2 projects, currently undergoing official assessment process in the US and Canada) and do not provide detailed information on their projects. Therefore, mostly only general information is available, which is published for their promotional activities in publicly available sources.

The most accessible information is on reactors of more traditional designs, light water reactors. For these reasons, the activities of SUJB in this field are still limited and conceptual and cannot be devoted to detailed assessment of specific projects and technologies or the preparation of relevant regulatory changes.

However, all the information available to SUJB is continuously used to analyse the situation and is taken into account in the planning of the Authority's future activities, including legislative.

For these reasons, the Authority is unfortunately able to answer your questions so far only in general terms, without dividing the answers according to specific technologies. Regarding resources of information, SUJB is forced to refer you to publicly available sources, e.g.:

<https://www.iaea.org/topics/small-modular-reactors/smr-regulators-forum>

<https://www.nuscalepower.com/>

<https://www.rolls-royce.com/innovation/small-modular-reactors.aspx#/>

The following are outline answers to your questions.

General questions on SMRs

1) Do you think that the SMR concept could create a different organisational model for

and implementation compared to large nuclear units?

Yes. Some of the technologies outlined will imply changes in the life cycle of nuclear facilities that will no longer be fully compliant with current licensing regime under § 9 of the Atomic Energy Act. E.g. the anticipated replacement of entire units/reactors through turnkey delivery and their mere installation in an existing facility, or the serial nature of nuclear reactors. Such technology units will not be subject to usual construction or decommissioning, which will likely need to be reflected in the legislation.

2) Do you foresee differences in terms of nuclear safety and radiation protection for the operation of several SMRs at a single site compared to the operation of a single SMR large reactor? Has the SUJB requested specific safety data on this yet?

The operation of multiple nuclear installations on a single site always represents, from the point of view of nuclear safety and radiation protection, there is a need to reflect on the synergies and relationships between them, so some differences from the operation of a single nuclear installation are to be expected. These are not necessarily negative.

Specific safety data are not currently available because the technology is still at too early a stage of development.

3) What type of SMR would you see as suitable for use in the Czech Republic?

In view of the limited information on the technology, the suitability of from this point of view. However, it is always possible to consider as more appropriate the type of technology that applies a conservative approach and builds on practice-proven procedures.

Licensing

To our knowledge, no special licences have been created till now for international security standards for SMRs.

4) Is the SUJB already working on the development of safety standards at national level? Do you consider the development of such safety standards necessary? If so, how long will it take until they can be applied in the Czech Republic?

SUJB has prepared a preliminary indicative analysis of the laws and decrees relevant to the potential licensing of small and medium-sized nuclear reactors in the Czech Republic with identification of areas of necessary modifications to streamline deployment nuclear power sources, specifically SMRs, in the Czech Republic. This analysis focuses on the Czech nuclear law. This analysis shows that some of the legislation is so general that it can be applied to SMRs, part of the legislation requires substantial modification, in particular in the area of the facility's design and its operation. The basic principles of nuclear safety and radiation protection must be respected. In the field of radiation protection, major changes are not likely to be expected, as the requirements for workplaces, workers

and their monitoring (including discharges and the environment) are apply regardless of the technology used.

In order to develop any safety standards, it is essential that they are accessible information on the technology they are intended to standardise. This is also true for any other standards, not excluding generally binding legislation. For this reason, for the time being, SUJB is not in a position to prepare national safety standards. For the latter, there tend to be (must be, to avoid deviations) the starting point for international standards, which, as you rightly point out, do not exist either. As soon as the information is available and international international standards are available, the SUJB will proceed with their national adaptation.

In addition, a number of decrees are largely responsive to international and European commitments and in this respect are mainly transposition in nature and the amendment of these decrees will only be possible after the transposed and transposed and implemented provisions of the relevant European or international documents level. These implementing regulations include, for example, decrees regulating details of non-proliferation rules (e.g. Decree No 374/2016 Coll., on the registration and control of nuclear materials and notification data on them), as well as Decree No 379/2016 Coll. on the type approval of certain products in the field of peaceful uses of nuclear energy and ionizing radiation and transport radioactive or fissile material.

The preparation of the corresponding national standards may then be a matter of a several years.

5) In your opinion, what new aspects could be brought to the SMR licensing process compared to conventional large reactors?

The technologies outlined bring a number of revolutionary solutions, although it is questionable, how realistic they are. If they are implemented, the licensing process may will require some exemptions for certain types of SMRs. Framework-wise, the licensing regime will remain the same, but the serial and standardised nature of SMRs may lead to some steps (as mentioned above - construction, commissioning, decommissioning) will be simplified or replaced by other forms of licensing (e.g. certification/approval type of design and subsequent assessment of individual reactors' conformity).

However, at the moment, this is only a framework and speculation.

6) Do you think that SMR licensing could be done in some simplified form that could lead to increased efficiency and a shorter licensing process?

It cannot be said unequivocally that the licensing process would be simplified. Some stages of the lifecycle could be virtually eliminated, but it is possible that completely new types of decisions/licences (e.g. reactor unit replacement, refurbishment, fuel exchange/outage for re-fueling, etc.) will be created.

7) Do you think that SMRs that are not of the light-water type could be licensed by SUJB in within a few years and, if so, on the basis of what evaluations and experience? They are already for these types of SMRs, with which there is no operational or licensing experience, testing and licensing methods ready?

No. According to the available (very limited) information, projects of this type are not yet at stages close to implementation and commercial deployment.

8) Some technical solutions imply a simplification of the design, for example consider designs without containment. Is your authority considering the possibility of reducing the requirements for design for SMRs compared to those required for conventional light water reactors? Is SUJB already working on a review of these requirements? If yes, what timeframe do you anticipate for such a review and the development of new rules, if taking into account the current staffing capacity of your office?

If the technological solution would not require some of the traditional design requirements, while maintaining a level of safety, then it would not be justified to require them. This would also require a change in legislation if it provides for the relevant obsolete requirement unconditionally.

The JRC, for the reasons stated above, is working on such analyses in the meantime conceptually. The preparation of appropriate legislative amendments may then be a matter of a few years.

9) Another important differentiating factor from LWRs may be the use of fuel rods without protective barriers. This would apply to reactors using molten salt. They are already new licensing rules developed or in the works? If so, by when do you expect them to be finalized?

See answer to question 4.

10) Would an SMR using plutonium as fuel be conceivable for you in the Czech Republic?

See answer to questions 3 and 4.

11) Do you anticipate that the scale of any event or accident considered in licensing of conventional reactors will differ from the licensing process for SMRs? Do you consider that risks with external causes -such as earthquakes, floods, terrorist attack or sabotage should be assessed in a different way in the case of SMRs? Could for example, sites for the construction of SMRs be assessed with less rigour for this type of events?

According to the available information, the main asset of SMRs should be the high level of passive and other security compared to conventional technologies. If a new technology exhibits such features, the likelihood of these accidents is likely to be lower and the relevance of the current legal requirements should be considered.

in this respect. However, in many cases it may be assumed that the requirements will remain the same (an accident should always be excluded in such a manner, that it is unlikely), only in the case of SMRs will be easier to fulfil.

Emergency preparedness

12) Do you have information on the existence of an assessment that indicates the ability of the SMR to operate either with a very reduced emergency planning zone or with no emergency

planning zone at all? Alternatively, that the SMR can in principle be located and operated anywhere as a flexible "plug and play" resource?

Yes. Some SMR concepts assume such approaches. In this respect, it is close to e.g. research nuclear facilities, which do not pose such a radiation risk to require an emergency planning zone. This does not exclude the possibility that the facility must undergo an appropriate assessment and be shown to have a radiation accident(s) cannot occur with a specified probability. It can be assumed that even in this case there would not be any reduction in the legal requirements, but rather it would be easier for the SMR to comply with them.

We would be happy to provide follow-up information in case of further developments.

Sincerely,

Signed electronically