COMMENTED INTERNATIONAL ENVIRONMENTAL JURISPRUDENCE AND ITS CONNECTIONS WITH BRAZILIAN ENVIRONMENTAL LAW: Chernobyl case

JURISPRUDÊNCIA AMBIENTAL INTERNACIONAL COMENTADA E SUAS CONEXÕES COM O DIREITO AMBIENTAL BRASILEIRO: Caso Chernobyl

Alexandre Oheb Sion
Universidade Autónoma de Lisboa, Lisboa, Portugal
Lattes: http://lattes.cnpq.br/1776901364728469
E-mail: alexandre.sion@sionadvogados.com.br

Álvaro Sánchez Bravo
Profesor de la Facultad de Derecho de la Universidad de Sevilla, Sevilla, Andalucía, Espanha
E-mail: alexandre.sion@sionadvogados.com.br

Izadora Gabriele dos Santos Oliveira
Instituto Minere, Belo Horizonte, MG, Brasil
Lattes: http://lattes.cnpq.br/1970992584585714
E-mail: iza_oliveira123@hotmail.com

Lucas Fonseca Marinho
Pontifícia Universidade Católica de Minas Gerais, Belo Horizonte, MG, Brasil
Lattes: https://lattes.cnpq.br/3191760362189011
E-mail: fonseca_marinho@hotmail.com

Trabalho enviado em 15 de novembro de 2022 e aceito em 13 de março de 2023

ABSTRACT

This article aims to evaluate in a systemic way the regulatory and judicial consequences driven by the Chernobyl case at the international level and in Brazil, and for the analysis of the Brazilian scenario, the cumulative impacts and consequences due to the proximity of the event related to the Cesium-137 case will be considered. The methodology used was the theoretical-documentary deductive type, with bibliographic analysis, legal and, mainly, jurisprudential. It concluded the creation of a robust system in response to Chernobyl, worldwide and nationally, which, although not perfectly adequate, ensures the regulation of nuclear activity and provides means for monitoring and preventing accidents of this magnitude. On the other hand, several problems remain unresolved, requiring a continuous effort to update national and international standards on the subject.

Keywords: Chernobyl. Cesium-137. Nuclear Energy. Jurisprudence. Environment.

RESUMO

O presente artigo pretende avaliar de forma sistêmica as consequências regulatórias e judiciais impulsionadas pelo caso Chernobyl em âmbito internacional e no Brasil, sendo que, para a análise do cenário brasileiro, serão considerados os impactos e consequências cumulativas em razão da proximidade do evento relacionado ao caso Césio-137. A metodologia utilizada foi a teórico-documental do tipo dedutivo, com análise bibliográfica, legal e, principalmente, jurisprudencial. Concluiu-se a criação de um sistema robusto em resposta à Chernobyl, mundial e nacionalmente, que, apesar de não ser perfeitamente adequado, garante a regulamentação da atividade nuclear e fornece meios para fiscalização e prevenção de acidentes dessa magnitude. Por outro lado, vários problemas ainda continuam sem solução, requerendo um esforço contínuo para a atualização das normas nacionais e internacionais sobre o tema.

Palavras-chave: Chernobyl. Césio-137. Energia Nuclear. Jurisprudência. Meio Ambiente.

1 INTRODUCTION

About 183 km from Kiev was located the Chernobyl Atomic Energy Plant, strategically built close to the main centers, industries and rural villages, with vegetable cultivation and livestock farming. The city Pripyat was built to house employees of the Chernobyl plant and had around 20,000 inhabitants, with an average age of 26 years. The plant, considered the largest and best equipped in the Union of Soviet Socialist Republics (USSR), was responsible for providing electrical energy in the USSR. The Pripyat River, which gave the city its name and was approximately 4 km long, was used as a reservoir for the plant (CHERNOUSENKO, 1991).

The accident that would be marked as the biggest nuclear disaster in world history occurred on the night of Friday (25/04/1986) to Saturday (26/04/1986), when a reduced team of employees[1] of the plant worked in the control room to carry out tests on reactor No. 4, at the request of the State Committee for the Use of Atomic Energy (HAWKES et al, 1986).

According to the International Agency of Atomic Energy, the 10-day radioactive leak released a total of 500 tons of fuel, 700 tons of graphite and radioactive gases into the atmosphere (INTERNATIONAL AGENCY OF ATOMIC ENERGY, 2005). In the regions directly impacted, especially in the regions of present-day Ukraine and Belarus, more than 100,000 people were evacuated from their homes in the weeks following the accident.

The radiation released into the atmosphere after the accident crossed the borders of the USSR, with studies indicating that the radiation reached much of Europe, Asia and, to a lesser extent, North America. The damage was increased by the ineffectiveness of the USSR's preventive actions as well as by the country's delay in recognizing the occurrence of the disaster.

The direct and indirect consequences of the accident were invaluable, both from the point of view of socio-environmental damage and from a political point of view, especially considering the turbulent international geopolitical scenario at the time.

From a political point of view, the first international collaboration coordinated by the International Atomic Energy Agency (IAEA) was observed, called the International Chernobyl Project. Approximately two hundred experts from twenty-five countries collaborated in the analysis of the health conditions of the population affected by radiological material in 1990 and 1991, completing a study that encompassed a total of eight hundred and twenty-five people in three states

[1] Reduced team on occasion of holidays in the USSR: May 1st (International Workers' Day) and May 9th (Victory Day). The team had 150 employees at night. Of the 17 responsible employees, 10 were on vacation during the period (HAWKES, et al 1986).

affected by industrial operations, with its results disclosed without restrictions to ensure public health and safety (SAENKO, 2011, p. 239).

Another body that played a central role in the study and management of public health consequences was the World Health Organization (WHO), which launched the International Program on the Health Effects of the Chernobyl Accident (IPHECA) in May 1991, with budgetary support from some countries such as Japan, Finland, the Czech Republic, Switzerland and Slovakia and aimed to offer medical, psychological, oral health assistance and combating the effects of radiation on the thyroid, especially for liquidators (civilians and military personnel who were responsible for cleaning radioactive residue from the accident). In 1991, with the end of the USSR, the government of the former USSR requested assistance from the Sasakawa Memorial Health Foundation (SMHF) in Japan to provide assistance to the population of contaminated territories (SAENKO, 2011, p. 240).

From the point of view of international regulations on the subject, the delay in official responses from the USSR[2] about the accident, it opened the door for various criticisms from both society and the international community, as there was a delay in action to contain the spread of radioactivity and assist the population; a lack of clear, quick and effective provision of information about the accident and the numbers resulting from it; as well as a lack of preparation to deal with a disaster of such magnitude.

Thus, despite there already being some prior international regulation on compensation for nuclear damage and the potential cross-border impacts of a possible nuclear accident, it was noted that at the time of the accident there was not great international adherence to current international rules, which were also not sufficient and effective to provide a broad mechanism for compensating the transboundary impacts of a nuclear disaster of the scale of Chernobyl, a fact that led to an immediate reaction from the international community to improve international standards on the subject.

Specifically in Brazil, the commotion of the Chernobyl disaster was heightened by the fact that the largest national radiological-nuclear disaster, known as the Cesium-137 case, occurred just one year after the event in Ukraine, leaving deep marks on the country's history.

[2] *See* national reports from the main affected countries: Ukraine, Russia and Belarus Available at: http://chernobyl.undp.org/english/nat_rep.shtml.

Therefore, the aim of this article is to systematically evaluate the regulatory and judicial consequences driven by the Chernobyl case internationally and in Brazil, and for the analysis of the Brazilian scenario, the impacts and cumulative consequences due to the proximity of the event related to the Cesium-137 case.

2 INTERNATIONAL REGULATORY AND LEGAL CONSEQUENCES OF THE CHERNOBYL ACCIDENT

The Chernobyl accident was a paradigm case in the context of nuclear disasters, being considered the largest nuclear accident in history. The event caused great global commotion and, consequently, gave rise to great political movement at the international level for greater regulation of issues relating to the safety of nuclear plants, as well as for responses and compensation resulting from nuclear damage.

Soon after the international community became aware of the accident, several countries expressed their intention to obtain compensation from the USSR for the damages that occurred.[3]

However, despite the unequivocal responsibility of the USSR for the Chernobyl accident, the extent of the damage – which significantly exceeded the borders of the USSR – and the large number of victims resulting from the disaster, there is no record of legal actions being filed by affected countries (BIRNIE and BOYLE apud DYKE, 2006) or judicial sentences to the USSR seeking compensation for damages arising from the accident.

As SCHWARTZ (2006) points out, this was mainly due to the fact that, at the time of the accident, (i) there was no special legislation in force in the USSR regarding compensation for damages resulting from nuclear accidents and (ii) the USSR was not a party of any international convention or agreement regarding compensation for transboundary nuclear damage.

Therefore, even if it were possible to consider the possibility of affected countries or individuals legally requesting the USSR to be held responsible for the damages that occurred, such an obligation would not be enforceable – or would be of remote feasibility – due to the gaps and weaknesses in the international standards in force at the time – in particular the Paris and Vienna Conventions - on the subject and the USSR's lack of adherence to the few existing international provisions (HARTKE, 1987, p. 342).

[3] Malone (1987, p. 207) cites some examples of attempts by European countries and states in the United States of America in this regard.

In this scenario in which there were no local or international legal frameworks applicable to the USSR, there was great difficulty in obtaining effective compensation for the victims through judicial decisions. Thus, the compensation of victims, in the USSR, depended on the political will of the country[4] and, in the other affected countries, it depended on eventual legislation and legal principles provided for in domestic legal systems, as well as on the political will of those in power.

Regarding the international regulatory consequences arising from the Chernobyl accident, it is important to recover the regulatory scenario regarding the prevention and compensation of nuclear damage in force at the time of the accident.

Until 1986, there were basically two independent international conventions relating to liability for nuclear damage, the first being the Paris Convention on Third Party Liability of 1960, mostly adhered to by Western European countries under the auspices of the Organization for Economic Co-operation and Development (OCDE)[5], and the Vienna Convention on Civil Liability for Nuclear Damage of 1963, adhered to more globally by countries in the Americas (including Brazil, which ratified it in 1993), Africa, Asia and Eastern Europe under the tutelage of the IAEA (BURNS, 2018).

As the doctrine presents (SCHWARTZ, 2006; GUIMARÃES, 2017), the two conventions established the bases of civil liability for nuclear damage that are in force to this day, these being:

> i. Objective and exclusive liability of the operator of the nuclear installation for damages caused to third parties by nuclear incidents arising from the plant or during the transport of nuclear substances.
> ii. Limitation of the volume of compensation due by the operator.
> iii. Limitation of the operator's liability over time.
> iv. Obligation of compulsory financial insurance to compensate for possible damages.
> v. Determination of jurisdiction and applicable legislation.
> saw. Non-discrimination of victims.

However, even though they were formulated on common bases and principles, the two conventions were completely independent and did not interact, which is why victims of nuclear damage could only benefit from compensation if the nuclear accident originated or was the responsibility of a country that was also a member of the same country. convention, generating a limitation in terms of the effectiveness of compensation for cross-border damages.

[4] The Central Committee of the Communist Party of the Soviet Union claimed to have paid $1.12 billion in compensation to 116,000 victims of the disaster. See: https://www.upi.com/Archives/1986/12/13/Soviets-pay-112-billion-in-compensation-for-Chernobyl-disaster/3146534834000/

[5] By 1986, the Paris Convention had already been revised twice by the Supplementary Protocols signed in 1964 and 1982, as well as supplemented by the 1963 Brussels Convention, which came into force in 1974.

The conventions also, obviously, only applied to member countries, so that if the accident occurred in a non-signatory country, it would not be bound by any international standard (as was the case with the USSR). Furthermore, conventions had not been established for a scenario of the magnitude of the Chernobyl accident, limiting the total compensation owed by operators to relatively low amounts.

Given the insufficiency of conventions for cases of cross-border nuclear damage, since 1963 there were initiatives that attempted to establish a joint protocol that would link the provisions of the two Conventions, which never progressed due to lack of political interest. As will be seen later, the main consequence of the Chernobyl accident was precisely to encourage the parties to take more forceful initiatives to correct the gaps in existing regulations.

Having overcome the presentation of the pre-Chernobyl regulatory context, we move on to discuss the political consequences of this event.

The most immediate consequence of the Chernobyl accident was to highlight the gaps between national and international nuclear safety standards and measures and alert the international community to the need to strengthen international regulations to mitigate the consequences of the accident and prevent the occurrence of other situations. similar (RAUTENBACH; TONHAUSER; WETHERALL, 2006, p. 25). Furthermore, the disaster contributed to alerting the international community to the importance of including new themes to existing standards, such as damage to the environment (PELZER, 2006, p. 104).

One of these gaps was that, despite the great assistance from the international community after the accident at the Chernobyl Plant, there was no regulation on prompt notification and mutual assistance in cases of environmental disasters of this magnitude, which only developed after the occurrence of the nuclear disaster.

The need to have a protocol for reporting environmental accidents of this magnitude and for assistance to countries affected by radioactive material grew even more after international authorities raised the issue that the disaster at the Chernobyl Plant was only publicized after the discovery by " instruments for measuring environmental radiation from one of the nuclear power plants in Sweden" (SOARES, 2003, 715). For example, after the accident occurred, some countries voluntarily began sending information to the IAEA regarding measurements of radiation levels in the environment, including the verification of radioactive substances in the soil, air and water, as well as in the people's organism (SALO, 1986, p. 18).

As FISCHER points out:

> [...] Chernobyl radically altered the way Member States examined the issue of nuclear safety - the pressing need for closer international cooperation, and therefore the work of the Agency and its potential to raise safety standards and prevent future accidents or mitigate its effects. Chernobyl also greatly increased interest in several existing security programs and demands for security services. The IAEA [...] has increasingly focused on raising awareness among Member States of the paramount importance of nuclear safety and on practical measures to increase levels of safety and radiation protection, both at national level and at individual plants nuclear (FISCHER, 1997, p. 204).[6]

The IAEA, therefore, began to act with a view to ensuring the validity of effective national legislation and regulations in the States; the internalization of recently approved basic international safety standards; the operation and effective functioning of national regulatory entities; the promotion of radiation dosimetry services; the development of programs and procedures to face emergencies; the registration and licensing of radiation sources to ensure safe use; the creation of programs to protect workers, society and the environment against radiation and the preparation of States to deal with issues related to the planning, construction and operation of nuclear plants (FISCHER, 1997).

The idea of nuclear safety was one of the innovations brought about by the Chernobyl accident, which became a legally considered topic to the point of encouraging the review of existing international legislation (PELZER, 2006, p. 116).

The impacts of the accident with cross-border repercussions led the international community to become more concerned about nuclear safety based on the view that it was not just a matter of national proportion, as they are of cross-border consequences, so that it would be of interest of all nations to maintain security in accordance with high standards, becoming seen as a topic of international responsibility. In this way, there was the establishment and development of a "global nuclear safety regime" (RAUTENBACH; TONHAUSER; WETHERALL, 2006, p. 8).

Thus, the most immediate regulatory response to the accident was the signing, on September 26, 1986, of the Convention on Prompt Notification of Nuclear Accidents[7] and the Convention on

---

[6] "[…] *Chernobyl radically changed the way in which Member States looked at the question of nuclear safety — at the pressing need for closer international cooperation, and hence at the Agency's work and its potential for raising safety standards and avoiding future accidents or mitigating their effects. Chernobyl also greatly increased interest in several existing safety programmes and demands for safety services. The IAEA* […] *focused increasingly on raising consciousness in Member States of the overriding importance of nuclear safety, and on practical steps to raise the levels of safety and radiation protection, both nationally and at particular nuclear plants*".

[7] ARTICLE 1 - 1. This Convention shall apply in the case of any accident involving installations or activities of a State Party or of persons or legal entities under its jurisdiction or control, referred to in paragraph 2 below, from which a release of radioactive material has occurred or may occur and which has resulted or may result in an international cross-border release for the radiological safety of another State. [...].
ARTICLE 2 - In the event of a nuclear accident specified in Article 1 (hereinafter referred to as 'nuclear accident'), the State Party referred to in that Article shall: a) notify immediately, directly or through the International Atomic

Assistance in the event of a Nuclear Accident or Radiological Emergency, the result of an initiative by the IAEA (SOARES, 2003, p. 715).

The Convention on Prompt Notification of Nuclear Accidents establishes the obligation of notification, directly or through the IAEA, by States where nuclear installations are located, to other States that have been or may be physically affected by the impacts of a possible nuclear accident. Despite the fact that the aforementioned convention does not address liability and compensation for damages resulting from the accident, it imposes an obligation on States to provide accurate, transparent and pertinent information on nuclear accidents as quickly as possible, with affected States being guaranteed the possibility of demanding further information or consultations, aiming to limit, as much as possible, the consequences of radioactive elements within their jurisdiction (KISS; SHELTON, 2007).

The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, despite not dealing with the responsibility and reparation of States, deals with the same subject as the Convention previously mentioned, but with the specificity of establishing cooperation between the States Parties, through bilateral adjustments or multilateral, to minimize the consequences of nuclear accidents.[8]

The aforementioned Convention imposes on States the obligation to collaborate in cases of nuclear accidents. However, it does not indicate the means for intervention. The norm expressly provides for the possibility of signing bilateral and multilateral agreements "to promote, facilitate and support cooperation between States parties provided for in the [...] Convention" (BRASIL, 1991b). Thus, even if it is not at the origin of the accident, any State exposed to the risk and emergency can request assistance from other countries, as long as the risk is within its territory and under its jurisdiction or control (KISS; SHELTON, 2007, p. 219). The two Conventions were ratified by Brazil in 1991, under Decrees Nos. 9/1991 and 8/1991, respectively (BRASIL, 1991a; BRASIL, 1991b).

Energy Agency (hereinafter referred to as ' Agency'), the States that are or may be physically affected, as specified in Article 1, and the Agency of the nuclear accident, its nature, the time at which it occurred and its exact location where appropriate; and b) promptly provide the States mentioned in item a), directly or through the Agency, as well as to the Agency, with available information relevant to minimizing the radiological consequences in those States, specified in Article 5 (IAEA, 1986a, p. 3).

[8] "ARTICLE 1 - 1. States Parties shall cooperate with each other and with the International Atomic Energy Agency (hereinafter referred to as the 'Agency'), in accordance with the provisions of this Convention, to facilitate prompt assistance in the event of a nuclear accident or radiological emergency , to minimize their consequences and to protect life, property and the environment from the effects of radiological emissions. 2. To facilitate such cooperation, States Parties may conclude bilateral or multilateral arrangements, or, where appropriate, a combination of both, to prevent or minimize injury or damage that may occur in the event of a nuclear accident or radiological emergency." (IAEA, 1986b, p. 3).

The Chernobyl accident also prompted significant updates to nuclear damage compensation regulations established by the Vienna and Paris Conventions, which were revised respectively by the 1997 Protocol (which entered into force in 2003) and the 2004 Protocol. Furthermore, the The disaster unlocked negotiations for an international agreement that would somehow connect the two conventions, which came to fruition through the 1988 Common Protocol for the application of the Paris and Vienna Conventions. As Winter and Botelho point out:

> The main purpose of the aforementioned Protocol was to expand the scope of application of the two conventions, resolving conflicts of law that may arise due to the dual application of such conventional instruments in the event of a nuclear accident, mainly in the case of international transport by nuclear ships (WINTER; BOTELHO, 2013, p. 11).

Regarding the gaps in the regulation regarding compensation for nuclear damage for non-signatory countries, Soares makes the following argument:

> [...] there was an international convention in force, which regulated the responsibility of States for nuclear accidents with transboundary effects, but which could not be applied in casu, given the fact that the State that caused the accident, the USSR, was not a party to it: the Convention on Vienna on Civil Liability for Nuclear Damage, adopted in Vienna, 21-5-1963, under the auspices of the IAEA (SOARES, 2003, p. 715).

The 1997 Supplementary Convention for Compensation for Nuclear Damage made significant provisions, maintaining the essential principles established under the Paris and Vienna Conventions, while providing a tool by which States can ensure greater financial availability to compensate more victims. of nuclear damage (IAEA, 2004).

To this end, the Convention establishes a first level of compensation with a minimum value stipulation, to be provided by the responsible nuclear operator, the State of installation or both. The establishment of an international fund is considered the second level of compensation to which all Contracting Parties will contribute in the event that the damage to be compensated exceeds the amount fixed by the first level and whose size will be determined by the number and type of states that accede to the Convention. Half of the fund must be allocated to victims within and outside the State of installation, and the other half only to cross-border victims. This 50% division is an important innovation in the Vienna Convention on Civil Liability for Nuclear Damage (IAEA, 2006, p. 50).

The Supplementary Convention for Compensation for Nuclear Damage is specially designed as an independent Convention system, open to any Nation, without the need for prior accession to the Paris and Vienna Conventions, thus aiming to attract the largest possible number of energy generating States nuclear power to participate in this regime. However, countries that are not party to any of the Conventions must have legislation in place that reflects the principles of the Conventions. There are some special provisions to allow the United States of America (USA) to participate in the regime; Given its relevance to the production of energy from nuclear sources, the Convention would probably have little impact if the USA were not a party (IAEA, 2006, p. 50).

The scope of application of the convention is determined by reference to the two different levels of compensation. Regarding the 1st level, the law of the State of Installation determines to what extent nuclear damage suffered in non-contracting States will be covered; in relation to the 2nd level, the Convention prohibits its distribution to compensate for nuclear damage suffered in non-Contracting States, a restriction that is also found in the Brussels Supplementary Convention and follows the philosophy that a fund comprising public resources should be distributed only to victims in states that contribute to this fund (IAEA, 2006, p. 50).

Despite the fact that a considerable number of countries with nuclear power plants have not adhered to any of the above-mentioned conventions - including the USA, China and India - the Chernobyl accident caused several countries, signatories or not to the aforementioned Conventions, to review their internal regulations to establish stricter rules for nuclear safety and compensation for nuclear damage. Some of the regulatory trends in national legislation, for example, permeate the stipulation of unlimited liability in the case of environmental damage, which has been adopted by countries such as Austria, Germany, Switzerland and Japan (SCHWARTZ, 2006).

Finally, it is important to highlight that the robust system created in response to Chernobyl - and subsequently to the accident at the Fukushima Nuclear Power Plant - is not perfect and that several problems still remain unresolved, such as low country adherence, difficulties in obtaining insurance and limitations on amounts for compensation. The problem revolves around the fact that nuclear damage is as serious and extreme as possible, but also because nuclear energy is among the most effective in the world. Therefore, the solution to such problems, as Schwartz points out, involves the need for new changes to the existing system.

3 ANALYSIS OF THE CONSEQUENCES OF THE CHERNOBYL PARADIGM CASE IN THE BRAZILIAN LEGAL ORDER

Brazil is a producer of nuclear energy through the nuclear power plants of Angra 1 (in operation since 1985) and Angra 2 (in operation since 2001), responsible for producing around 3% of the energy consumed in the country (ROSSI , 2019, s. p.). Furthermore, the Angra 3 Plant has been under construction since 1984, having had its construction slowed down and, on several occasions, stopped due to various political issues and also because of popular resistance to this type of energy generated precisely by accidents. of Chernobyl and, later, of Fukushima.

On a political level, perhaps the main consequence of the Chernobyl accident for Brazil was precisely the slowdown in new nuclear energy projects. Despite Angra 2 having been completed and put into operation in 2001, it can be seen, as stated above, that the accident – added to the Césio case – created a great national popular commotion against nuclear energy, generating a political scenario that collaborated with the stoppage of works on Angra 3 to this day and which discouraged the commissioning of new similar projects in Brazil after 1987.

However, members of the National Nuclear Energy Commission (CNEN) have already stated that the Chernobyl accident, as well as other disastrous nuclear accidents, such as Three Mile (USA) and Fukushima (2011), led to improvements in procedures, protocols and technologies applied in national plants (IPEN, 2019, s. p.).

In the regulatory scenario, it is clear that, after the 1987 accident, Brazil signed and ratified the Vienna Convention[9] in 1993, which became one of the main national legislative references on civil liability for nuclear damage.[10] In addition, Brazil has also adhered to the Convention on Prompt Notification of Nuclear Accidents – promulgated by Federal Decree No. 9/1991 – and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Federal Decree No. 8/1991).

Even though all national nuclear plants had been commissioned before the Chernobyl accident and one of these (Angra 1) was already in operation in 1987, Brazil was not a signatory to the existing International Conventions on the subject.

[9] Federal Decree No. 911/1993 promulgates the Vienna Convention on Civil Liability for environmental damage in Brazil.
[10] It is clear, however, that the country has not signed the Protocol to amend the 1997 Vienna Convention, nor the Convention on Supplementary Compensation for Nuclear Damage.

On the other hand, the Brazilian legal system already had provisions relating to the prevention and compensation of nuclear damage. Civil liability for nuclear damage, for example, was already regulated by Federal Law No. 6,453/1977 - later modified by Provisional Measure No. 1,049/2021 and Federal Law No. 14,118/2021 - which regulates the responsibility of the nuclear installation operator independently of guilt verification, also bringing some concepts of high importance to nuclear activity, such as the concept of nuclear installation operator and nuclear damage.

Said law expressly adopts the responsibility of the operator of the nuclear installation for accidents occurring at the nuclear installation or involving radioactive material, regardless of the verification of guilt, according to art. 4th of the standard. If it is proven that the damage occurred exclusively due to the victim's fault, the operator must be exempt from the obligation to compensate the victim (art. 6). In cases where responsibility is attributed to more than one operator, as long as it is not possible to identify the fault in the cause of the damage individually, the liability between the agents will be joint and several (art. 5). The art. 8th of the aforementioned law presents exclusionary causes of liability.[11]

With regard to compensation, art. 9th established a limit set at 1,500,000 Adjustable National Treasury Bonds (type of title now extinct). Pursuant to art. 11, the Federal Court is competent to process and judge actions seeking compensation for nuclear damage. The right to claim compensation expires in 10 years, counting from the date of the nuclear accident. The standard also established the installation operator's obligation to maintain insurance and financial guarantee capable of covering their liability for possible compensation. The Union is also responsible for guaranteeing compensation in the event of insufficient resources presented for insurance and guarantee by the operator. Damages may also be borne by the Union if the accident was caused by nuclear material illegally possessed or used and not related to any operator, considering the compensation limit provided for in art. 9 and with the exception of the right of recourse against the agent causing the damage.

In its arts. 17 and 18, Federal Law No. 6,453/1977 sets out the hypotheses in which the law should not be applied, not applying "to compensation relating to nuclear damage suffered: I - by the nuclear installation itself; II - for assets located in the installation area, intended for its use; III - by the means of transport in which, when the nuclear accident occurred, the material that caused it was contained" (BRASIL, 1977). The criminal approach brought in Chapter III of the law deals

[11] Art. 8 - The operator is not responsible for repairing damage resulting from a nuclear accident caused directly by armed conflict, hostilities, civil war, insurrection or exceptional act of nature" (BRASIL, 1977).

with the criminal responsibility of the agent and, for methodological reasons, will not be developed in this work.

National legislation also provided for other preventive measures against nuclear damage, such as Federal Decree nº 85,565/1980, which indicated that the Special Secretariat for Civil Defense should reach agreements with CNEN to establish the range of areas "likely to be affected in the future". case of emergencies resulting from nuclear accidents", in addition to Federal Decree nº 84,973/1980, which states that nuclear plants must be located in areas defined as ecological stations.

Regarding the assumptions of nuclear civil liability, the exercise of the activity in which the nuclear accident occurs and the existence and verification of nuclear damage stand out. Taking into account the high level of potential risk of nuclear activity and the consequent need to ensure effective protection for potential victims of nuclear accidents, civil liability is termed as aggravated. From the balance of damage caused by nuclear activity, as a result of exposure to radiation and/or contamination of nuclear substances to which people, property and the environment are exposed, it can be inferred that the damage is of a patrimonial and moral nature.

Furthermore, in 1981, Federal Law no. 6,938/1981, which established the National Environmental Policy (PNMA) and provided, in its art. 14, the obligation of any person causing environmental damage or pollution (including nuclear damage) to repair the damage caused, regardless of fault or intent.

With regard to the environmental licensing of nuclear activities, Federal Decree No. 99,274/1990, which regulated the PNMA, established, in its art. 14, that the responsibility for licensing lies with CNEN, upon the opinion of IBAMA, after consulting state and municipal environmental control bodies.

Shortly after Chernobyl, the Constitution of the Federative Republic of Brazil of 1988 (CRFB/1988) was promulgated, which established a series of provisions relating to the exploration and regulation of nuclear resources in Brazil. Among these, we highlight (i) the exclusive competence and monopoly of the Union for the administration and exploitation of nuclear resources;[12] (ii) the objective nature of civil liability for nuclear damage;[13] (iii) the exclusive competence of the Union to legislate on nuclear activities of any nature;[14] (iv) the exclusive competence of the National Congress to approve Executive Branch initiatives relating to nuclear

[12] Art. 21, XXIII e 177, V.
[13] Art. 21, XXIII "d".
[14] Art. 22, XXVI.

activities[15] and (v) the requirement that nuclear plants must have their location defined in federal law as a condition for their installation.[16]

CRFB/1988 also established the Fundamental Right to an Ecologically Balanced Environment,[17] establishing the duty of the Public Power and the community to preserve it for present and future generations, as well as establishing triple environmental responsibility, whereby conduct and activities considered harmful to the environment will subject offenders, whether individuals or legal entities, to sanctions criminal and administrative penalties, regardless of the obligation to repair the damage caused.

Finally, it is worth highlighting that, after CFRB/1988, a large part of the doctrine and most of the jurisprudence, especially from the Superior Court of Justice (STJ), began to understand civil liability for environmental damage as objective, guided by theory full risk (does not accept exclusions of liability), joint, unlimited, imprescriptible and *propter rem*.[18] Therefore, if nuclear damage is considered as a type of environmental damage, there is currently a clear conflict between the provisions of the Vienna Convention concomitantly with Federal Law No. 6,453/1977 and the current interpretation regarding environmental damage. Paulo Affonso Leme Machado, for example, argues that nuclear damage is a type of environmental damage, so that liability must be unlimited, as is the obligation to repair environmental damage (MACHADO, 2012, p. 1014 e 1039).

3.1 Jurisprudential analysis

According to the Report of the Environment and Sustainable Development Committee of the Chamber of Deputies, 16 nuclear accidents were recorded between 1987 and 2004 in Brazil. The most serious accident recorded was the Césio 137 case in Goiânia, caused by radioactive material of the same name, being the only case brought to the consideration of the STJ (2006, p. 135).

[15] Art. 49, XIV.
[16] Art. 225, §6º.
[17] BESSA ANTUNES, Paulo de. **Direito Ambiental**. 16. ed. São Paulo: Atlas, 2014. p. 61.
[18] On the subject, see STJ understandings: "It is worth clarifying that, in Brazilian law and in accordance with the jurisprudence of the Superior Court of Justice, civil liability for environmental damage, whatever the legal qualification of the degrader, public or private, owner or administrator of the degraded area, is of an objective, joint and unlimited nature, being governed by the principles of polluter pays, reparation in integrum, priority of reparation in natura and favor debilis." (STJ - REsp 1,374,284 / MG – 08/2014); "The allegation of exclusive fault of a third party for the accident in question, as an exclusion of liability, must be rejected, given the incidence of the theory of integral risk and objective liability inherent to environmental damage*" (Our mark, STJ – AREsp 378.165 / PR 11/2013).*

The Goiano Institute of Radiotherapy (IGR), based in Goiânia, in 1987, acquired an Italian cesium 137 pump, with authorization from CNEN, to provide radiology services. The IGR had its headquarters transferred to another address, abandoning the cesium 137 pump in the old building without any communication of the fact to CNEN or the State Department of Health. In May 1987, the building underwent demolition without them knowing of the existence of the cesium pump. The Report of the Nuclear Inspection and Safety Working Group narrated in detail the facts that followed the demolition:

> On September 13, 1987, two paper collectors entered the rubble and took with them, among other objects, the abandoned bomb. Sequentially, the radioactive object was broken into two pieces, one larger, weighing 300 kg, and the other weighing 120 kg. The smaller piece was transported to a house, where it was broken with a hammer until the iridium window, inside which the radioactive substance was stored, was reached. On 9/14/1987, two other people went to the rubble of the former IGR headquarters and took the larger piece from there, later sold to a scrap yard. The radioactive accident was aggravated by the curiosity and fascination aroused by the brilliant color of the Cesium 137 source, providing a chain of events that resulted in the contamination of three scrap metal deposits, a backyard, some residences, a Health Surveillance office and public places several. Due to the capsule being ruptured in the open, there was direct contamination of the soil (BRASIL, 2006, p. 196).

According to the report, four people died in Goiânia two months after the accident. CNEN began monitoring 112,800 people to check for possible contamination. Of these more than 112 thousand, 297 had radiation levels above normal (BRASIL, 2006, p. 196). As is natural with nuclear accidents, the real number of people affected by the accident in Goiânia is still unknown, and new cases of contamination may come to light, as the report itself points out (BRASIL, 2006, p. 197). According to Bessa Antunes, “the facts related to the accident demonstrate a sad reality of poverty, non-compliance with the law, irresponsibility and ignorance, which were absolutely essential for the accident with the Cesium 137 capsule to have the consequences that it actually had” (BESSA ANTUNES, p. 1181).

Regarding the actions of the Public Authorities, the report presents a series of mistakes made by the State in terms of corrective action and repair of damages, such as inadequate packaging and improper transportation of radioactive material; hiring unprepared employees; the use of the accident as a scientific experiment to study the effects of cesium on the human body, among other alarming situations that reinforced the lack of care on the part of the Public Authorities regarding the situation.

"Until 1995, the victims of the accident had not yet been compensated and some legal actions dragged on without reaching any solution, despite the public outcry generated by the events" (BESSA ANTUNES, p. 1182). Regarding the reparation of damages by the State, Federal Law No. 9,425/1996 was enacted, which provided "for the granting of a special pension to victims of the nuclear accident that occurred in Goiânia" (BRASIL, 1996), not covering, however, the indirectly affected, such as liquidators[19] who acted on the corrective action.

In the criminal sphere, the owners of the IGR were convicted of manslaughter, sentencing them to 3 years in prison, as seen in the considerations made by Bessa Antunes:

> In the criminal field, there was a conviction for manslaughter of the owners of the clinic who, criminally, left the device that used cesium 137 abandoned. The penalty applied by the Court was 3 years of detention, subject to conversion into provision of services to the community. The penalty was strict, within the fragility of current legislation. The conviction, however, only occurred in 1992. The appeals filed by the defendants, inevitably, resulted in the prescription, in concrete terms, of the right to punish the criminals. I think that Goiânia's criminal decision brings us some important points for reflection. The first of these concerns the total insufficiency of ordinary criminal legislation as an instrument of repression against crimes produced with radioactive material. The injury caused was immense and the law treated it as if it were a simple manslaughter (BESSA ANTUNES, 2020, p. 1182).

An investigation was opened and a Public Civil Action (ACP) was filed against the Union, CNEN, the State of Goiás, the Institute of Social Security and Assistance of the State of Goiás and directors of the IGR by the Public Ministry (MP), culminating in Process No. 0008354 - 98.1995.4.01.3500, whose sentence was handed down in March 2000 by the 8th Federal Court of the Judiciary Section of Goiás, where it was processed.

The federal judge who analyzed the case, Juliano Taveira Bernardes, understood that the Union was passively illegitimate due to joint and several liability, excluding it from the passive pole of the demand, considering that the exercise of the monopoly of nuclear activity "was decentralized into the hands of the CNEN, an agency with its own legal personality and assets, which is therefore responsible for individually bearing the possible effects of the origin of the request" (BRASIL, 2000). Still in this sense:

> In fact, the initial decision imputes liability to the Union resulting from its alleged omission in the duty to monitor the monopoly it holds. However, there is no way to apply the precept set out in art. 1,518 of the Civil Code against the Union, since the damage did not result from its own activities, but from those supervisory tasks that had been delegated exclusively to CNEN. It is true that the Union may

[19] Men and women who worked to prevent the catastrophe from being even greater, removing radioactive materials and cleaning the site for later closure, became known as liquidators.

> eventually be held liable in a subsidiary manner for the obligations arising from the actions of its autarchy. This possible hypothesis, however, does not give the Union the necessary passive legitimacy to appear in the present procedural relationship (BRASIL, 2000).

With regard to the responsibility of the State of Goiás, it was understood that there was no omission regarding inspection, deeming the request in relation to this entity of the federation to be unfounded. On the other hand, CNEN, among other obligations, was ordered to pay compensation, aiming to protect the victims.

In 2010, the STJ, in Special Appeal (REsp) nº 1.180.888/GO filed by the Union, assessed the case, an opportunity in which the rapporteur, Minister Herman Benjamin, understood the passive legitimacy of the Union and its joint liability:

> [...] one can easily ascertain the causal link between the Union's omission, both due to the lack of prompt response from CNEN to the fate to be given to the equipment after the shutdown of the Institute of Radiology, and through the Ministry of Health, which did not developed a health surveillance program plan for locations, facilities, equipment and agents that use radiodiagnostic and radiotherapy equipment (BRASIL, 2010).

The rapporteur brought up the existence of a "legal duty of health surveillance specific to the handling of equipment with radioactive sources" to be exercised by the Union.

> In other words, on a topic of such relevance to people's lives and health, any irregularity that comes to the attention of the Public Authorities deserves immediate and complete investigation. Here, there is no room to tolerate even the slightest inertia or lethargy of the State, especially under the cover of unjustifiable and unacceptable conflicts of attributions, popularly known as 'push-push' games. (BRASIL, 2010).

The STJ in June 2010 unanimously dismissed REsp, following the rapporteur's vote.

> ADMINISTRATIVE. NUCLEAR LAW. OBJECTIVE CIVIL LIABILITY OF THE STATE. RADIOACTIVE ACCIDENT IN GOIÂNIA. CESIUM 137. ABANDONMENT OF THE RADIOTHERAPY DEVICE. DUTY OF SANITARY-ENVIRONMENTAL SUPERVISION AND SURVEILLANCE OF ACTIVITIES WITH RADIOACTIVE DEVICES. SOLIDARY RESPONSIBILITY OF THE UNION AND THE STATES. PASSIVE LEGITIMACY 1. The life, health and physical-psychological integrity of people is a supreme ethical-legal value in the Brazilian system, which stands out in relation to all others, both in the economic, political and social order. 2. Art. 8th of Decree No. 81,394/1975, which regulates Law No. 6,229/1975, gave the Ministry of Health the authority to develop health surveillance programs for places, facilities, equipment and agents that use radiodiagnostic and radiotherapy equipment. 3. It is up to the Union to develop health inspection programs for radiotherapy equipment, which would have enabled the safe removal of the Cesium 137 capsule, which caused the tragedy that occurred in Goiânia in 1987.

> 4. In terms of nuclear activity and radioactive, sanitary and environmental inspection is concurrent between the Union and the States, resulting in joint liability in the event of failure in its exercise. 5. If it were not for the lack of communication from the Department of Nuclear Facilities and Materials (which is part of the structure of the National Nuclear Energy Commission – CNEN, a federal body) to the Department of Health of the State of Goiás, the serious accident that killed so many innocent people and poor would not have occurred. Finding of the Court of origin that cannot be reviewed in the STJ, under penalty of violation of Precedent 7. 6. Objective and joint civil liability applies to nuclear and radiological accidents, which are equivalent for the purposes of health and environmental surveillance. 7. The controversy was resolved strictly in light of a violation of Federal Law, namely, by the exegesis of arts. 1st, I, 'j', of Law No. 6,229/1975; 8th of Decree nº 81,384/1978; and 4th of Law No. 9,425/96. 8. Special Appeal not provided (BRASIL, 2010).

Despite the definitive decision having been published in 2010, due to popular pressure, the Federal Government had already recognized, in 2001, its indirect responsibility for the case (BRASIL, 2006, p. 196). According to the Report of the Nuclear Inspection and Safety Working Group, the Césio 137 case is the most serious in Brazilian history in terms of nuclear accidents, especially due to the way it was handled by the Brazilian authorities (BRASIL, 2006, p. 195).

4 CONCLUSION

The accident at the Chernobyl Power Plant can be considered the largest case of nuclear accident in the world in terms of the size and size of the plant, as well as the contamination and socio-environmental and health impacts caused by it. Furthermore, the Chernobyl accident had a major impact on the regulation of nuclear accidents, previously regulated by the Paris and Vienna Conventions (1960 and 1963, respectively). These Conventions dealt with the civil liability of States for damages resulting from nuclear accidents, and were not applied to the Chernobyl case, because the former USSR was not a party to the existing treaties and did not have specific legislation on compensation for damages resulting from nuclear accidents.

With the accident in Ukraine, several standards were consolidated internationally and within countries, under the influence of the IAEA. At the international level, we had, more immediately, the Convention on Prompt Notification of Nuclear Accidents and the Convention on Assistance in the event of a Nuclear Accident or Radiological Emergency, later ratified by Brazil in 1991, as a way of increasing nuclear safety largely due to recognition of the transboundary impacts of nuclear accidents. Furthermore, we had a Supplementary Convention for Compensation for Nuclear Damage, with a view to civil liability for nuclear damage.

In Brazil, there were several influences on nuclear regulation. One year after the Chernobyl accident, there was, in Brazil, the nuclear accident called Case Césio 137 in Goiânia, which further accentuated the need for specific regulation on the subject at a national level. In 1988, CRFB/1988 was enacted, which provided for the exploration and regulation of nuclear resources, such as the Union's monopoly for the administration and exploitation of nuclear resources, the objective nature of civil liability for nuclear activities and the exclusive competence of the National Congress. to approve Executive Branch initiatives related to nuclear activities. Furthermore, Brazil became a signatory, in 1991, of the Conventions on Prompt Notification of Nuclear Accidents and on Assistance in the event of a Nuclear Accident or Radiological Emergency and, in 1993, of the Vienna Convention on Civil Liability for Nuclear Damage.

Post-Chernobyl nuclear legislation, therefore, can be understood according to the following evolutionary relationship: (i) 1986 - Convention on Advance Notification of Nuclear Accidents and Convention on Assistance in the Event of a Nuclear Accident or Radiological Emergency; (ii) 1988 - Joint Protocol Relating to the Application of the Vienna and Paris Convention; (iii) 1994 - Convention on Nuclear Safety; (iv) 5/09/1997 - Joint Convention on the Safety of the Management of Spent Fuel and Radioactive Waste; (v) 12/09/1997 - Protocol of Amendment to the Vienna Convention on Civil Liability for Nuclear Damage and Supplementary Convention on Compensation for Nuclear Damage; (vi) 2004 - Protocol of Amendment to the Convention on Third Party Liability in the Field of Nuclear Energy and (vii) 2005 - Amendment to the Convention on the Physical Protection of Nuclear Material (PELZER, 2006).

Finally, it is important to highlight that the robust system created in response to Chernobyl is not perfect and that several problems remain unresolved, requiring a continuous effort to update national and international standards on the subject.

REFERENCES

AIEA. Convenção sobre Responsabilidade Civil por Danos Nucleares e a Convenção de 1997 sobre Suplementos Compensation for Nuclear Damage, Explanatory Texts. **Agência Internacional de Energia Atômica**, Viena, jul. 2004.

BESSA ANTUNES, Paulo de. **Direito Ambiental**. 16. ed. São Paulo: Atlas, 2014.

BESSA ANTUNES, Paulo de. **Direito Ambiental**. 21. ed. São Paulo: Atlas, 2020.

BRASIL, Decreto nº 9, de 15 de janeiro de 1991. Promulga a Convenção sobre Pronta

Notificação de Acidente Nuclear. **Diário Oficial da União**, Brasília, 16 jan. 1991a. Disponível em: http://www.planalto.gov.br/ccivil_03/decreto/1990-1994/D0009.htm. Acesso em: 2 nov. 2021.

BRASIL. Comissão de Meio Ambiente e Desenvolvimento Sustentável. **Relatório do Grupo de Trabalho Fiscalização e Segurança Nuclear**. Brasília: Câmara dos Deputados, 2006. Disponível em: https://bd.camara.leg.br/bd/bitstream/handle/bdcamara/3743/relatorio_grupo_trabalho.pdf?sequence=5&isAllowed=y. Acesso em: 3 nov. 2021.

BRASIL. [Constituição (1988)]. Constituição da República Federativa do Brasil de 1988. **Diário Oficial da União**, Brasília, 05 out. 1988. Disponível em: http://www.planalto.gov.br/ccivil_03/constituicao/constituicao.htm. Acesso em: 7 nov. 2021.

BRASIL. Decreto nº 8, de 15 de janeiro de 1991. Promulga a Convenção sobre Assistência no Caso de Acidente Nuclear ou Emergência Radiológica. **Diário Oficial da União**, Brasília, 16 jan. 1991. Disponível em: http://www.planalto.gov.br/ccivil_03/decreto/1990-1994/d0008.htm. Acesso em: 2 nov. 2021.

BRASIL. Justiça Federal da Seção Judiciária de Goiás. Ação Civil Pública 0008354-98.1995.4.01.3500. Oitava Vara Federal. Ementa. Juiz Juliano Taveira Bernardes, 17 mar. 2000. **Diário de Justiça Eletrônico**, Goiânia, 17 mar. 2000.

BRASIL. Lei nº 9.425, de 24 de dezembro de 1996. Dispõe sobre a concessão de pensão especial às vítimas do acidente nuclear ocorrido em Goiânia, Goiás. **Diário Oficial da União**, Brasília, 26 dez. 1996. Disponível em: http://www.planalto.gov.br/ccivil_03/leis/l9425.htm. Acesso em: 3 nov. 2021.

BRASIL. Superior Tribunal de Justiça. Agravo em Recurso Especial nº 378.165. Segunda Turma. Ementa. Relator: Min. Raul Araújo. 14 nov. 2013. **Diário Oficial da União**, Brasília, 25 out. 2013.

BRASIL. Superior Tribunal de Justiça. Recurso Especial nº 1.374.284. Segunda Turma. Ementa. Relator: Min. Luis Felipe Salomão. 27 ago. 2014. **Diário de Justiça Eletrônico**, Brasília, 27 ago. 2014.

BRASIL. Superior Tribunal de Justiça. Recurso Especial nº 1.180.888. Segunda Turma. Ementa. Relator: Min. Herman Benjamin, 17 jun. 2010. **Diário de Justiça Eletrônico**, Brasília, 28 fev. 2012.

BURNS, Stephen G. The impact of the major nuclear power plant accidents on the international legal framework for nuclear power. *In*: OECD. **Nuclear Law Bulletin Nº. 101**. OECD Better Policies for Better Lives, Paris, 2018. Cap. 1, p. 7-30.

CHERNOUSENKO, V. M. **Chernobyl:** Insight from the Inside. Springer-Verlag: Berlim, 1991.

DROTTZ-SJÖBER, Britt-Marie. Social/Psychological Effects. IAEA BULLETIN, 3/1996.

DYKE, Jon M. **Liability and Compensation for Harm Caused by Nuclear Activities**. In: Denver Journal of International Law 7 Policy; Volume 35, 2006.

GUIMARÃES, Leonam. Regimes Internacionais de Seguro para Usinas Nucleares. **Ceiri News**, São Paulo, 2017.

HARTKE, Victoria Riess. **The International Fallout of Chernobyl**. In: Penn State International Law Review: Vol. 5: No. 2, Article 8. 1987. Disponível em: http://elibrary.law.psu.edu/psilr/vol5/iss2/8. Acesso em: 02 nov. 2021.

HAWKES, N. *et al*. **The Worst Accident in the World - Chernobyl:** the end of the nuclear dream. Pan Books & William Heinemann, London, 1986.

IAEA. Convention on assistance in the case of a nuclear accident or radiological emergency. **International Atomic Energy Agency**, Vienna, 18 nov. 1996b. Disponível em: https://www.iaea.org/publications/documents/infcircs/convention-assistance-case-nuclear-accident-or-radiological-emergency. Acesso em: 30 out. 2021.

IAEA. Convention on Early Notification of a Nuclear Accident. **International Atomic Energy Agency**, Vienna, 18 nov. 1996a. Disponível em: https://www.iaea.org/sites/default/files/infcirc335.pdf. Acesso em: 30 out. 2021.

IAEA. **International Nuclear Law in the Post-Chernobyl Period**. Vienna: International Atomic Energy Agency, 2006.

INTERNATIONAL AGENCY OF ENERGY ATOMIC. **ChernobyPs legacy:** Health, environmental and socio-economic impacts and recommendations to the governments of Belarus, the Russian Federationhttp://www.iaea.or and Ukraine 2003-2005. http://www.iaea.org/Publications/Booklets/Chernobyl/chernobyl.pdf

IPEN. Desastre relembrado na série 'Chernobyl' inspirou protocolos de segurança em Angra. **Instituto de Pesquisas Energéticas e Nucleares**, Brasília, 01 jul. 2019.

KISS, Alexandre, SHELTON, Dinah. **Guide to International Environmental Law**. Leiden: Martinus Nijhoff Publishers, 2007.

MACHADO, Paulo Affonso Leme. **Direito Ambiental Brasileiro**. 20. ed. rev., atual. e ampl. São Paulo: Malheiros, 2012.

MALONE, Linda A. **The Chernobyl Accident:** A Case Study in International Law Regulating State Responsibility for Transboundary Nuclear Pollution. *In:* William & Mary Law School Scholarship Repository, Faculty Publications 590, 12 Columbia Journal of Environmental Law. p 203-241. 1987. Disponível em: "The Chernobyl Accident: A Case Study in International Law Regulating S" by Linda A. Malone (wm.edu).

RAUTENBACH, Johan; TONHAUSER, Wolfram; WETHERALL, Anthony. Overview of the International Legal Framework Governing the Safe and Peaceful Uses of Nuclear Energy – Some Practical Steps –In: NEA-OECD/ IAEA. International Nuclear Law in the Post-Chernobyl Period. Paris: OECD, 2006. ISBN 92-64-02293-7. Disponível em: https://www.oecd-nea.org/law/chernobyl/nea6146-iaeachernobyl.pdf, acesso em 28/05/2013.

ROSSI, Amanda. Tudo o que você precisa saber sobre as usinas nucleares de Angra 1 e 2, e por que são diferentes de Chernobyl. **BBC News Brasil**, São Paulo, 23 jun. 2019. Disponível em: https://www.bbc.com/portuguese/brasil-48683942. Acesso em: 10 nov. 2021.

SAENKO, V. IVANOVY, V. TSYBY, A. BOGDANOVA, A. TRONKO, M. DEMIDCHIK, Yu, YAMASHITA. The Chernobyl Accident and its Consequences. **Clinical Oncology**. n. 23, p. 234-243, 2011.

SALO, Anneli. Information Exchange after Chernobyl. From a radiation protection viewpoint, observations on the information flow. IAEA BULLETIN, autumn 1986.

SCHWARTZ, Julia A. **International Nuclear Third Party Liability Law: The Response to Chernobyl**. *In***:** International Nuclear Law in the Post-Chernobyl Period. Vienna: International Atomic Energy Agency, 2006. p. 37-72.

SOARES, Guido Fernando Silva. **Direito Internacional do Meio Ambiente:** emergências, obrigações e responsabilidade. São Paulo: Atlas, 2003.

WALSKE, Carl. Lessons of Chernobyl. IAEA BULLETIN, autumn 1986.

WINTER, Luís Alexandre Carta; BOTELHO, Martinho Martins. **Energia Nuclear e desenvolvimento:** o papel institucional da AEIA. 2013. Disponível em: www.publicadireito.com.br/artigos/?cod=869a7463ba2ba841. Acesso em: 30 out. 2021.

WNA. RBMK Reactors – Appendix to Nuclear Power Reactors. **World Nuclear Association**, London, 2020. Disponível em: https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-power-reactors/appendices/rbmk-reactors.aspx. Acesso em: 28 out. 2021.

Sobre os autores:

Alexandre Oheb Sion
Presidente da Associação Brasileira de Direito da Energia e do Meio Ambiente (ABDEM). Advogado com extensa atuação nas áreas de Energia e Meio Ambiente. Pós-doutorando em Direito pela Universidad de Salamanca na Espanha (certificado de conclusão pendente da defesa do doutorado). Doutorando em Ciências Jurídicas pela Universidade Autónoma de Lisboa, Portugal (tese depositada). Mestre em Direito Internacional Comercial (LL.M) pela Universidade da Califórnia, Estados Unidos. Especialista em Direito Constitucional. Pós-graduado em Direito Civil e Processual Civil (FGV). Coordenador da Pós-graduação em Direito de Energia da PUC Minas. Presidente da ADIMIN – Associação para o Desenvolvimento do Direito da Mineração. Presidente da ABDINFRA-Associação Brasileira de Direito da Infraestrutura. Diretor Jurídico e Administrativo do ICLEI – Governos Locais pela Sustentabilidade. Foi o primeiro Vice-Presidente da União Brasileira da Advocacia Ambiental (UBAA). Membro Consultor da Comissão Especial de Direito de Infraestrutura da OAB Nacional. Membro da Comissão de Direito Ambiental do Instituto dos Advogados Brasileiros (IAB). Foi Consultor da Comissão Nacional de Direito Ambiental da OAB – Conselho Federal. Coordenador do MBA em Direito da Mineração, Ambiental e ESG da Faculdade Arnaldo / Instituto Minere. Professor da Fundação Escola do Ministério Público de Minas Gerais. Professor da PUC/MG e convidado de inúmeras instituições de ensino. Palestrante atuante no Brasil e na Europa. Autor de inúmeros livros e artigos jurídicos.
Universidade Autónoma de Lisboa, Lisboa, Portugal
Lattes: http://lattes.cnpq.br/1776901364728469
E-mail: alexandre.sion@sionadvogados.com.br

Álvaro Sánchez Bravo
Doctor en Derecho - Universidad de Sevilla, España, 1996. Profesor de la Facultad de Derecho de la Universidad de Sevilla, España. Secretario del Departamento de Filosofía del Derecho. Profesor de Política Criminal del Instituto Andaluz Interuniversitario de Criminología (1994-2012). Presidente de la Asociación Andaluza de Derecho, Medio Ambiente y Desarrollo Sostenible.
Profesor de la Facultad de Derecho de la Universidad de Sevilla, Sevilla, Andalucía, Espanha
E-mail: alexandre.sion@sionadvogados.com.br

Izadora Gabriele dos Santos Oliveira
Advogada e Pesquisadora. MBA em Direito da Mineração, Ambiental e ESG pelo Instituto Minere (em andamento). Pós-graduanda em Lei Geral de Proteção de Dados. Pós-graduada em Direito Ambiental. Graduada em Direito pela Pontifícia Universidade Católica de Minas Gerais (PUC/MG). Autora do livro "Direito ambiental, economia e relações internacionais: terras raras, guerra comercial e Teoria dos Jogos". Vencedora da Competição de Startups Dom Helder e do Prêmio Rosa Nery – I Concurso de Vídeos Jurídicos Nacionais, promovido pela ABDC. Associada da Associação Brasileira de Direito da Energia e do Meio Ambiente (ABDEM). Associada da União Brasileira da Advocacia Ambiental (UBAA). Associada da Associação para o Desenvolvimento do Direito da Mineração (ADIMIN). Membro da Latin American Climate Lawyers Iniciative for Mobilizing Action (Laclima). Climate Reality Leader na The Climate Reality Project Champion United People Global (UPG). Autora de diversos artigos científicos.
Instituto Minere, Belo Horizonte, MG, Brasil
Lattes: http://lattes.cnpq.br/1970992584585714
E-mail: iza_oliveira123@hotmail.com

Lucas Fonseca Marinho
Advogado e Pesquisador com atuação focada em Direito Ambiental e Mudanças Climáticas. Possui graduação em Direito pela Pontifícia Universidade Católica de Minas Gerais (2016). Especialista/Pós graduado em Direito Público, Ambiental e Minerário também pela Pontifícia Universidade Católica de Minas Gerais. Possui formação complementar em diversos cursos voltados especialmente ao Direito Ambiental, Mudanças Climáticas e Sustentabilidade. Possui cerca de 07 anos de forte atuação focada na prática consultiva e contenciosa administrativa e judicial em matéria ambiental. É membro Latin American Climate Lawyers Initiative for Mobilizing Action (LACLIMA), da União Brasileira de Advogados Ambientais (UBAA), da Associação Brasileira de Direito da Energia e do Meio Ambiente (ABDEM), da Climate Reality Leadership Corps e dos Grupos de Estudo em Direito Ambiental e Minerário da UFMG ("GEDA E GEDIMIM"). É autor de diversos artigos sobre Direito Ambiental e Direito Minerário.
Pontifícia Universidade Católica de Minas Gerais, Belo Horizonte, MG, Brasil
Lattes: https://lattes.cnpq.br/3191760362189011
E-mail: fonseca_marinho@hotmail.com

Os autores contribuíram igualmente para a redação do artigo.