**NUCLEAR LIABILITY FOR SMALL MODULAR REACTORS**

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1. *INTRODUCTION*

Affordable and clean energy is one of the United Nation’s sustainable development goals. Currently, around 85% of the world global energy consumption is met by fossil-based fuels. [1] Some of the fossil fuel reserves could run out in this century and more importantly we should not use all the fossil fuel reserves of the world in order not to destroy the environment suitable for human life. As it is known, the 2015 Paris Agreement aims to limit the global temperature increase caused by human-induced greenhouse gas emissions to below 2 degrees centigrade. So, as it clearly understood, the world will need to harness all low-carbon sources of energy in order to meet the carbon emission reduction goal and limit the rise in global temperature to the targets of the Paris Agreement. Additionally, global energy demand is expected to increase by 30 % by 2040, according to the International Energy Agency’s (IEA) New Policies Scenario; whereas demand for electricity might double by 2060 according to the World Energy Council’s ‘World Energy Scenarios. Because of global demand for energy and the security of energy supply concerns, interest in small modular reactors (SMRs) is increasing day by day and there are many new SMR designs. In this context, it is obvious that the interest in nuclear energy and SMRs is at a high level in future planning for either Earth, Moon and Mars. SMRs display an enhanced safety performance through inherent and passive safety features, offer better upfront capital cost affordability and provide options for remote regions with less developed infrastructures.

The difficulties faced in building large nuclear plants and the evolving needs of the power system have generated interest [2] in SMRs, their applications and SMRs are being considered by many Member States as a potential viable nuclear option that contributes to mitigate the climate change. [3] There are many different SMR designs around the world, which are developed by various countries including leading states in nuclear energy such as United States of America (USA) and Canada. Additionally, National Aeronautics and Space Administration of USA (NASA) announced plans to support the space bases which it aims to establish on Moon and Mars with mini nuclear reactors. In this context, it is obvious that the interest in nuclear energy and SMRs is at a high level in future planning for either our Earth, Moon and neighboring planet Mars. [4]

A major milestone has already been reached in SMR technology deployment. The Akademik Lomonosov, Floating Nuclear Power Plant (FNPP) with two 35 MWe KLT-40S reactors in the Russian Federation, has been connected to the grid and started commercial operation in May 2020.

The increasing interest to the SMRs create many challenges. For instance, SMRs and other new technologies were not envisaged when international nuclear conventions were drafted. Therefore, such conventions would need to be reviewed in the light of these new technologies and reactor types. The international nuclear legal framework does not address SMRs in a consistent fashion, but does not intentionally exclude SMRs from its scope. It can be applied to all SMRs in some instances; in contrast, to certain types only in others [5]. In order to address these issues, IAEA has published a document in 2023 “*Applicability of IAEA Safety Standards to Non-Water-Cooled Reactors and Small Modular Reactors*” which is about the applicability of existing safety standards to SMRs.

This paper will seek answers to a similar question; whether the existing nuclear liability conventions can be applied to SMRs or not; together with the current situation and future of the SMRs. Section 1 gives an overview of the SMRs. Section 2, describes the synopsis of the existing liability conventions. Section 3, discusses the applicability of the existing liability conventions for SMRs. And finally, Section 4 offers concluding remarks.

1. *SMALL MODULAR REACTORS*

IAEA classifies any nuclear reactor with a power output of more than 700 megawatts (MWe) as large reactors, and those with outputs between 300 and 700 MWe are considered as medium-sized reactors. [6] And SMRs are defined as newer generation nuclear reactors which designed to be modular and generate electric power between 10 and 300 megawatts. To better understand this scale, 300 MWe of electricity can power approximately 300,000 homes. [7] Most of the SMRs are simplified versions of already existing designs. Their components and systems can be pre-fabricated and then transported as modules to the sites for installation. [8] Small modular reactors are used to generate electricity and other energy types by utilizing the steam produced by thermal energy like conventional nuclear power plants.

The interest and investment in SMRs in the world, both by the public authorities of the countries and the private institutions is increasing constantly. In addition to Russia’s Akademik Lomonosov, the world’s first floating nuclear power plant that began commercial operation in May 2020, other SMRs are under construction or in the licensing stage in Argentina, Canada, China, Russia, South Korea and the USA. [9]

* 1. **Small modular reactors types**

According to the Organization for Economic Cooperation and Development (OECD) Nuclear Energy Agency (NEA), SMRs utilize nuclear fission reactions to create heat that can be used directly or to generate electricity. Some SMRs are based on currently deployed technologies, while others are based on so-called “Generation IV” and advanced reactor concepts. [10]. So far, SMRs are operational only in Russia and China, but more than 80 SMR designs are currently at different stages of development and deployment in 18 countries according to the IAEA ARIS (Advanced Reactors Information System) database lists. While the term “SMR” has been adopted around the world to refer to all small reactor designs, significant differences remain across the major types of SMRs under development. [11]

Although there are many SMR types, SMRs can be examined in 6 different basic categories. These categories are land-based water-cooled SMRs, marine-based water-cooled SMRs, high temperature gas-cooled SMRs (HTGRs), liquid metal-cooled fast neutron spectrum, molten salt SMRs and microreactors. [12]

The SMR design and engineering are completed after the regulatory review and assessment and permission processes from national regulatory bodies. As far as 2023, only the American NuScale, Korean SMART, Argentinian CAREM, Russian, and Chinese designs have received regulatory permission or are currently under construction. Therefore, it is thought that many designs’ proposals will not complete regulatory approval or construction until 2030. [13]

* 1. **Advantages and disadvantages of small modular reactors**

As already known, nuclear energy offers many advantages like electricity, heating and more applications such as radioisotype generation in other areas such as in medicine. However, in addition to these advantages nuclear power plants’ risks have always been a source of concern.

Small modular reactors can be produced with very low budgets in terms of production costs, and thus can be easily accessed by anyone who needs high-power energy. Since this technology is modular, it can be adapted to any environment. It is sufficient to deliver it to the area of energy requirement and connect it to the power line by programming it appropriately. SMRs can be constructed on locations that are not suitable for larger nuclear power plants. Prefabricated units of SMRs can be manufactured and then shipped and installed on site, making them more affordable to build than large power reactors, which are often custom designed for a particular location, sometimes leading to construction delays. SMRs offer savings in cost and construction time, and they can be deployed incrementally to match increasing energy demand.

SMR’s are facilitating access to nuclear energy in remote locations and can offer high efficiency as well as low risk. Additionally, one of the most important advantages of small modular reactor technology is that it works with nuclear fuel, which can produce energy but cannot be converted into nuclear weapons thus creating a structure that is compatible with peaceful use of nuclear energy.

In comparison to larger nuclear power reactors, SMR designs are generally simpler, and the safety concept for SMRs often relies more on passive systems and inherent safety characteristics of the reactor, such as low power and operating pressure. There is also a lower risk for unsafe releases of radioactivity to the environment and the public in case of a nuclear incident. Furthermore, SMRs may require less frequent refueling than existing nuclear power reactors. While conventional nuclear reactors refuel every 3 to 7 years, some SMRs are designed to operate for up to 30 years without refueling. [14]

It would not be wrong to say that, in addition to the many advantages mentioned above, there are also some disadvantages for SMRs. Many designs exist for small modular reactors and this may lead to confusion as to which technology will be chosen in the design and which will be safer. Since very few of the technologies considered in current designs are suitable for commercial use, it creates a problem as to which ones will continue to be developed and will be commercially available in the market. Additionally, another challenge for small modular reactors is existence of applicable law and licensing procedure SMR’s. Serious work may be required for the licensing processes of small modular reactors equipped with new designs and technologies in the national legislation.

Another problem that small modular reactors may experience compared to conventional reactors arises in supply chain processes. The production of the technological parts required for the small modular reactors and the supply problems related to the fuel to be used as well as the necessary raw materials stand out as challenges that must be overcome. The fact that the high-grade and low-enriched uranium used as the most common fuel in these reactors is the most important fuel problem in the field of SMRs that needs to be re-evaluated and new supply chains to be created.

Another disadvantage about SMRs is the radioactive waste disposal. Nuclear waste is highly radioactive and must be properly stored and disposed of in order to protect the environment and public health. This can be a complex and controversial issue, as there is currently no permanent solution for the disposal of high-level nuclear waste. SMRs may generate smaller amounts of waste than traditional nuclear power plants, but they will still produce some waste that needs to be managed safely. [15]

Finally, the fear of harmful effects of radiation caused by past accidents related to nuclear energy presents another challenge for small modular reactors. Although the risk of accidents is quite low, it is known that serious fears have arisen in the public about this issue.

1. *EXISTING NUCLEAR LIABILITY CONVENTIONS*

Nuclear energy brings many risks as well as its advantages. Protecting people, property and the environment from the hazardous effects of ionizing radiation is the main goal of both national regulatory bodies and international organizations in this field. Since the damages that occur after nuclear incidents cause great transboundary effects, nuclear liability regime must be carried out within a uniform system. International nuclear law would be regarded as complete with its fourth pillar: civil liability for nuclear damage. In addition to enforcing high standards of safety, security, and safeguards, nuclear law also regulates the legal methods to guarantee “adequate” and “quitable” compensation for a nuclear incident which would also have transboundary effects. In order to ensure that the consequences of nuclear incidents can be compensated for third parties who suffer from these accidents, nuclear liability regimes have been developed, and these regimes have been regulated by international conventions. These international conventions governing nuclear third-party liability are:

1. Paris Convention on Third Party Liability in the Field of Nuclear Energy (Paris Convention and Revised Paris Convention-PC),
2. Vienna Conventions on Civil Liability for Nuclear Damage (Vienna Convention and Revised Vienna Convention-VC),
3. Convention on Supplementary Compensation for Nuclear Damage (CSC).

The PC, which is under the auspices of the OECD, covers most Western European countries. The Vienna Conventions, under the auspices of the IAEA, have an international spread and cover most Eastern European countries. There is a Joint Protocol that forms a bridge between the PC and the VC. Finally, the CSC provides a supplementary system of compensation pursuant to the national laws of VC states, PC states or states with national laws deemed compliant with the prescriptions of the Annex of the CSC, referred to as “Annex states”, provided that such a state, when possessing a nuclear installation as defined in the Convention on Nuclear Safety (CNS) on its territory, is a party to the CNS. Like the VC, the CSC has an international spread. [16]

It would be useful to mention the Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (JP) in this section by the IAEA and the OECD. The Joint Protocol jointly convened on 21 September 1988, by a diplomatic conference in Vienna and entered into force on 27 April 1992. The 1988 Joint Protocol provides for a mutual extension of the operator’s liability under the Paris and Vienna systems thus, if a nuclear incident occurs for which an operator is liable under both the Vienna Convention and the Joint Protocol, he shall be liable in accordance with the Vienna Convention for nuclear damage suffered not only in the territory of Parties thereto, but also in the territory of Parties to both the Paris Convention and the Joint Protocol; conversely, if an incident occurs for which an operator is liable under both the Paris Convention and the Joint Protocol, there shall be reciprocity. Moreover, the Joint Protocol is meant to eliminate conflicts which might otherwise arise, especially in transport cases, from the simultaneous application of the two Conventions. [17]

Existing international liability systems follow the five basic principles of nuclear liability:

* Strict liability of the operator, that is, liability without fault: Establishing a causal link between the incident and the nuclear damages occurring in the nuclear facility or during the transportation of nuclear materials is considered sufficient for the liability and compensation obligation of the nuclear facility operator to arise, regardless of the fault of the nuclear facility operator.
* Exclusive liability of the operator: It is accepted that only the operator of the nuclear facility is responsible for these damages to third parties, regardless of who is responsible for the behavior that causes nuclear damages occurring in the nuclear facility or during the transportation of nuclear materials.
* Establishing a minimum amount of liability for the operator: The liability of the operator is limited in terms of amount, and it is accepted that the operator will not be obliged to pay additional compensation for the part exceeding this amount.
* Limitation of the operator’s liability in time: Considering the difficulty of establishing a causal link between these damages and the nuclear incident for damages that occur long after exposure to ionizing radiation as a result of a nuclear incident, it is accepted that the liability of the facility operator should be limited in terms of amount.
* Compulsory financial security for the operator: Operators are required to provide a financial guarantee that corresponds to the amount for which they are responsible, in order to secure their liability against third parties arising from nuclear damages. Although financial guarantee is mostly insurance, it may also include letter of guarantee provided by banks or the state, insurance pools established by nuclear facility operators, and sometimes even other financial assurance mechanisms such as self-insurance by the nuclear facility operator.

Along with the existence of these basic five principles, the principles of exclusive jurisdiction, non-discrimination and equal treatment are also accepted as important cornerstones of nuclear liability.

The main objective in existing liability conventions is to establish minimum requirements in terms of the sum for which operators should be liable in the case of a nuclear incident and the obligation for operators to maintain financial security to ensure that they will be able to meet the amount of their liability amount to ensure that adequate and equitable compensation for persons who suffer from nuclear damage. [18]

* 1. **The overview of the basic definitions regarding nuclear liability**

In this section, the basic definitions in existing liability conventions regarding nuclear liability that affect the SMRs will be examined.

* + 1. *Nuclear reactor*

The VC and RVC (Vienna Convention as amended by 1997 protocol) both state the following that nuclear reactor means any structure containing nuclear fuel in such an arrangement that a self-sustaining chain process of nuclear fission can occur therein without an additional source of neutrons. This definition of a nuclear reactor is very broad and potentially covers all the previously presented types with the exception of reactors that would be subcritical during operation.

In contrast to the VC, there is no definition for nuclear reactor in the PC. However, the words nuclear reactor as may be subsequently observed in the next section, of the definition of “nuclear installation”. This does not change the conclusion just drawn regarding the VC as the PC also makes a clear distinction between critical and subcritical reactors. The “Exposé des Motifs” mentions an interpretation adopted by the Steering Committee for Nuclear Energy on 8 June 1967 “according to which the term ‘reactors’ in the sense of the Article 1(a)(ii) … does not include sub-critical assemblies, that … are not capable of maintaining a self-sustaining chain process of nuclear fission.” Although their deployment as SMRs is not discussed in this work, it would be desirable to include subcritical reactors in the convention’s definitions of a “nuclear reactor” to avoid ambiguity. [19]

The CSC provides a definition of a “nuclear reactor” that resembles that of the VC.

* + 1. *Nuclear installation*

The PC article 1 states that a “nuclear installation” refers to the following:

• Reactors other than those comprised in any means of transport;

• Factories for the manufacture or processing of nuclear substances;

• Factories for the separation of isotopes of nuclear fuel;

• Factories for the reprocessing of irradiated nuclear fuel;

• Facilities for the storage of nuclear substances other than storage incidental to the carriage of such substances;

• Installations for the disposal of nuclear substances;

• Any such reactor, factory, facility or installation that is in the course of being decommissioned; and

• Such other installations in which there are nuclear fuel or radioactive products or waste as the Steering Committee for Nuclear Energy of the Organisation … shall from time to time determine.

The same definition also states that “any 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.

Under the VC, a “nuclear installation” is defined as the following:

* Any nuclear reactor other than one with which a means of sea or air transport is equipped for use as a source of power, whether for propulsion thereof or for any other purpose;
* Any factory using nuclear fuel for the production of nuclear material, or any factory for the processing of nuclear material, including any factory for the reprocessing of irradiated nuclear fuel; and
* Any facility where nuclear material is stored, other than storage incidental to the carriage of such material; provided that the Installation State may determine that several nuclear installations of one operator which are located at the same site shall be considered as a single nuclear installation.
* Such other installations in which there are nuclear fuel or radioactive products or waste as the Board of Governors of the International Atomic Energy Agency shall from time to time determine.

Finally, the explanatory text of the VC states that “at its eighteenth meeting (2018), International Expert Group on Nuclear Liability (INLEX) concluded that the exclusion does not apply to transportable nuclear power plants”, while reaffirming the conclusion that such transportable nuclear power plants in a fixed position would be covered by the convention.

* + 1. *Operator*

The PC defines the operator as the person designated or recognised by the competent public authority as the operator of that installation.

The VC and CSC define the operator as the person designated or recognized by the Installation State as the operator of that installation. The installation state is defined in the framework of the VC as “the Contracting Party within whose territory that installation is situated or, if it is not situated within the territory of any State, the Contracting Party by which or under the authority of which the nuclear installation is operated.

The VC, the PC and the CSC further state that the operator of a nuclear installation shall be liable for nuclear damage.

* + 1. *Nuclear damage*

Under the provisions of the Paris and Vienna Conventions, the nuclear operator is held liable for physical injuries or loss of life of any person, and for damage to or loss of any property. Under the revised Paris and Vienna Conventions and under the Convention on Supplementary Compensation for Nuclear Damage (CSC), in addition to the above mentioned damage, the definition of nuclear damage also covers, to the extent determined by the law of the competent court: (Costs of measures to reinstate significant environmental impairment; certain categories of economic loss, including loss of income sufficiently related to environmental damage; costs of preventive measures and any damage caused by such measures.) [20]

The PC applies not only to nuclear damage suffered in the territory of a contracting party to the Convention (including its maritime zones or on board a ship or aircraft registered by such party, but also to nuclear damage suffered in a non-Paris Convention state (including its territories and maritime zones or on board a ship or aircraft registered by such state) if: it is a party to the Vienna Convention and the 1988 Joint Protocol; or it has no nuclear installations; or its nuclear liability legislation affords equivalent reciprocal benefits and is based on principles identical to those contained in the PC. Non-contracting states not mentioned under Article 2(ii)-(iv) are termed “excluded” below. With respect to maritime zones, the explanatory text of the PC clarifies that the term ‘maritime zones’ as used in the Convention means maritime zones that are established in accordance with international law. Such zones are understood to include the territorial sea, a contiguous zone, an exclusive economic zone and the continental shelf. [21]

* + 1. *Jurisdiction and competent courts*

The principle established by the special nuclear liability regime is that the competent court is designated by the Contracting Party in whose territory the nuclear accident took place. However, where the accident occurred outside the territory of a Contracting Party like during the transport of a nuclear fuel, jurisdiction lies with the courts of the Contracting Party in whose territory the installation of the liable operator is located.

Under the RVC PC as well as under the jurisdictional competence of a Contracting Party has been extended in the case of an accident occurring during maritime transport, to cover the situation where the accident occurs within its exclusive zone.

1. APPLICABILITY OF THE EXISTING LIABILITY CONVENTIONS FOR SMALL MODULAR REACTORS

One of the major legal issue surrounding SMRs is nuclear liability and applicability of the existing liability conventions for SMRs. In this context, this section would summarize SMRs’ status in the face of existing nuclear liability conventions.

Under the existing liability conventions, the definitions provided for nuclear installation, are quite similar and cover all land-based reactors. The PC excludes “reactors other than those comprised in any means of transport”, The “Exposé des Motifs” of PC states that “Nuclear installations are defined as reactors, other than those which are used or incorporated for use in a means of transport as a source of power for any purpose”. Similar to the PC, VC states that cases in which the nuclear reactor is used as a source of power, whether for the propulsion of the means of transport or for any other purpose, are not covered by the convention.

Within this scope, definitions in existing liability conventions clearly show that land-based SMRs are included in the definition of nuclear installation provided in the liability conventions, which covers “*reactors other than those comprised in any means of transport*”. The RVC applies to SMRs except the ones used in air or sea transportation, the ones in an installation excluded by a State, and the ones used for military purposes. The PC applies to SMRs as long as they are not used in means of transport. The CSC applies to SMRs except the ones used in air or sea transportation, and the ones used for military purposes. [22] Additionally, it can be directly concluded that all SMRs used for the propulsion of a means of transport or to produce energy for any purpose related to their transport are excluded by both the PC and the VC.

Having regard to the nature of the nuclear installation involved and to the likely consequences of a nuclear incident originating therefrom, the conventions allow countries to establish a lower amount of liability for that installation, provided that in no event shall any amount so established be less than the amounts provided in the conventions for low-risk installations. The aim of this option is to avoid burdening the nuclear operators concerned with unjustified insurance or financial security costs. Therefore, SMRs may be considered as low-risk installations if the installation states’ nuclear liability conventions and national laws allow for such a case. However, if the damage caused by the nuclear incident proves to be in excess of that lower amount, the Installation State must ensure that public funds shall be made available up to the minimum amount provided in the applicable convention for nuclear installations in general. It is clear that the existing liability conventions do not cover SMRs comprised in any means of transport such as reactors used as a source of power for a ship, whether the power is used for propulsion or any other purpose associated with the operation of a ship.

It is thought to be clear that land-based SMRs are within the scope of the existing nuclear liability conventions, while reactors used for transportation purposes are excluded from the scope of these conventions.

One of the main reasons for the adoption of the international nuclear liability conventions, besides to protect humans and environment and also the need to consolidate the legal and financial regime applicable to the nuclear area, has been to promote the international harmonization of such a regime, particularly for nuclear material transport operations. [23]

The existing nuclear liability conventions address the liability of the different operators when involved in transport between nuclear installations. When SMR’s transport from the supplier state to the host state, the vendor who puts the fuel in the reactor remain liable for nuclear incidents in the transportation of SMR, until their liability with regard to nuclear incidents has been transferred to the operator of the host state. [24] The conventions also allow the operator to transfer their liability to the carrier of the SMR, who can be recognised as an operator with the consent of the first operator, in which quality they are considered to be the operator of a nuclear installation situated within the territory of the supplier state. Similar considerations apply to the SMRs on its way back to the supplier state. As can be seen from the examination of the conventions, the transport of fuelled SMRs between different states and different nuclear installations, currently implicated at the international level. [25]

Another issue that needs to have special attention is transportable nuclear power plant (TNPP). A TNPP is a factory manufactured, transportable and relocatable nuclear power plant which, when fuelled, is capable of producing final energy products such as electricity and heat. There is no doubt that TNPPs should be subject to the nuclear liability regime. [26]

Most experts concur on the view that the conventions do cover SMRs located on ships that are anchored or otherwise fixed in a specific place and are used exclusively for generating power for external consumption, as long as these reactors are not intended to propel the platform but are to be operated once the ship is anchored at shore and immobilised. In such a case, the ship would be viewed as a floating platform on which the reactor is located and not as a nuclear ship that is excluded from the application of the conventions. It would be beneficial, in order to avoid different interpretations by national courts, for parties to the international liability conventions to nevertheless clarify the above understanding, as well as the concept of operator. Under the conventions, the operator of a nuclear installation is the person designated or recognised by the competent public authority as the operator of that installation. It is important to ensure a common understanding of what the competent public authority is with regard to a floating nuclear power plant. Although most experts agree that a floating nuclear power plant anchored at shore and immobilised should be considered as a nuclear installation covered by the international third-party nuclear liability conventions, questions remain with regard to the application of such conventions when the floating nuclear power plant moves. For the time being, the conventions only refer to the carriage of nuclear substances (other than natural uranium and other than depleted uranium) and radioactive products and waste. [27]

* 1. **Reduced liability amount**

Under the PC, RVC and the CSC, there are provisions that give states the possibility of reducing the liability amounts within certain limits. The idea of these provisions is to maintain a graded approach.

Under the PC, Contracting Party may establish a lower amount of liability when the nuclear installation is not considered by that Contracting Party as likely to cause significant damage compared to other nuclear installations and transports referred to in the Convention as indicated for certain small research reactors or laboratories. This reduced amount must not be less than 70 million EUR in the case of a nuclear installation. [28]

Under the RVC, the reduced liability amount provided by the conventions for low-risk activities and installation is 5 million International Monetary Fund special drawing rights in the case of the RVC and the CSC.

TABLE 1. LIABILITY AMOUNTS IN EXISTING LIABILITY CONVENTIONS [29]

|  |  |
| --- | --- |
| Vienna Convention | USD 5 million, based on USD gold value on 29 April 1963  (approximately USD 262 million today) |
| Revised Vienna Convention | SDR 300 million |
| Paris Convention | SDR 15 million |
| Revised Paris Convention | EUR 700 million |
| Convention on Supplementary Compensation for Nuclear Damage | SDR 300 million |

TABLE 2. REDUCED LIABILITY AMOUNTS IN EXISTING LIABILITY CONVENTIONS

|  |  |
| --- | --- |
| Vienna Convention | USD 5 million, based on USD gol value on 29 April 1963  (approximately USD 262 million today) |
| Revised Vienna Convention | SDR 5 million |
| Paris Convention | SDR 5 million |
| Revised Paris Convention | EUR 70 million |
| Convention on Supplementary Compensation for Nuclear Damage | SDR 5 million |

1. *CONCLUSION*

The main purpose of nuclear law is to establish and implement the regulations to protect people from the harmful effects of ionizing radiation while benefiting from nuclear energy and its applications. To achieve this purpose, a complete and effective international legal framework must exist. This framework includes national regulations, bilateral and multilateral cooperation, international harmonization of national policies and international instruments. The international instruments cover all main areas of nuclear law, often referred to as the "Three S" concept of nuclear safety, nuclear security and safeguards. Nuclear Safety aims to protect workers, the public and the environment from the harmful effects of ionizing radiation. Nuclear security aims to prevent, detect, and respond to malicious acts. Safeguards assure that nuclear material is not diverted for use in the production of nuclear weapons or other nuclear explosive devices. [30]

In addition to this "Three S" concept there is one more pillar: nuclear liability for nuclear damage. Nuclear law also establishes regulations to guarantee adequate compensation in a nuclear incident which would also have transboundary effects. Nuclear liability aims for the establishment of a minimum standards for protection against nuclear damages resulting from the peaceful uses of nuclear energy.

It is expected that small modular reactors will continue to develop and will be put into operation in many locations in the coming years ahead by the characterstics of SMRs creating a very important opportunity for a safe and practical solution to the increasing energy needs of the future. In this context, it is thought that nuclear liability regarding SMRs will be among the issues that will frequently come to the fore. Since new technologies such as SMRs were not foreseen when the current international nuclear conventions were prepared, these conventions need to be re-evaluated and reviewed to adapt them to the new concept. The commercialization and disposition of SMRs requires the resolution of several legal issues concerning the interpretation and applicability of existing liability conventions in relation to SMR designs.

In IAEA Safety Reports Series No. 123, it is stated that the existing safety framework described in the safety standards contains the tools to assess and regulate the safety of Evolutionary and Innovative Design (EID), but some modifications or additions may be necessary to supplement the IAEA Safety Standards Series publications. [31] Essentially, the situation is quite similar for nuclear liability regarding SMRs. As examined in detail above, it is considered that existing nuclear liability conventions cover SMRs in principle. This issue is clearly understood from the explanatory documents of the conventions. Reduced liability limits are determined for low-risk activities in existing liability conventions. These reduced liability limits can also can also be applied to SMRs. States may decide a liability amount between the reduced liability amount and the minimal liability amount for SMRs.

Whether the nuclear liability conventions could or could not apply for floating / transportable as for small modular reactors is more open to discussion. The general opinion that a floating nuclear power plant anchored at shore, immobilised and used for generating power should be considered as a nuclear installation covered by the existing nuclear liability conventions. What will be the liability regime in case floating nuclear power plants are in move and whether existing liability conventions will be implemented are among the problems whose answers need to be clarified.

As it seen, in order to ensure predictability regarding the SMRs, which will increase in number in the future, it is deemed useful to create special provisions within the scope of both Vienna Convention, Paris Convention, CSC and elucidate status regarding SMRs.

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