

## REPROCESSING OF NUCLEAR FUEL: CERTAIN LEGAL ISSUES ARISING FROM THIS UNIQUE TECHNOLOGY

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**Abstract:** A key, nearly unique, characteristic of nuclear energy is that spent fuel may be reprocessed to recover fissile materials to provide fresh fuel for existing and future nuclear installations. United Kingdom, France, Russian Federation, China, India and Japan have policies to reprocess spent fuel, although government policies in many other countries have not yet come to seeing spent fuel as a resource rather than a waste. In 1997, the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management reaffirmed the right of the State to define its own fuel cycle policy, i.e. either to consider spent fuel as a resource that may be reprocessed, or to dispose it as waste. Further, the Convention also reconfirmed the right of its Contracting Parties to export spent fuel for reprocessing in a third country and its return to the State of origin. This article is dealing with topical legal issues arising from this unique technology.

**Key words:** radioactive waste management, reprocessing of spent fuel, nuclear safety, nuclear liability, nuclear installations

### 1. INTRODUCTION<sup>2</sup>

The International Atomic Energy Agency (IAEA) estimates,<sup>3</sup> that since the start of nuclear power based electricity production in 1954<sup>4</sup> to the end of 2013, a total of about 370 000 t HM<sup>5</sup> of spent fuel was discharged from all nuclear power plants worldwide. Spent nuclear fuel is considered to be waste in some States as well as a potential future energy resource in others. If it is considered waste, it will be disposed of as such after some decades of interim storage (“open fuel cycle”). Otherwise, it might be reprocessed to recover fissile materials for future use (“closed fuel cycle”).

Consequently, over the last 50 years the principal reason for reprocessing spent fuel has been to recover unused plutonium and thereby close the fuel cycle, gaining some 25% to 30% more energy from the original uranium in the process. This contributes to national energy security. A secondary reason is to reduce the volume of material to be disposed of

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<sup>3</sup> IAEA (ed.). *Status and Trends in Spent Fuel and Radioactive Waste Management* (IAEA 2018), 1.

<sup>4</sup> On 27 June 1954, the world’s first grid-connected nuclear power plant to generate electricity (albeit at small scale) commenced operations at the Institute of Physics and Power Engineering in Soviet Obninsk. The world’s first full scale power plant, Calder Hall in the Great Britain, commenced its operation on 17 October 1956.

<sup>5</sup> Tonnes of heavy metal, abbreviated as “t HM”, is a unit of mass used to quantify uranium, plutonium, thorium and mixtures of these elements.

as high-level radioactive waste to about one-fifth.<sup>6</sup> In addition, the level of radioactivity in the waste from reprocessing is much smaller and after about 100 years falls much more rapidly than in spent fuel itself.<sup>7</sup>

A great deal of reprocessing has been going on since the 1940s, originally for military purposes. Currently, United Kingdom, France, Russian Federation, China, India and Japan do operate reprocessing installations in their territory. These installations do not only serve for reprocessing of spent fuel produced by these states, but also for reprocessing of fuel being produced in third states.

Taking the prospective importance for national energy security and contribution to the reduction of the volume of radioactive waste, the technology of reprocessing attracts attention of executives of those States, planning further development of the use of nuclear energy in their territory. Recently, this is also the case of the Czech Republic. Consequently, also the Nuclear Energy Act No. 263/2016 Coll.<sup>8</sup> has explicitly addressed the issue of reprocessing installations to be *potentially* operated in the territory of the Czech Republic.<sup>9</sup> Further, the Act also provides for rules on export of spent fuel from the territory to be reprocessed abroad.

It is a matter of fact that authors have already dealt with various legal issues arising from radioactive waste management.<sup>10</sup> In this regard, *Eugénie Vial* argued that developing a legal framework in this field constitutes a part of responsibility of the recent generation to the future generations for the radioactive waste legacy.<sup>11</sup> Consequently, the principle of sustainable development is being considered as one of the key principles of international nuclear law.<sup>12</sup>

However, the reprocessing technology hasn't so far attracted wider attention of legal community so far. Taking the potential impact of this technology for prospective reduction

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<sup>6</sup> RILEY, P. *Nuclear Waste: Law, Policy and Pragmatism*. Burlington: Ashgate Publishing, 2004, pp. 264–265.

<sup>7</sup> So far, some 100.000 tonnes of used fuel from nuclear installations has been reprocessed. Annual reprocessing capacity is now about 5000 tonnes per year for normal oxide fuels, but not all of it is operational.

<sup>8</sup> Act of 14<sup>th</sup> July 2016, Nuclear Energy Act, was published in the Collection of Laws under the No. 263/2016 and entered into force on 1<sup>st</sup> January 2017.

<sup>9</sup> The legal framework being in place until 1<sup>st</sup> January 2017 did address merely the issue of export of spent nuclear fuel for reprocessing in a third state. Further, its Article 33 referred to the Vienna Convention on Civil Liability for Nuclear Damage of 1963 concerning specification of which installations are covered by the regime of liability and compensation. Consequently, this *renvoi* to the international convention had provided for the only reference to a reprocessing installation being potentially operated in the territory of the Czech Republic. There are recently no reprocessing facilities, operated in the territory of the Czech Republic.

<sup>10</sup> See in particular (i) STROHL, P. Legal, Administrative and Financial Aspects of the Long-Term Management of Radioactive Waste. *Nuclear Law Bulletin*. 1977, Vol. 21, pp. 77–88. (ii) HANCHER, L. Radioactive Waste Disposal, an International Legal Perspective. *Leiden Journal of International Law*. 1990, Vol. 3, pp. 143–166. (iii) MONTJOIE, M. *Droit international et gestion des déchets radioactifs*. Paris: L.G.D.J., 2011. (iv) ODENDAHL, K. Storage and disposal of radioactive waste: The search for a global solution. In: J. L. Black-Branch – D. Fleck (eds.). *Nuclear Non-Proliferation in International Law, Vol. III: Legal aspects of the Use of Nuclear Energy for Peaceful Purposes*. Vienna: Springer, 2016, pp. 277–294. (v) HANDRLICA, J. The Vienna Convention on Civil Liability for Nuclear Damage and Radioactive Waste Management: Problems Revisited. *Czech Yearbook of Public & Private International Law*. 2017, Vol. 8, pp. 392–403.

<sup>11</sup> VIAL, E. The Concept of Responsibility to Future Generations for the Management and Storage of Radioactive Waste. *Nuclear Law Bulletin*. 2004, No. 74, pp. 15–26.

<sup>12</sup> HANDRLICA, J. Nuclear law revisited as academic discipline. *Journal of World Energy Law & Business*. 2019, Vol. 12, pp. 52–68.

of burden arising from radioactive waste, this article aims to address certain issues arising in this regard.

The article will analyse the problem of reprocessing from two different viewpoints. Firstly, the issue will be addressed from the perspective of international law. It is a matter of fact, that there are only few States today, which operate reprocessing facilities in their territories and consequently, these facilities serve not only for domestic purposes, but also for reprocessing of spent fuel produced abroad. Therefore, reprocessing process bears always certain international aspect. Thus, the first part of the article aims to identify, which issues regarding the reprocessing technologies are regulated by these international conventions and which issues were left for regulation of respective bilateral agreements between the concerned States.

Secondly, the issue will be addressed from the perspective of the legal framework in the Czech Republic. Here, the requirements arising from the directives adopted by the European Atomic Energy Community (Euratom) are to be reflected in parallel to the requirements arising from international law.

Thus, this article aims to contribute to the legal scholarship dealing with new technologies from two different viewpoints. On one hand, it is dealing with the topic from the viewpoint of the reprocessing technology, which represents a promising nuclear technology able to address challenges arising from the sustainable development principle. On the other hand, the article aims to deal with this technology from the viewpoint of the Czech Republic, which aspires to further develop peaceful uses of nuclear energy in its territory.

## 2. REPROCESSING AND INTERNATIONAL LAW

From the legal perspective, the peaceful uses of nuclear energy and ionizing radiation are currently governed by a vigorous legal framework, established by binding multilateral instruments of international law, adopted under auspices of the International Atomic Energy Agency (thereinafter “the IAEA”), the Organisation for Economic Cooperation and Development (thereinafter “the OECD”) and to a certain extent the International Maritime Organisation (thereinafter “the IMO”). The instruments of international law cover the issues of early notification<sup>13</sup> and mutual assistance<sup>14</sup> in a case of a nuclear accident or radiological emergency, nuclear safety,<sup>15</sup> nuclear liability (established both under the auspices of the OECD<sup>16</sup>, IAEA<sup>17</sup> and IMO<sup>18</sup>) and nuclear security<sup>19</sup> as well as the issues of

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<sup>13</sup> The Convention on Early Notification of a Nuclear Accident (adopted 26 September 1986, entered into force 27 October 1985), INFCIRC/335.

<sup>14</sup> The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (adopted 26 September 1986, entered into force 26 February 1987), INFCIRC/336.

<sup>15</sup> The Convention on Nuclear Safety (adopted 17 June 1994, entered into force 24 October 1996), INFCIRC/449.

<sup>16</sup> The Convention on Third Party Liability in the Field of Nuclear Energy (adopted 29 July 1960), as amended by the Additional Protocol of 1964 (adopted 28 January 1964, entered into force 1 April 1968) and by the Protocol of 1982 (adopted 16 November 1982, entered into force 7 October 1988), and the Protocol to Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960 as Amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982 (adopted 12 February 2004, not yet in force).

radioactive waste management.<sup>20</sup> These instruments of international law are currently binding for a majority of States operating nuclear installations for electricity production within their territory.

It is matter of fact that these fail to represent self-executing international conventions and thus require inclusion in the legal norms of national legislation.<sup>21</sup> Further, there are many areas that have yet to be governed by *any* multilateral international instruments and are exclusively subject to bilateral agreements among the States and to the national legislation of the concerned States.

Consequently, following paragraphs will address the question, to which extend is reprocessing of nuclear fuel governed by existing multilateral instruments and what aspects remain to be governed by other instruments of international law, or national legislation.

### International conventions in the field of nuclear liability

The issue of reprocessing of spent fuel was addressed already by the provisions of the Paris Convention on Third Party Liability in the Field of Nuclear Energy of 1960 (thereinafter “the Paris Convention”<sup>22</sup>). By signing the Convention, the Contracting Parties were already aware<sup>23</sup> of the risks arising from the operation of reprocessing installations and consequently, included “*factories for the reprocessing of irradiated nuclear fuel*” under the nuclear installations to which the liability framework is applicable. Subsequently, the issue of reprocessing was addressed also by the Vienna Convention on Civil Liability for Nuclear Damage of 1963 (thereinafter “the Vienna Convention”<sup>24</sup>) which similarly includes “*any factory for the processing of nuclear material, including any factory for the reprocessing of irradiated nuclear fuel*” under the nuclear installations covered by the liability framework as established by this instrument. Currently, the provisions of the Paris Convention establish basic nuclear liability principles in 16 states<sup>25</sup> that are Member States

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<sup>17</sup> The Vienna Convention on Civil Liability for Nuclear Damage (adopted 21 May 1963, entered into force 12 November 1977), INFCIRC/500; the Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (adopted 21 September 1988, entered into force 27 April 1992), INFCIRC/402; the Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage (adopted 12 September 1997, entered into force 4 October 2003), INFCIRC/566 and the Convention of Supplementary Compensation of Nuclear Damage (adopted 12 September 1997, entered into force 15 April 2015), INFCIRC/567.

<sup>18</sup> The Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material (adopted 17 December 1971, entered into force 15 July 1975).

<sup>19</sup> The Convention on the Physical Protection of Nuclear Material (adopted 26 October 1979, entered into force 8 February 1987), INFCIRC/274 and the Amendment to the Convention on the Physical Protection of Nuclear Material (adopted 8 July 2005, entered into force 8 May 2016), INFCIRC/274/Rev.1/Mod.1.

<sup>20</sup> Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (adopted 5 September 1997, entered into force 18 June 2001), INFCIRC/546.

<sup>21</sup> This is, to a large extent, the case of radiological protection, which is however subject to vigorous regulation under the law of the European Atomic Energy Community (Euratom).

<sup>22</sup> The Convention on Third Party Liability in the Field of Nuclear Energy of 29<sup>th</sup> July 1960, as amended by the Additional Protocol of 28<sup>th</sup> January 1964 and by the Protocol of 16<sup>th</sup> November 1982. The Paris Convention and the Additional Protocol entered into force on 1<sup>st</sup> April 1968. The Protocol of 1982 entered into force on 7<sup>th</sup> October 1988.

<sup>23</sup> NOVOTNÁ, M., HANDRLICA, J. *Zodpovednosť za jadrové škody*. Bratislava: Veda, 2011, pp. 154–155.

<sup>24</sup> The Vienna Convention on Civil Liability for Nuclear Damage of 21<sup>st</sup> May 1963 entered into force on 12<sup>th</sup> November 1977.

<sup>25</sup> Belgium, Denmark, Finland, France, Germany, Greece, Italy, Netherlands, Norway, Portugal, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

to the Organisation for Economic Cooperation and Development. At the same time, the Vienna Convention covers 40 states worldwide.<sup>26</sup> The Vienna Convention was signed under the auspices of the International Atomic Energy Agency.

International conventions covering the field of nuclear liability contain some basic liability principles<sup>27</sup> that differ considerably from the principles of ordinary tort law:

1. Firstly, each nuclear installation must have a person in charge: the *operator*. Under the liability regime established by the conventions, the operator of a nuclear installation is exclusively liable for nuclear damage.<sup>28</sup> Consequently, the conventions provide for very limited liability relief. As a *quid pro quo* for these very strict conditions of the operator's liability, the Contracting Party may limit the operator's liability by national legislation.<sup>29</sup> However, the conventions provide for liability limits, which may be implemented by the respective Contracting Party.

2. Further, the conventions require the operator to maintain mandatory insurance or to provide other financial securities covering its liability for nuclear damage in such amounts, of such types and in such terms as the Contracting Party specifies.

3. At the same time, the conventions provide that courts of the Contracting Party where the nuclear incident occurred will have exclusive jurisdiction over all actions brought for damages caused by a nuclear incident occurring in their territory. At this place, several remarks are to be made concerning the applicability of both Paris and Vienna Convention to reprocessing installations:

The liability framework, as established by the conventions, is applicable to “*factories for the reprocessing of irradiated nuclear fuel*”, irrespective whether the spent fuel comes from nuclear installations operated for commercial, scientific, or other purposes.<sup>30</sup>

<sup>26</sup> Argentina, Armenia, Belarus, Bolivia, Bosnia and Herzegovina, Brazil, Bulgaria, Cameroon, Chile, Croatia, Cuba, Czech Republic, Egypt, Estonia, Hungary, Jordan, Kazakhstan, Latvia, Lebanon, Lithuania, Mauritius, Mexico, Montenegro, Morocco, Niger, Nigeria, Peru, Philippines, Poland, Republic of Macedonia, Republic of Moldova, Romania, Russian Federation, Saint Vincent and Grenada, Saudi Arabia, Senegal, Serbia, Slovakia, Ukraine and Uruguay.

<sup>27</sup> HARDY, M. Nuclear Liability: The General Principles of Law and Further Proposals. *British Yearbook of International Law*. 1960, Vol. 36, pp. 223–249.

<sup>28</sup> There is, however, one exception to this basic principle. Under the conventions, the Contracting Party may provide by legislation that a *carrier* of radioactive waste, or a person handling radioactive waste, be designated or recognised as operator in the place of the operator concerned. Further, the substitution must be *requested* by the carrier, or a person handling the waste. In such a case, a carrier who is designated or recognised by the national legislation as subject liable for nuclear damage, has legally the status of the operator of the nuclear installation and shall be bound by all provisions of nuclear liability legislation. However, it is a matter of fact, that it is not common in the legislative practice of the Contracting Parties to channel the liability to other subjects, then the operators of nuclear installations. Theoretically, this provision may be applied mainly by railway companies or by other carriers who transport radioactive waste based on regular transportation services.

<sup>29</sup> Consequently, the Article 35 of the Act No. 18/1997 Coll. limits the liability of an operator to either 5 billion CZK (in cases of nuclear installations operated for energy purposes, storage facilities and final disposal facilities) or to 2 billion CZK (in cases of other nuclear installations).

<sup>30</sup> It is a matter of fact, that the conventions remain silent concerning the definition of “irradiated nuclear fuel”. However, the Paris Convention provides in its Article 1 Paragraph a/iii, that nuclear fuel means “fissionable material in the form of uranium metal, alloy, or chemical compound (including natural uranium), plutonium metal, alloy, or chemical compound, and such other fissionable material as the Steering Committee for Nuclear Energy

Concerning this, the conventions also provide, that any Contracting Party may determine that two or more installations of one operator which are located on the same site shall, together with any other premises on that site where radioactive material is held, be treated as a single installation.<sup>31</sup>

However, if a reprocessing installation is being operated for reprocessing of spent fuel for military purposes, it does not fall under the liability framework established by the conventions, as they are intended to cover exclusively installations operated for peaceful purposes.<sup>32</sup> In this respect, it is interesting to mention, that the question of applicability of the liability framework to those nuclear installations, which are operated *jointly* for peaceful and defence purposes hasn't been fully answered yet.<sup>33</sup>

If a reprocessing facility is being operated for peaceful purposes, the liability framework created under the Convention is applicable also in a case, spent fuel being reprocessed originates partially or exclusively from a third country. In this respect, the conventions provide,<sup>34</sup> that the operator may have a right of recourse against a third person only if and to the extent that it is so provided expressly by contract. Consequently, a mere fact, that the spent fuel being reprocessed is owned by a third person does not exclude the operator of a reprocessing installation from his liability as established by the conventions.

### International conventions in the field of nuclear safety

While the issues of nuclear liability had been addressed by international conventions already in the 1960s, the issues of nuclear safety have been regulated only in aftermath of the Chernobyl accident. In this regard, the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management<sup>35</sup> (thereinafter “the Joint Convention”) provided for basic principles of the safe management with spent fuel

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of the OECD shall from time to time determine”. Similarly, the Vienna Convention provides in its Article I Paragraph 1/i, that nuclear fuel means “any material which is capable of producing energy by a self-sustaining chain process of nuclear fission.” See HANDRLICA, J. *The Vienna Convention on Civil Liability for Nuclear Damage and Nuclear Installations: Application Problems Revisited. Czech Yearbook of Public & Private International Law*. 2015, Vol. 6, pp. 149–160.

<sup>31</sup> The Paris Convention (Article 1 Paragraph a/ii), the Vienna Convention (Article I Paragraph 1/j).

<sup>32</sup> In this respect, the Preamble of the Paris Convention states, that one of reasons for concluding the Convention was the desirability of “ensuring adequate and equitable compensation for persons who suffer damage caused by nuclear incidents whilst taking the necessary steps to ensure that the development of the production and uses of nuclear energy for peaceful purposes is not thereby hindered”. Similarly, the Preamble of the Vienna Convention refers to the desire if the Contracting parties to establish “some minimum standards to provide financial protection against damage resulting from certain peaceful uses of nuclear energy”. It is a matter of fact, that there is no further indication in the conventions as to whether it also applies to military facilities. However, it is a common understanding, that the liability framework established is not applicable to any nuclear installations operated for military (defence) purposes. See KISSICH, S. *Internationales Atomhaftungsrecht: Anwendungsbereich und Haftungsprinzipien*. Baden Baden: Nomos Verlag, 2004, pp. 142–143.

<sup>33</sup> TROMANS, S. *Nuclear Law. The Law Applying to Nuclear Installations and Radioactive Substances in its Historic Context*. Oxford: Hart Publishing, 2010, at pp. 34–36.

<sup>34</sup> The Paris Convention (Article 6 Paragraph f/ii), the Vienna Convention (Article X Paragraph a).

<sup>35</sup> The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (adopted 5 September 1997, entered into force 18 June 2001), INFCIRC/546.

and radioactive waste.<sup>36</sup> The Joint Convention declared that “*the definition of a fuel cycle policy rests with the State, some States considering spent fuel as a valuable resource that may be reprocessed, others electing to dispose of it*”.<sup>37</sup> In this respect, the Joint Convention also provided for the definition of the terms “*spent fuel*”<sup>38</sup> and “*reprocessing*”<sup>39</sup> for the first time in international law.

Notwithstanding the option of the fuel cycle chosen by the Contracting Party (either the “open fuel cycle” or the “closed fuel cycle”), the Joint Convention declared, that radioactive waste<sup>40</sup> should, as far as is compatible with the management safety of such material, be disposed<sup>41</sup> of in the State in which it was generated.<sup>42</sup> Also, the Joint Convention recognized the right of any Contracting Party to ban import into its territory of foreign spent fuel and radioactive waste.<sup>43</sup> Further, Contracting Parties shall not license the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees south for storage or disposal.<sup>44</sup> Additional obligations are provided to all Contracting Parties involved in transboundary movement of radioactive waste, in particular the requirement to establish an appropriate authorization system, necessity to obtain consent of the State of the destination and the obligation to permit re-entry into its territory, if a transboundary movement is not or cannot be completed in conformity with the Joint Convention, unless an alternative safe arrangement can be made.<sup>45</sup>

From the viewpoint of this article, it is necessary to highlight, that Joint Convention explicitly reaffirmed the rights of Contracting Parties to export its spent fuel for reprocessing and the corresponding rights of other Contracting Parties to “*return, or provide for the return of, radioactive waste and other products resulting from reprocessing operations to the State of origin.*”<sup>46</sup>

<sup>36</sup> Concerning obligations arising from the Joint Convention see (i) KAGENECK, A., PINEL, C. The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. *International and Comparative Law Quarterly*. 1998, Vol. 47, No. 2, pp. 409–425. (ii) Web, G. The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management: Development and Technical Content. *Journal of Radiologic Protection*. 1998, Vol. 18, No. 4, pp. 265–275. (iii) JANKOWITSCH-PREVOR, O., TONHAUSER, W. The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. In: OECD (ed.). *International Nuclear Law in the Post-Chernobyl Period*. Paris: OECD, 2006, pp. 201–214.

<sup>37</sup> Preamble, Paragraph vii.

<sup>38</sup> The Joint Convention provides in its Article 2, Paragraph n/, that “*spent fuel*” means nuclear fuel that has been irradiated in and permanently removed from a reactor core.

<sup>39</sup> The Joint Convention provides in its Article 2, Paragraph l/, that “*reprocessing*” means a process or operation, the purpose of which is to extract radioactive isotopes from spent fuel for further use.

<sup>40</sup> “Radioactive waste” is being defined as “radioactive material in gaseous, liquid or solid form for which no further use is foreseen by the Contracting Party or by a natural or legal person whose decision is accepted by the Contracting Party, and which is controlled as radioactive waste by a regulatory body under the legislative and regulatory framework of the Contracting Party” (Article 2.h.). Consequently, if considered for no further use, spent fuel constitutes radioactive waste under the Convention.

<sup>41</sup> “Disposal” is defined as “the emplacement of spent fuel or radioactive waste in an appropriate facility without the intention of retrieval” (Article 2.d.).

<sup>42</sup> Preamble, sub (xi).

<sup>43</sup> Preamble, sub (xii).

<sup>44</sup> Article 27, Paragraph 2.

<sup>45</sup> Article 27, Paragraph 1.

<sup>46</sup> Article 27, Paragraph 3.

At last but not at least, the Joint Convention provided for minimal safety standards of the spent fuel management.<sup>47</sup> During negotiations leading to the adoption of the Joint Convention, the delegation of the United Kingdom argued that since reprocessing represents undoubtedly one of the most controversial aspects of the spent fuel management, its exclusion would be very difficult to explain to the public and would most likely damage the credibility of the Convention. In this respect, the United Kingdom believed, that the Joint Convention would be a suitable vehicle to address the safety aspects of reprocessing at international level.<sup>48</sup> However, the final wording of the Article 3 explicitly declares, that spent fuel held at reprocessing facilities as part of a reprocessing activity is not covered in the scope of this Convention unless the Contracting Party declares reprocessing to be part of spent fuel management. This provision represents a delicate compromise between interests of those States supporting inclusion of reprocessing installations under the framework of the Convention<sup>49</sup> and those opposing such inclusion due to the unpreparedness to apply this framework on already existing installations.<sup>50</sup>

In this concern, it is important to note, that under the European Atomic Energy Community (Euratom), a special regional framework has been established in this area. This exists in parallel to the international framework, existing under the Joint Convention. Here, the Directive 2011/70,<sup>51</sup> reaffirmed both the right of each Member State to refine its own fuel cycle policy<sup>52</sup> and the right to provide for reprocessing of spent fuel abroad.<sup>53</sup> However, in contrast to a rather ambivalent position established by the Joint Convention, the Directive opted explicitly for inclusion<sup>54</sup> of the reprocessing in the framework of the spent fuel management. This step clearly reflected the position of several Member States, which was expressed already during the negotiations leading to the adoption of the Joint Convention. Consequently, the Directive established a special regional framework, providing for stricter criteria, as required directly by the Joint Convention itself.<sup>55</sup>

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<sup>47</sup> The Joint Convention provides in its Article 2, Paragraph 0/, that “*spent fuel management*” means all activities that relate to the handling or storage of spent fuel, excluding off-site transportation.

<sup>48</sup> This opinion was shared inter alia by the delegations of France, Japan, Germany, Ireland and the Czech Republic.

<sup>49</sup> Consequently, the United Kingdom, France and Japan issued a “Joint Declaration” regretting the fact; reprocessing installations haven’t been included under the scope of the Convention and urging other Contracting Parties to do so unilaterally, as foreseen in the final version of the Article 3. See IAEA (ed.). *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*. Vienna: IAEA, 1998, pp. 72–73 (with the text of the “Joint Declaration” published at p. 125).

<sup>50</sup> This was in particular the case of India and Pakistan.

<sup>51</sup> Council Directive 2011/70/EURATOM of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste, OJ 199/48.

<sup>52</sup> The Directive 2011/70 provides in its Preamble (recital 20), that “the spent fuel can be regarded either as a valuable resource that may be reprocessed or as radioactive waste that is destined for direct disposal. Whatever option is chosen, the disposal of high-level waste, separated at reprocessing, or of spent fuel regarded as waste should be considered”.

<sup>53</sup> The Directive provides in its Article 2, Paragraph 4 that it shall not affect the right of a Member State or an undertaking in that Member State to which spent fuel is to be shipped for treatment or reprocessing to return to its country of origin radioactive waste recovered from the treatment or reprocessing operation, or an agreed equivalent.

<sup>54</sup> The Directive 2011/70 provides in its Article 3, Paragraph 12 that “*spent fuel management*” means all activities that relate to the handling, storage, reprocessing, or disposal of spent fuel, excluding off-site transportation.

<sup>55</sup> In the Czech Republic, the Nuclear Energy Act No. 263/2016 Coll. provides in its Article 106, that “*spent fuel management*” includes collecting, storage, reprocessing and final disposal of spent fuel.



## The role of the bilateral agreements

It is a matter of fact that the reprocessing of spent fuel as such is to be considered as a special kind of service under the terms of civil law. Consequently, an agreement between the reprocessing enterprise and the owner of the spent fuel will be necessary to address the issues of liability transfer, ownership of spent fuel, payment for the reprocessing etc.<sup>56</sup>

However, reflecting the fact, the reprocessing technology is only partially regulated by the multilateral instruments of international law, the issue triggers need to address the respective issues by the means of bilateral agreements.<sup>57</sup> Taking the potential safety and security concerns arising from the spent fuel, the issues of reprocessing became subject of bilateral agreements, concluded between the States of the fuel origin and the States of fuel reprocessing. Existence of these bilateral agreements underline the fact, the concerned States are well aware of the safety and security risks arising from the reprocessing process and consider regulation by the agreements between the private parties as not sufficient.<sup>58</sup>

These bilateral agreements do currently represent the backbone of international framework for reprocessing. These agreements do regularly address the issues of *ultimate responsibility* for the outcomes of the reprocessing process<sup>59</sup> (i.e. for the new fuel and for the radioactive waste produced as a consequence of the reprocessing process). Such *ultimate responsibility* can rest either by the State of origin, or by the State of reprocessing. Consequently, the issue of reprocessing is currently one of the issues in the area of nuclear law, which remain to be regulated rather in bilateral agreements, than in the multilateral instruments.

This is also of importance for the Czech Republic. Consequently, in case of prospective further development of reprocessing technologies and interest of the domestic producers of spent fuel in its reprocessing abroad, there will be necessary to adopt a corresponding bilateral agreement with the concerned State.<sup>60</sup>

## New reprocessing technologies and international law

In the context of the reprocessing issue, it must be mentioned that, most recently, new reactor technologies are being advanced. With Generation II, III and III+ reactors currently operating (or under construction), research and development efforts are forging ahead with Generation IV fast reactors, being promoted by the “Generation IV International

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<sup>56</sup> COOK, H. *The Law of Nuclear Energy*. 2<sup>nd</sup> revised edition, London: Sweet and Maxwell, 2018, pp. 388–389.

<sup>57</sup> With respect to the Czech Republic, the issue of reprocessing of used nuclear fuel abroad has been addressed in the Agreement between the Governments of the Russian Federation and the Czech Republic of 4<sup>th</sup> December 1994 as Amended by the Protocol of 15<sup>th</sup> April 1999. The issue is also covered by the Agreement between the Governments of the Ukraine and the Czech Republic of 30<sup>th</sup> June 1997.

<sup>58</sup> Reflecting these concerns, the Agreement between the Governments of Czechoslovakia and the United States of America of 13<sup>th</sup> June 1991 forbids any reprocessing of nuclear fuel, delivered as provided under this Agreement.

<sup>59</sup> For further details, see HANDRLICA, J. Odpovědnost státu a přepracování jaderného paliva v zahraničí. *Revue pro právo a technologie*. 2017, Vol. 8, No. 1, pp. 3–18.

<sup>60</sup> This will be also true *vis-à-vis* the third countries, irrespectively from their position towards inclusion of reprocessing under the framework of the Joint Convention.

Forum” (GIF) established under the umbrella of the OECD.<sup>61</sup> The Forum has selected six technologies<sup>62</sup> for further study and support, each of which have the potential to become crucial for the future development of nuclear industry.

In addition to these new technologies, new fuel cycle activities are also being advanced, including new methods of reprocessing spent nuclear fuel. One example of innovation in the nuclear fuel cycle is pyro-chemical processing (or *pyro-processing*), a high-temperature method of recycling spent fuel into fuel, which can be applied in the future for reprocessing fuel from the Generation IV reactors.<sup>63</sup> It is expected that, when used in conjunction with Generation IV fast reactors, pyro-processing would allow 100 times more energy in the uranium ore to be used to produce electricity compared to current commercial reactors.<sup>64</sup> At the same time, pyro-processing would markedly reduce both the amounts of waste and the time it must be isolated (from approximately 300,000 to approximately 300 years) by recycling all actinides.<sup>65</sup>

Most recently, Helen Cook emphasised the legal challenges arising from this new technology.<sup>66</sup> From the perspective of this article, I would suggest considering pyro-processing facilities as fitting into the category of the “factories for the re-processing of irradiated nuclear fuel”<sup>67</sup> as provided by the existing multilateral instruments of international law. Taking the arising risks into consideration and the fact that pyro-processing represents a further development of the previously known reprocessing technologies,<sup>68</sup> it would be necessary to include these prospective pyro-processing facilities into the liability regime established by the existing international conventions.

### 3. REPROCESSING AND THE LEGAL FRAMEWORK OF THE CZECH REPUBLIC

Taking prospective contribution of reprocessing to the national energy security and to the reduction of radioactive waste, it is worth to examine legal issues arising from this unique technology with respect to the legal framework existing in the Czech Republic.

Here, two scenarios are to be analysed. In the first scenario, spent fuel is produced in the territory of the Czech Republic and is exported abroad for reprocessing in order to obtain new nuclear fuel. This fuel is to be used in nuclear installations, operated in the territory of the Czech Republic. In the second scenario, a reprocessing installation will be

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<sup>61</sup> Following members are participating at the GIF recently: Argentina, Brazil, Canada, China, Euratom, France, Japan, Russian Federation, South Africa, South Korea, Switzerland, the United Kingdom and the United States. For further details see: [https://www.gen-4.org/gif/jcms/c\\_9260/public](https://www.gen-4.org/gif/jcms/c_9260/public).

<sup>62</sup> Gas-cooled fast reactors, very-high-temperature reactors, supercritical-water-cooled reactors, sodium-cooled fast reactors, lead-cooled fast reactors and molten salt reactors.

<sup>63</sup> SIMPSON, M. *Fundamentals of Spent Nuclear Fuel Pyroprocessing*. In: J. Zhang (ed.). *Nuclear Fuel Reprocessing and Waste Management*, London: World Scientific, 2019, pp. 27–29.

<sup>64</sup> *Ibid.*

<sup>65</sup> *Ibid.*

<sup>66</sup> COOK, H. *The Law of Nuclear Energy*. p. 422.

<sup>67</sup> *Ibid.*

<sup>68</sup> See also HANDRLICA, J. Underground repositories, reprocessing facilities, floating nuclear power plants. *Journal of Energy & natural Resources Law*. 2019, [2019-02-27]. Available at: <<https://www.tandfonline.com/doi/full/10.1080/02646811.2019.1575064>>.

constructed and operated in the territory of the Czech Republic. This will serve not only for reprocessing of spent fuel produced in the nuclear installations operated in the territory of the Czech Republic, but also for spent fuel imported from abroad.

### Reprocessing of spent fuel abroad

The Nuclear Energy Act No. 263/2016 Coll. explicitly refers to the issue of reprocessing of spent fuel abroad. Here, reflecting the requirements arising from the Directive 2011/70, the principle of the ultimate responsibility of the State was implemented. Hence, the Act proclaims, that “for the case, radioactive waste is being sent from the territory of the Czech Republic, to the territory of other State being member of Euratom, or to another non-member State for processing or reprocessing, the responsibility of the Czech Republic for safe and responsible management with this fuel remains”.<sup>69</sup>

Consequently, the provision provides for an extraterritorial responsibility of the Czech Republic for spent fuel exported abroad. Consequently, the question arises, what are the consequences of this extraterritorial responsibility. Pursuant to the existing bilateral agreement between the Czech Republic and the Russian Federation, the spent fuel coming from the nuclear installations operated in our territory can be reprocessed in reprocessing installations operated in the territory of the Russian Federation. In such a case, obligation of the Czech Republic to *accept* produced fissile materials, radioactive waste and other products resulting from reprocessing is provided explicitly.<sup>70</sup>

However, the Nuclear Energy Act No. 263/2016 Coll. implicitly provides also for a possibility, the radioactive waste produced will be disposed in the territory of the Russian Federation. In this regard, the Act presumes that such disposal is provided by a corresponding bilateral agreement, which is to be notified to the European Commission.

This regime will be applicable also by potential reprocessing in other States. As argued above, each reprocessing abroad must be addressed by a special bilateral agreement concluded between the Czech Republic and the State of reprocessing.

### Reprocessing of spent fuel in our territory

The Nuclear Energy Act No. 263/2016 Coll. provides for a list of technologies, which are to be considered as “nuclear installations”. Further, the Act provides for a special permitting and surveillance regime for these installations, executed by the State Authority for Nuclear Safety. The reprocessing facilities have been included into these installations by the Act. Consequently, one can argue that the Act did establish a basic framework for a prospective development of reprocessing technologies in the territory of the Czech Republic.

However, there are some constrains that are to be discussed. While the Nuclear Energy Act No. 263/2016 Coll. provides for responsibility of the Czech Republic by reprocessing abroad, it do not provide for a similar rule with regard to a prospective reprocessing in

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<sup>69</sup> Article 107, Paragraph 1.

<sup>70</sup> The Agreement between the Governments of the Russian Federation and the Czech Republic of 4<sup>th</sup> December 1994 as Amended by the Protocol of 15<sup>th</sup> April 1999 (Article 5).

a reprocessing installation operated in the territory of the Czech Republic. Consequently, any prospective development of reprocessing technologies in the territory of the Czech Republic will require establishing of corresponding legal framework in this regard.

Further, it is interesting to note, that while the Nuclear Energy Act No. 263/2016 Coll. provides for certain rules concerning an operation of reprocessing facility, the Act No. 18/1997 Coll. (providing for rules on liability for nuclear damages) does not provide for a specific reference to such installations. Consequently, an explicit provision on amount of operator's liability with concern to reprocessing facilities is missing in existing legal framework.

This situation must be addressed by future legislative efforts in order to provide for a clear and transparent environment for further development of this promising technology.

## CONCLUSIONS

Reprocessing represents a unique technology, which can cope with the challenges arising from the prospective multiplication of radioactive waste in the future. The existing legal framework, governing this technology is based on four layers of legal norms. Firstly, there are multilateral instruments of international law. However, these fails to provide for a comprehensive framework and do refer only to partial issues. Secondly, there are bilateral agreements between the States of origin and the States of reprocessing. Currently, these agreements represent the backbone of the international regime, providing for a set of rules delimiting responsibility of the concerned States. Thirdly, there is national legislation, governing safety and security of reprocessing facilities operated in the territory of the concerned States. And finally, there are agreements between concerned enterprises, regulating mutual rights and obligations of private nature.

The reprocessing technology is attractive also for the Czech Republic. However, in case of a decision to support further development of this particular technology, several adaptations of the existing legal framework will be needed. These adaptations do not only consider national legal framework, but also adaption of new bilateral agreements regulating this specific area.