

SMALL MODULAR REACTORS TO DECARBONIZE THE INDUSTRY: THE IMPACT OF NUCLEAR LIABILITY*

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Abstract

Nuclear liability is a special regime that was adopted to ensure an adequate compensation of potential victims having suffered nuclear damage caused by a nuclear incident. It should also be considered when developing an SMR project to decarbonize industrial activities, as it will have an impact on the financial scheme, risk allocation and structure of the project. Among the provisions of the nuclear liability conventions that would apply, the following are the most important ones:

- the definition of "**nuclear installation**": an SMR will be qualified as such, whatever its size and capacity. Determining the site of the nuclear installation is also crucial as nuclear liability only compensates off-site damage.
- the definition of "**operator**": the operator is not automatically the licensee, other entities may bear the nuclear liability based on a number of criteria. It is also important to note that SMR vendors will have different approaches, as some expect to own and operate the reactors, while others will sell them to third parties who will take over or outsource the operator's role.
- the definition of "**nuclear incident**": if damage is caused jointly by an incident taking place at the nuclear installation and at the industrial site, the nuclear liability conventions will determine who will compensate the victims. The siting of the SMR will be important to avoid such situation and to comply with the safety requirement applicable to both the SMR and the industrial site.
- the definition of "**nuclear damage**" determines the financial consequences of an incident or of preventive measures.

Finally, SMRs could be considered as low risk based on the safety assessment and other criteria. If that were the case, the operator would benefit from a lower nuclear liability and insurance amount. It may also allow more alternatives to the nuclear insurance pools.

1. INTRODUCTION

When discussions were held to launch the development of nuclear power after World War II, the industry and the public raised concerns about the potential consequences a nuclear accident could have. The governments had to develop a specific regime to adequately compensate the victims while allowing the industry to contribute to the development of the new sector without putting them before an unbearable risk. This led to the establishment of a special regime that has since applied to the nuclear power sector.

In the context of common tort law, it is up to the victim to prove (i) the existence of a damage, (ii) the fault, negligence, or recklessness of the alleged liable person, as well as (iii) the causal link between the act of the person alleged to be liable and the damage suffered.

Due to the technical complexity and the number of entities participating to the construction and operation of a nuclear power plant, it would not be beneficial for the different organisations involved to apply common tort law. It would be extremely difficult and time-consuming for a victim to identify the exact cause of a nuclear accident and the organisation responsible for causing the accident. The victims, as well as the operator and the suppliers would spend years in litigations to determine the entity that should compensate the victims for the damage caused, especially in case of transboundary damage as the competent court and the applicable law should also be determined.

2. THE INTERNATIONAL FRAMEWORK APPLICABLE TO NUCLEAR LIABILITY

In order to protect the interests of the various stakeholders involved (the public, the operator and the suppliers) and to enable the development of nuclear power, the States decided to establish a special liability regime that would apply only to risks that would be considered “exceptional” because of the radiological risk involved, the geographical reach of the accident (transboundary risks) and the lack of regular insurance to cover such specific risk (insurance policies usually provide for a nuclear risk exclusion clause).

The Paris Convention on Third Party Liability in the Field of Nuclear Energy was adopted in 1960 (the “Paris Convention”) under the auspices of the Organisation for Economic Co-operation and Development (“OECD”). At the time this convention was only open to OECD member countries (which is not the case anymore), therefore the International Atomic Energy Agency (“IAEA”) adopted a very similar convention in 1963: The Vienna Convention on Civil Liability for Nuclear damage (the “Vienna Convention”) that was open to all the States members of the United Nations.

After the 1986 Chernobyl nuclear accident, States sought to strengthen the legal regime of civil nuclear liability based on the lessons learned from that accident, which demonstrated among other issues, the risks and consequences of transboundary damage, and the nature of the damage that could be caused (including to the human body, the economies, and the environment). In 1997, the Protocol to amend the Vienna Convention was adopted (the “Revised Vienna Convention”) with the particularity that a State may accede to the Revised Vienna Convention without being a party to the 1963 Vienna Convention. Accordingly, in the event of transboundary damage caused by a nuclear accident occurring in a State which is a party to the revised Vienna Convention, that Convention will apply in its relations with the parties to that Convention, and the 1963 Vienna Convention will apply in its relations with States that are parties only to the 1963 Vienna Convention. The two Vienna Conventions (the 1963 Vienna Convention and the Revised Vienna Convention) co-exist and a State may accede to either or both. This is not the case with the Paris Convention, the many amendments of which have been incorporated into the body of the text. The current Paris Convention incorporates the amendments made by the Additional Protocol of 28 January 1964, the Protocol of 16 November 1982 and the Protocol of 12 February 2004.

Finally, a last Convention was adopted in 1997: The Convention on Supplementary Compensation for Nuclear damage (the “CSC”). This convention aims to be the only one applicable at the international level in the future, and therefore allows for States parties to the Paris and Vienna Conventions (revised or not) to adhere to it, as well as States that are parties to none of them.

All these conventions provide for the same nuclear liability principles, as it was considered essential to harmonise the different regimes as much as possible at the international and national levels. Most countries having nuclear reactors in operation today have adhered to at least one of these conventions and have implemented them in their legislation. However, there are a few that have not joined any of these international regimes; this is the case of China, Iran, Korea, Pakistan, and South Africa.

These principles will need to be considered when structuring the small modular reactor (“SMR”) projects, as they impact the allocation of risks, an important issue for the financial institutions.

3. THE NUCLEAR LIABILITY REGIMES APPLICABLE TO SMRS

The nuclear liability regime only applies to “nuclear damage”¹ caused by a “nuclear incident”² occurring at a “nuclear installation”³ or during the carriage of “nuclear substances”⁴. The terms are all defined in the different conventions, but we will only see those who are relevant to the topic of this article. As the Paris Convention was the first international convention to be adopted in the nuclear liability field and the last one to be updated, we will use it as the convention of reference. In addition, the article will only address the consequences of a nuclear incident occurring at a nuclear installation and not during the carriage of nuclear substances, as the latter has no incident on the structuring or financing of an SMR project.

The objective of nuclear liability is to determine the entity that will be liable to adequately compensate the victims for “nuclear damage”, i.e., the “damage [arising] out of or [resulting] from ionising radiation emitted by any source of radiation”, either through contamination or irradiation. The international conventions (except the 1963 Vienna Convention) provide for a more detailed definition of nuclear damage, which will not be addressed here.

3.1. Operator’s strict and exclusive liability

3.1.1. *The international conventions*

The operator of the “nuclear installation” where the accident that caused the “nuclear damage” took place is strictly and exclusively liable to compensate third parties. This is, in the view of many, the most important nuclear liability principle.

According to the conventions, the operator is defined as “the person designated or recognised by the competent public authority as the operator of that nuclear installation”⁵. It may therefore not necessarily be the operator who has received the authorisation or license to operate the nuclear installation, although this is commonly the case.

According to Article 6 of the Paris Convention, “the right to compensation for nuclear damage caused by a nuclear accident may be exercised only against an operator liable for such nuclear damage in accordance with this Convention”. The Operator is liable even if it has not committed fault, negligence, or recklessness. The victims will only have to prove the causal link between the nuclear accident and the nuclear damage suffered and not the fault, negligence, or recklessness of the operator.

Finally, nuclear damage is only compensated under the nuclear liability regime established by the applicable international convention and the national law or regulation, and no other law will apply (such as common tort law or environmental law). This follows from Article 6(c)(ii) of the Paris Convention: “The Operator shall not be held liable, outside of this Convention, for nuclear damage caused by a nuclear accident.

In summary, victims of nuclear damage can only bring a claim against the operator of the nuclear installation where the nuclear accident that caused the nuclear damage occurred, and they can only seek compensation under the national nuclear liability law or regulation.

¹ Article 1(a)(vii) of the Paris Convention; Article I.1(k) of the Vienna Convention and the Revised Vienna Convention; Article I(f) of the CSC.

² Article 1(a)(i) of the Paris Convention; Article I.1(l) of the Vienna Convention and the Revised Vienna Convention; Article I(i) of the CSC.

³ Article 1(a)(ii) of the Paris Convention; Article I.1(j) of the Vienna Convention and the Revised Vienna Convention; Article 1.1(b) of the Annex to the CSC.

⁴ Article 1(a)(v) of the Paris Convention. Under Article I.1(h) of the Vienna Convention and the Revised Vienna Convention and Article 1.1(c) of the Annex to the CSC, the term used is “nuclear material” instead of “nuclear substance”, but all definitions address the same thing.

⁵ Article 1(a)(vi) of the Paris Convention; Article I.1(c) of the Vienna Convention and the Revised Vienna Convention; Article 1.1(d) of the Annex to the CSC.

3.1.2. *The impact on the SMR projects*

SMR vendors have different approaches to the operation of the reactors. Some intend to be the owner and operator of the SMR, others will only provide the reactor and will let another entity own or operator it.

Regarding large reactors, there have been projects where separate entities have owned and operated reactors. This is the case for example in Bulgaria, Canada, China, Hungary, Romania, and Slovenia. According to the IAEA Power Reactor Information System, among the 100 reactors in operation in the European Union, 82 are owned and operated by the same organisation, and 19 are owned and operator by two different entities.

It will be important that the entity that will be identified as the “operator” has the sufficient financial capacity to bear the nuclear liability and the additional costs related to it (see paragraph 3.4 hereunder), in addition to have the financial, technical, and human resources to duly operator the reactor(s).

The conventions also provide that “[i]f nuclear damage gives rise to liability of more than one operator [...], the liability of these operators shall be joint and several” if the damage attributable to each operator is not reasonably separable. “In no case shall any one operator be required, in respect of a nuclear incident, to pay more than the amount established with respect to him [...]”. This provision will apply in case several reactors operated by different entities are situated on the same site.

3.2. **Determining the “nuclear installation”**

3.2.1. *The international conventions*

As mentioned above, the nuclear liability regimes apply to “nuclear damage” caused by a “nuclear incident” occurring at a “nuclear installation”.

The definition of “nuclear installation” provided in the different conventions clearly include:

- “reactors”, except those used for propulsion (e.g., in submarines or icebreakers), and
- any facility where “nuclear substances” are stored (other than those storing them temporarily during a transport).

The definition of “nuclear substances” include:

- nuclear fuel, i.e., “fissionable material [other than natural uranium and depleted uranium] in the form of uranium metal, alloy, or chemical compound [...], plutonium metal and such other fissionable material as the Steering Committee for Nuclear Energy of the OECD Nuclear Energy Agency shall from time to time determine”; and
- radioactive products or waste: i.e., “any radioactive material produced in or made radioactive by exposure to the radiation incidental to the process of producing or utilizing nuclear fuel”, but it excludes radioisotopes for industrial, commercial, agricultural, medical, scientific, or educational purpose.

The SMRs will therefore be covered by the nuclear liability conventions, whatever their size (i.e. whether micro or not).

3.2.2. *The impact on the SMR projects*

One of the major arguments in favour of the SMRs is that they are expected to be less dangerous than large reactors. The conventions allow a nuclear installation to be excluded from their scope if “the small extent of the risks involved so warrants”. However, this will require the consensus of several countries:

- for the Paris Convention the decision lies with the Steering Committee for Nuclear Energy of the OECD Nuclear Energy Agency (“OECD/NEA”);

- for the revised Vienna Convention and the CSC, a country party to either of these conventions may exclude an installation as long as it is done in accordance with the criteria established by the IAEA Board of Governors.

The 1963 Vienna Convention does not provide for this possibility and the exclusion of SMRs would therefore require amending the convention itself, which is a more complex and lengthy process.

It will be important to define the “nucleate site” as the operator will have to bear the financial costs of the “damage [caused by the nuclear accident] to the nuclear installation itself and any other nuclear installation, including a nuclear installation under construction on the site where that installation is located; and [the] damage to any property on that same site which has been used or to be used in connection with any such installation”. This means that the nuclear liability amount is exclusively to compensate third parties, and not the operator for its loss.

If several reactors are installed on the same site, the conventions provide that “a Contracting Party may determine that two or more nuclear installations of one operator which are located on the same site shall, together with any other premises on that site where nuclear fuel or radioactive products or waste are held, be treated as a single nuclear installation”.

Finally, it is important to have in mind that usually the used fuel and radioactive waste is stored on a nuclear power plant site until it is transportable to a separate storage or disposal facility. The used fuel and radioactive waste management schemes must have been decided from the conception of the SMR project, as the land used for their storage near the reactor will be considered as part of the “nuclear installation”.

3.3. The “nuclear incident”

3.3.1. The international conventions

Under the conventions, a “nuclear incident” is “any occurrence or series of occurrences having the same origin which causes nuclear damage” but it also includes events that create a “grave and imminent threat of causing such damage”, in which case preventive measures apply and give rise to a claim for compensation for the loss or damage caused by such measures.

It is important to note, for those who are familiar with the International Nuclear and Radiological Event Scale (or INES scale), that the definition of “nuclear incident” provided under the nuclear liability conventions does not distinguish between the different levels of events. If the nuclear or radiological event has caused a “nuclear damage” as defined under the conventions (see paragraph 3 above), it will give rise to a claim for compensation. The INES scale is only a communication tool developed in 1990 by the IAEA and the OECD/NEA that classifies the nuclear and radiological events as “incidents” or “accidents” to explain to the public their level of risk.

3.3.2. The impact on the SMR projects

The emergency planning zone will have an impact on how the nuclear liability regime will be applied. The conventions (except for the 1963 Vienna Convention) explicitly mentions “the costs of preventive measures, and further loss or damage caused by such measures” as being part of the “nuclear damage” to be compensated. “Preventive measures” means “any reasonable measures taken by any person after a nuclear incident or an event creating a grave and imminent threat of nuclear damage has occurred, to prevent or minimise nuclear damage [...]”. This means that any cost relating to the precautionary evacuation of the population around the nuclear installation in case of “grave and imminent threat” will have to be exclusively borne by the operator.

Under the conventions, “[w]here nuclear damage is caused jointly by a nuclear incident and by an incident other than a nuclear incident, that part of the damage, which is caused by such other incident, shall, to the extent that it is not reasonably separable from the nuclear damage caused by the nuclear incident, be considered to be nuclear damage caused by the nuclear incident”. As one of the purposes of the SMRs will be to provide energy to energy intensive industries, one should have in mind this provision to determine how close the nuclear reactor should be situated from the industrial site, which will certainly also depend on the activity carried out at the

industrial site. Putting a nuclear reactor near a mine will not have the same safety concerns as putting it near a chemical plant. If an accident occurs at the industrial facility which causes a nuclear incident, or if a nuclear incident causes damage to the industrial facility, and that in each case it is not possible to distinguish the damage caused by the nuclear incident itself from the damage caused by the accident that occurred at the industrial site, it will be the operator that will solely have to compensate for all of it in accordance with the applicable nuclear liability regime.

Siting the SMR will certainly give rise to discussions between the nuclear safety authority and the authority in charge of supervising the industrial activity, to ensure the protection of human health and the environment. The siting of the SMR will have to comply with the expectations of both authorities to limit the potential consequences of a nuclear incident, whether it is caused by the reactor itself or the industrial facility.

3.4. The operator's liability in amount

3.4.1. The international conventions

The different conventions provide for the minimum amount of nuclear liability States can provide in their legislation or regulation:

Table 1 – Nuclear liability amounts for nuclear installations

Paris Convention	1963 Vienna Convention	Revised Vienna Convention	CSC
EUR 700 million	US\$ 5 million, based on US\$ gold value on 29 April 1963	SDR 300 million	SDR 300 million

Some countries have provided a nuclear liability cap beyond such minimum amounts, e.g.:

- Belgium and the Netherlands have provided for EUR 1.2 billion, and
- Germany, Japan, and Switzerland have provided for unlimited liability.

However, the conventions allow the States to provide for a lower nuclear liability amount “having regard to the nature of the nuclear installation involved and to the likely consequences of a nuclear incident originating therefrom” provided that such amount may not be lower than the following:

Table 3 – Nuclear liability amounts for low-risk installations

Paris Convention	1963 Vienna Convention	Revised Vienna Convention	CSC
EUR 70 million	/	SDR 5 million	SDR 5 million

This lower liability amounts may be provided to avoid burdening the operator with unjustified insurance or financial security costs. Usually, research reactors are considered as low risk installations and specific nuclear liability amounts are determined on a case-by-case basis.

3.4.2. The impact on the SMR projects

For SMRs to benefit from lower liability amounts, a risk assessment shall need to be carried out and its classification as a low-risk installation will need to be approved by the nuclear safety authority and the

government. The later needs to give its consent as the conventions require that the State where the low-risk installation is situated ensures that public funds be made available up to the amount established for nuclear installations (Table 1 above) in case the compensation for nuclear damage to be paid following a nuclear incident at the low-risk nuclear facility exceeds the lower liability amount provided in the national law or regulation.

It is important to note that the nuclear liability caps do not include any interest or costs awarded by a court in actions for compensation, which shall be payable by the operator in addition to any compensation for nuclear damage for which it is liable with regard to third parties.

3.5. The compulsory financial security

3.5.1. The international conventions

The conventions require that the operator covers its nuclear liability with “insurance or alternative financial security” to ensure that funds will be immediately available to compensate third parties for nuclear damage. Usually, having such insurance or financial security in place is a requirement to obtaining and maintaining the operating licence.

The operator may get such insurance from the nuclear insurance pools and/or mutuals or have other types of financial securities “of such type and terms as the competent public authority shall specify”. Among the different options available, operators tend to go with captive insurance companies, operators pooling systems, and self-insurance (for government owned and operated installations). The choices made by the operator will need to be approved by the relevant competent authority.

The State “within whose territory the nuclear installation of the liable operator is situated shall ensure the payment of claims for compensation for nuclear damage which have been established against the operator by providing the necessary funds to the extent that the insurance or other financial security is not available or sufficient to satisfy such claims, up to an amount not less than the amount referred to in [Table 1]”. This means that if no private insurance is available to fully cover the operator’s nuclear liability, the government will have to provide an insurance or a guarantee (at market price to avoid any State aid issues) to cover such nuclear damage that are not or only partially covered by the private sector. This has been the case, especially regarding loss of life or personal injury that may occur between the tenth and the thirtieth year following the nuclear incident.

3.5.2. The impact on the SMR projects

The SMR operator will need to opt for its nuclear liability coverage. The insurance pools and mutuals will be available, as it is the case for large reactors. However, if the State decides to consider the SMR as a low-risk installation (see 3.4 above), there may be additional insurance alternatives.

As mentioned in 3.2.2 above, the nuclear liability amounts (and therefore the related insurance and financial securities) cannot be used to compensate the operator for any loss it may incur on-site (i.e. damage to or loss of property owned by the operator). However, separate insurance is available to cover this type of on-site damage.

4. CONCLUSION

There is much to be assessed to implement the nuclear liability regimes to the SMRs. Its application will depend on a variety of issues, including the applicable nuclear liability convention, the national nuclear liability regime, the type and size of the reactor, the structure adopted (same or separate owner/operator), and the industrial facility it will be located near to. A case-by-case analysis will therefore need to be made.