



**International Legal Aspects of Carbon Dioxide Storage  
into the Sub-seabed Geological Formations**

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## **Acronyms**

CO2	Carbon dioxide
CS-SSGS	CO2 sequestration in sub-seabed geological structures
EOR	Enhanced oil recovery
GHG	Greenhouse gases
ISBA	International Seabed Authority
JEEPL	Journal for European Environmental & Planning Law
UNCLOS	United Nations Convention on the Law of the Sea
ZEP	European Technology Platform for Zero Emission Fossil Fuel Power Plants

## 1 Introduction

### 1.1 History of the development of CO<sub>2</sub> capture and storage technologies

Through the last 20 ó 25 years the disquietude of international community to the problem of global climate change has been increasing rapidly. This problem is likely caused by growing up the process of greenhouse gases (GHG) emission into the atmosphere that explicitly leads to the annual global temperature rise, desertification of territories, ice and glaciers melting in the Polar areas, permafrost decreasing and other negative effects.

For the purpose to mitigate the mentioned negative influences to the global environmental situation there has been a process of searching for appropriate technologies for the reduction of GHG atmospheric concentration. The largest part of GHG volume contributed to the atmosphere contains carbon dioxide gas (CO<sub>2</sub>) that is mostly released by coal, oil and gas power plants, cement and chemical factories, transport (including ships), offshore structures and installations, etc. The present conditions are mainly determined by the mode of current world economy utilizing hydrocarbon resources for the electricity and heat production that directly stimulates the growth of CO<sub>2</sub> emission into the atmosphere.

During the last decades the scientific rounds have been analyzing the best technologies to minimize CO<sub>2</sub> atmospheric concentration. One of the world wide-supported technologies includes the process of CO<sub>2</sub> capture, its offshore transportation and storage into sub-seabed geological formations. The given intention is a subject of detailed discussion on the political, scientific and business forums and partnerships such as the International Energy Agency Greenhouse Gas R&D Programme,<sup>1</sup> Carbon Capture and Storage Association,<sup>2</sup> CO<sub>2</sub> Capture Project,<sup>3</sup> the European Technology

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<sup>1</sup> See in detail an official website of the International Energy Agency Greenhouse Gas R&D Programme in the Internet: <http://www.ieaghg.org/>, date and time of accession ó 5 May 2010 at 14.25 UTC+1.

<sup>2</sup> See in detail an official website of the Carbon Capture and Storage Association in the Internet: <http://www.ccsassociation.org.uk/index.htm>, date and time of accession ó 5 May 2010 at 14.30 UTC+1.

<sup>3</sup> See in detail an official website of the CO<sub>2</sub> Capture Project in the Internet: <http://www.co2captureproject.org/index.html>, date and time of accession ó 5 May 2010 at 14.35 UTC+1.

Platform for Zero Emission Fossil Fuel Power Plants (ZEP),<sup>4</sup> and supported by some international environmental non-governmental organizations including, for instance, the Bellona Foundation.<sup>5</sup> In this regard the Norwegian experience plays quite important role. It is necessary to notice that in the world practice there are only few realized projects of offshore CO<sub>2</sub> storage and all of them are being operated on the Norwegian continental shelf.

Anyhow the discussed technologies can pursue two goals. On the one hand, the injection of the CO<sub>2</sub> into the sub-seabed oil reservoirs provides a pressure for enhanced oil recovery (EOR) and, on the other hand, the depleted reservoirs and aquifers can be used for CO<sub>2</sub> sequestration as a way to prevent global warming process. In the thesis these two positions will be considered jointly due to their similar legal reflection in the international law.

## 1.2 The relevant international legal documents and legal literature related to the sub-seabed CO<sub>2</sub> storage

The discovered technologies for the CO<sub>2</sub> storage on the continental shelf have had an essential influence on the development of international law and are reflected in numerous international instruments. The major anxieties regarding global warming effects are reflected in the United Nations Framework Convention on Climate Change, 1992 (UNFCCC).<sup>6</sup> For the development of the UNFCCC the Kyoto Protocol to this Convention,<sup>7</sup> 1997, in its Article 2 (1)(a)(iv) pays particular attention, inter alia, to the research on, and promotion, development and increased use of carbon dioxide sequestration technologies as a method to combat global climate change. The general provisions on the protection and preservation of the marine environment which can be applicable to the offshore CO<sub>2</sub> storage, are formulated in the Part XII of the United Nations Convention on the Law of the Sea, 1982 (UNCLOS).<sup>8</sup> This issue is clarified in some sense on the global level by the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (1972 London

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<sup>4</sup> See in detail an official website of the European Technology Platform for Zero Emission Fossil Fuel Power Plants (ZEP) in the Internet: <http://www.zeroemissionsplatform.eu/>, date and time of accession 6 May 2010 at 14.40 UTC+1.

<sup>5</sup> See in detail an official website of the Bellona Foundation in the Internet: <http://www.bellona.org>, date and time of accession 6 May 2010 at 14.45 UTC+1.

<sup>6</sup> United Nations Framework Convention on Climate Change, New York 9 May 1992.

<sup>7</sup> Kyoto Protocol to the United Nations Framework Convention on Climate Change, Kyoto 11 December 1997.

<sup>8</sup> United Nations Convention on the Law of the Sea, Montego Bay 10 December 1982.

Convention)<sup>9</sup>, and specifically by the Protocol to the 1972 London Convention, 1996 (1996 Protocol)<sup>10</sup>, amended in 2006. The subject issue is regulated at the regional level in the Convention for the Protection of the Marine Environment of the North-East Atlantic, 1992 (OSPAR Convention)<sup>11</sup> hereafter amended. Besides the given main international documents, there is a set of guidelines and technical requirements adopted for the most part through the states' cooperation within the legal mechanisms of 1972 London Convention, 1996 Protocol and the OSPAR Convention. The present work focuses on the mentioned international legal dimension in-depth and provides their proper analysis.

In spite of the legal development the legal literature is sparse. In this sense it is essential to mention the following works such as *Styring av aktiviteter for injeksjon av CO2 i kontinentalsokkelen*<sup>12</sup> by Lise Siverts and especially *Deponering av CO2 i undergrunnen på norsk kontinentalsokkel*<sup>13</sup> by Anders Matheson Hegna. Both of them are done in 2004.

In addition, the whole volume 4, number 5 of 2007 *Journal for European Environmental & Planning Law*<sup>14</sup> is directly devoted to the legal, political, social and technical aspects of CO2 capture and storage. The present paper intends to give the crossed references to some ideas and findings from this source.

With the limited literature within this field and due to the adoption of new legal instruments it is of significance to carry out a legal analysis of the relevant international instruments in the light of the legal development.

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<sup>9</sup> Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, London 13 November 1972.

<sup>10</sup> Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, London 2 May 1996.

<sup>11</sup> Convention for the Protection of the Marine Environment of the North-East Atlantic, Paris 22 September 1992.

<sup>12</sup> Lise Siverts, *Styring av aktiviteter for injeksjon av CO2 i kontinentalsokkelen (Management of activities for injection of CO2 in the continental shelf* (translation from Norwegian done)), In: *Injeksjon av CO2 i undergrunnen på norsk kontinentalsokkel*, Universitetet i Oslo, 2004.

<sup>13</sup> Anders Matheson Hegna, *Deponering av CO2 i undergrunnen på norsk kontinentalsokkel (Disposal of CO2 into the subsurface on the Norwegian continental shelf* (translation from Norwegian done)), In: *Injeksjon av CO2 i undergrunnen på norsk kontinentalsokkel*, Universitetet i Oslo, 2004.

<sup>14</sup> *Journal for European Environmental & Planning Law*, Berlin, Lexxion, Vol. 4, Number 5 (2007 JEEPL).



### 1.3 Research purpose, objectives, method and structure of the present paper

The examination of current international legal instruments of offshore CO<sub>2</sub> storage regulation is a main purpose of the present research that is laid through the whole text of the work.

In order to achieve this purpose the objectives of this thesis are to 1) clarify the relevant international legal instruments of offshore CO<sub>2</sub> storage and 2) identify legal gaps and disadvantages in international regulation of offshore CO<sub>2</sub> storage. The proper consideration of these two objectives will show the whole picture of the present international legal regime of the offshore CO<sub>2</sub> sequestration with its advantages and shortcomings. It is essential to note that an issue on how the identified legal gaps should be addressed is beyond the scope of this thesis due to necessity to conduct additional and full research that cannot be covered by this work.

As it was mentioned above the present research is based on the method of legal analysis that ensures an adequate discussion and final conclusions in the system of relevant global and regional international regimes. Through the application of this method the aim is to provide a proper and full investigation of the chosen problem and provides a reasonable clarification of the legal gaps in current international CO<sub>2</sub> storage regulation.

For the purpose to make the present examination logically correct, the structure of this work should contain the following necessary parts. In the second part the terminology used in international documents and state practice is discussed in addition to the clarification of sources of CO<sub>2</sub> emission and the technological process of its capture, transportation and injection into the sub-seabed geological formations. This part plays an essential role for the further analysis. It gives a scientific and technical foundation for the appropriate legal regulation of the envisaged issue and eventually determines the legal dimension of the relevant international instruments. The third part contains analysis of the international legal sources for offshore CO<sub>2</sub> storage regulation. The content of this part includes the identification of treaties, customs, principles of international law used in CO<sub>2</sub> storage and analysis of judicial decisions and teachings relevant to the discussed issue. The fourth and fifth parts of paper, in their turn, deal with the clarification of international legal regime of sub-seabed CO<sub>2</sub> storage through the analysis of legal rights and obligations of the states with regard to CO<sub>2</sub> storage in the World Ocean respectively. Finally, on the basis of the legal analyses

in the previous parts, the sixth part of this work describes the legal gaps and disadvantages in the existing international regime of sub-seabed CO<sub>2</sub> sequestration.

#### 1.4 Relevance of the problem of legal determination of sub-seabed CO<sub>2</sub> storage and role of the present paper in clarification of the identified problem

There is no doubt that the problem of international legal determination of the offshore CO<sub>2</sub> storage is still relevant to the world state relationships. The rapid rise of global temperature stimulates the international community to search and develop new technologies to mitigate the mentioned effects. The straightforward way that does not need heavy immediate expenses is to use the GHG capture and storage technologies including, *inter alia*, CO<sub>2</sub> sequestration into the subsoil. In this regard, the international legal foundation of the given activity should reflect the main points taking into account the technological features of the offshore CO<sub>2</sub> storage process and potential negative effects to the marine environment.

The current state practice shows the warming interests of the coastal states to exploit oil and gas resources on the continental shelf that necessarily leads to the consistent growth of number of offshore CO<sub>2</sub> injection projects<sup>15</sup>. The realization of these projects would pursue not only the goal of enhanced oil recovery from the offshore hydrocarbon fields but also the goal to fulfill the states' obligation under the Kyoto Protocol to stabilize or reduce CO<sub>2</sub> emission into the atmosphere by utilizing the modern technologies of CO<sub>2</sub> storage in the sub-seabed geological formations.

Moreover, the activity of offshore CO<sub>2</sub> sequestration may likely affect to the marine environment. The leakages of CO<sub>2</sub>, natural or accidental, may cause a significant damage to the marine ecosystem of the state that realizes this project and, certainly, have transboundary effect by inflicting harm to the interests of other states. Therefore, the proper and detailed regulation of the given activity can prevent deleterious consequences to the marine environment.

However, there is a risk for overlap or legal uncertainty as the subject issue is dealt with in different legal instruments. In this respect, the appropriate analysis of international legal determination of the sub-seabed CO<sub>2</sub> storage process with clarification of the actual legal gaps and shortcomings done by this work can visualize

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<sup>15</sup> See, for example, a research by E.J. Wilson and A.J. Gibbons. *Deploying Carbon Capture and Storage in Europe and the United States: a Comparative Analysis*. Vol. 4, Number 5 (2007) *JEEPL*, pp. 343-352.

the possible directions of its development. The present research can be helpful to clarify the legal situation.

After outlining the main basic points of this work it is necessary to refer to the analysis of the technological and legal aspects of CO<sub>2</sub> storage into a sub-seabed geological formations following to the structure identified above.

## **2 Sources of CO<sub>2</sub> and the technological process of its capture, transportation and injection: brief overview**

### 2.1 Terminology<sup>16</sup>

The technological process of the CO<sub>2</sub> injection into the sub-seabed geological formations is described in international documents through the geological terms which should be defined clearly for the first stage.

CO<sub>2</sub> capture and storage (sequestration) is a process consisting of the separation of CO<sub>2</sub> from industrial and energy-related sources, transport to a storage location and long-term isolation from the atmosphere.

In the sense of present work CO<sub>2</sub> is stored into the sub-seabed (subsoil) geological formations of the continental shelf. In this respect the geological formation is a body of rock of considerable extent with distinctive characteristics that allow geologists to map, describe, and name it.

There are several types of geological formations used for CO<sub>2</sub> storage such as deep saline aquifers and depleted reservoirs. The deep saline aquifer can be defined as a deep underground rock formation composed from permeable materials and containing highly saline fluids. CO<sub>2</sub> injected into such formation reacts with highly saline fluids transforming eventually into the minerals and losing GHG characteristics. The depleted reservoir in its turn is a subsurface body of rock with sufficient porosity and permeability to store and transmit CO<sub>2</sub> fluids where production of oil and gas is significantly reduced.

These geological terms are widely used in the international legal documents devoted to the regulation of the offshore CO<sub>2</sub> storage. Their realization assists to describe the technological process of CO<sub>2</sub> isolation from its capture to the storage into a sub-seabed geological formations of the continental shelf, and it also helps to specify the international legal regulation in this sphere.

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<sup>16</sup> The definitions are done in accordance with Appendix 3 of the Risk Assessment and Management Framework for CO<sub>2</sub> Sequestration in Sub-seabed Geological Structures adopted at the joint session of the 28<sup>th</sup> Consultative Meeting of Contracting Parties under the London Convention and the 1<sup>st</sup> Meeting of the Contracting Parties under the London Protocol (30 October ó 3 November 2006), <http://www.imo.org/>, date and time of accession ó 6 May 2010 at 15.00 UTC+1.

## 2.2 Sources of CO2 emission

As it will be seen clearly further, the international legal regime of CO2 sequestration is mostly depended on the sources of its emission. That is why it is necessary to consider this issue separately. The attention should be paid to the sources of CO2 emission provided generally by the human activity due to its incomparably more negative effect to the environment than the natural CO2 emission.

As a rule, all human sources of CO2 emission can be divided into two large groups. The first group consists of land-based sources of CO2 emission. For instance, the coal, oil and gas power plants, cement and chemical factories can directly be included into this group.

The second block of CO2 sources comprises the different types of marine activities including mainly the activities on the seabed under the national jurisdiction and beyond the limits of national jurisdiction and shipping. For example, the CO2 emission by the operation of offshore installations and structures, drilling, etc. can be referred as an activity on the seabed. Moreover, the shipping as a marine source of CO2 emission can also be taken into account by the reason that in present time most of the vessels use hydrocarbons fuel the burning of which in the vessel engine produces CO2 disposed afterwards into the atmosphere.<sup>17</sup>

The international legal regulation of the particular type of CO2 emission with respect to the activity of its storage will be discussed in present work thereafter.

## 2.3 Technological process of the CO2 capture, transportation and injection into the sub-seabed geological formations

The technological process of the CO2 capture, transportation and specifically injection into the sub-seabed geological formations is a vital factor that determines the particular features of its international legal regulation.

### 2.3.1 Capture and transportation

The CO2 capture and transportation are the first parts of the envisaged technological process. The CO2 capture is usually provided by the special technical facilities on the sources of CO2 emission (power plants, factories, offshore installations

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<sup>17</sup> See in detail Churchill R.R. and A.V. Lowe. *The law of the sea*. Third edition. Manchester, (Manchester University Press) 1999, pp. 329-331.

and structures, etc.). After the process of the CO<sub>2</sub> capture and its liquefaction it is transported by pipelines and/or ships to the place of its offshore injection.

### 2.3.2 Injection

The process of the offshore CO<sub>2</sub> injection may have several forms depending on the place from which CO<sub>2</sub> is injected into the sub-seabed geological formations, on the one hand, and the purpose of its injection, on the other hand. Firstly, the liquid CO<sub>2</sub> can be injected directly either from offshore installations and structures or from the land to the sub-seabed formations by pipelines. This gradation plays an important role in the CO<sub>2</sub> storage legal regulation due to the fact that the given two forms of CO<sub>2</sub> injection determine different types of legal regime that will be discussed properly below.

Secondly, the CO<sub>2</sub> can be injected into the sub-seabed geological formations with the purpose of its isolation and storage, and, additionally, the CO<sub>2</sub> injection into the oil reservoirs can also pursue the goal to provide a pressure for the enhanced oil recovery (EOR) from the exploited field. Anyway, the CO<sub>2</sub> injection for the purpose of enhanced oil recovery leads eventually to its storage when the oil reservoir becomes completely depleted. Precisely to this reason the CO<sub>2</sub> injection into the sub-seabed regardless the primary purpose of its injection is explicitly regulated by one block of international rules and standards. Due to similar international regulation of CO<sub>2</sub> injection for the EOR and its isolation and storage the present work does not distinguish them and considers these processes as a CO<sub>2</sub> injection into the sub-soil mainly for its storage.

The basic positions mentioned in this part of research will be taken into account in analyzing the international legal regime of CO<sub>2</sub> storage into the sub-seabed geological formations.

### **3 The international legal framework for the offshore CO2 storage**

Article 38 (1) of the Statute of the International Court of Justice,<sup>18</sup> reflects three main sources of international law such as international conventions (treaties), international custom and general principles of law and two subsidiary sources including judicial decisions and teachings. The given classification can to the full extent be applicable to the regulation of offshore CO2 storage.

#### **3.1 Treaties**

The main global international treaty relevant to the discussed problem is the United Nations Convention on the Law of the Sea, 1982. The UNCLOS formulates, inter alia, the legally binding rules for allocation of the states' rights to store CO2 into the sub-seabed geological formations and, secondly, provides a set of obligations to protect and preserve the marine environment.

At the same time, on the global level the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, concluded in London in 1972 and amended several times henceforth, regulates the environmental issues of the offshore CO2 storage process. Eventually, in 1996 the Protocol to London Convention was adopted pursuing revision and replacement of the London Convention. In 2006 the 1996 Protocol was amended by the provisions permitting CO2 storage into the sub-seabed geological formations.

At the regional the OSPAR Convention that deals with the protection of the marine environment of the North-East Atlantic is of significance. Annexes II and III of OSPAR Convention were amended in 2007 to regulate CO2 storage into the sub-soil geological formations. Other regional international treaties that could be relevant to the discussed problem include, inter alia, 1974 Convention for the Protection of the Marine Environment of the Baltic Sea Area,<sup>19</sup> 1992 Convention on the Protection of the Black

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<sup>18</sup> Statute of the International Court of Justice, 26 June 1945.

<sup>19</sup> Convention on the Protection of the Marine Environment of the Baltic Sea Area, Helsinki 9 April 1992.

Sea Against Pollution,<sup>20</sup> 1976 Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean,<sup>21</sup> 1986 Convention for the Protection of Natural Resources and Environment of the South Pacific Region.<sup>22</sup> All these regional treaties either explicitly or by implication determine international relationships in the offshore CO<sub>2</sub> storage. The last indicated conventions, except OSPAR Convention, establish a ban of any disposal into the sea and sub-seabed. To this reason the OSPAR Convention is only regional instrument that the present research deals with in detail.

### 3.2 Customs

Some of the treaty rules took their place in the international customary law. For instance, an obligation not to cause the transboundary environmental harm formulated in the Article 194 (2) of the UNCLOS, Principle 21 of the Declaration of the United Nations Conference on the Human Environment, Stockholm 1972 (1972 Stockholm Declaration), Principle 2 of the 1992 Rio Declaration on Environment and Development (1992 Rio Declaration), Article 3 of the Convention on Biological Diversity, Article 3 of the Draft articles on Prevention of Transboundary Harm from Hazardous Activities provided by the International Law Commission in 2001, is now part of international customary law as it is stated in the International Court of Justice's Advisory opinion on the Legality of the Threat or Use of Nuclear Weapons, 1996.<sup>23</sup> There is no doubt that it can be relevant to the technology of offshore CO<sub>2</sub> storage especially in the process of storage site selection and state activity in the case of CO<sub>2</sub> leakage.<sup>24</sup>

### 3.3 General principles of international law applicable to the regulation of offshore CO<sub>2</sub> storage

The evolution of the scope of international rules relating to the offshore CO<sub>2</sub> storage shows its consistent movement from the model of state sovereignty over natural

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<sup>20</sup> Convention on the Protection of the Black Sea Against Pollution, Bucharest 21 April 1992.

<sup>21</sup> Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, Barcelona 16 February 1976.

<sup>22</sup> Convention for the Protection of Natural Resources and Environment of the South Pacific Region, Noumea 24 November 1986.

<sup>23</sup> Advisory opinion on the Legality of the Threat or Use of Nuclear Weapons, 1996, International Court of Justice.

<sup>24</sup> See also Birnie Patricia, Alan Boyle and Catherine Redgwell. *International law and the marine environment*. Third edition. New York, (Oxford University Press) 2009, pp. 137-152.



resources to the non-harm rule. This process is reflected in the set of legal concepts which can be considered as the general principles of international law.

The given notice can be illustrated through the regulatory mechanisms of 1972 London Convention and 1996 Protocol. In this behalf the normative scheme of 1972 London Convention is mainly based on the coastal state sovereignty to exploit its natural resources and, hence, the dispose of any waste into the sea (dumping) is likely carried out with some exceptions. For the development of the envisaged strategy an Article IV of the 1972 London Convention establishes a general rule of dumping permission with the exceptions listed in Annex I to the London Convention dumping of which is prohibited. The dumping of other wastes requires a prior special or general permit.

Contrary to the London Convention the regulatory scope of the 1996 Protocol is based on the general prohibition of dumping of any waste with the exception of those listed in Annex 1 to the 1996 Protocol as it is formulated in its Article 4. The replacement of legal concept of state sovereignty to the non-harm rule used for the determination of waste disposal into the sea is a consequence of implementation of the precautionary approach and *polluter pays* principle in the 1996 Protocol.

The precautionary approach (principle) is internationally wide-spread legal concept reflected also in the Principle 15 of the 1992 Rio Declaration, Article 3 (3) of the UNFCCC, preamble to the Convention on Biological Diversity, Article 2 (2)(a) of the OSPAR Convention. In accordance with the mentioned provisions the precautionary measures are to be applied in the case of existence of risk to cause environmental harm or lack of certain, reliable and adequate scientific information about the states or processes of nature.<sup>25</sup> The international legal regime established by the 1972 London Convention and mostly 1996 Protocol comprises the set of legal rules illustrating an implementation of precautionary approach (principle) which can also be related to the offshore CO<sub>2</sub> storage.

First of all, they include a requirement of environmental impact assessment stated in Annex III to the 1972 London Convention that establishes the criteria governing the issue of permits for the dumping of matter at sea under Article IV(2) of the 1972 London Convention. The similar provisions are fixed in Annex 2 to the 1996

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<sup>25</sup> See e.g. Ibid. pp. 154-158.

Protocol formulating the rules of assessment of wastes or other matter that may be considered for dumping.

The essential place in the 1996 Protocol system is taken by the sub-concept of lowering the standard of proof figured out in its Article 3 (1). The given provisions require applying precautionary approach in the case of likelihood to cause environmental harm even when there is no conclusive evidence to prove a causal relation between inputs of wastes and their effects.<sup>26</sup>

Moreover, the application of precautionary approach is supported by the sub-concept of reversal of the burden of proof. It presumes that any activity may cause environmental damage and in this case the burden to prove the environmentally safe character of the made activity is laid on the polluter.<sup>27</sup> This sub-concept is implemented in the Article 4 (1.2) of the 1996 Protocol that requires the polluter to receive a permit for dumping. This permit determines a full assessment of dumping conditions which ensure at least insignificant affect of dumping to the marine environment. The mentioned conditions include, for instance, evaluation of types, amounts and relative hazard of wastes; detailed chemical, physical and biological description and characterization of the waste, water-column and the seabed; analysis of location of amenities, values and other uses of the sea in the area under consideration,<sup>28</sup> etc. Much weaker version of the sub-concept of reversal of the burden of proof is also reflected in Annex III to the 1972 London Convention.

Another sub-concept related to the application of precautionary approach is a concept of environmentally preferable alternatives visualized in the Article 4 (1.2) of and Annex 2 to the 1996 Protocol. This sub-concept proclaims that any activity threatening to the environment should be avoided in favour of environmentally preferable alternatives. In the case of CO<sub>2</sub> storage into the sub-seabed geological formations under the 1996 Protocol it is necessary to take into account other alternatives of CO<sub>2</sub> isolation including, inter alia, storage on the land. In accordance with the results of detailed assessment of all alternatives for CO<sub>2</sub> isolation a priority should be given to the most environmentally preferable.

Along with the implementation of precautionary approach, the 'polluter pays' principle has also been reflected in the modern regime of waste disposal as well as CO<sub>2</sub>

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<sup>26</sup> Ibid. p. 157.

<sup>27</sup> Ibid. pp. 158-159.

<sup>28</sup> In detail see Annex 2 to the 1996 Protocol.

sequestration. It takes its place in the Article 3 (2) of the 1996 Protocol and Article 2 (2)(b) of the OSPAR Convention. Under this principle the polluter bears the costs of pollution prevention, control and reduction measures. The given rule plays leading role in allocation of liability in cases of causing damage to the environment.<sup>29</sup> In the context of offshore CO<sub>2</sub> storage it has vital character due to lack of its international legal regulation.

Jointly with the wide application of precautionary approach and 'polluter pays' principle in the international legal regime for offshore CO<sub>2</sub> sequestration, the principle of sustainable development can be also relevant to the envisaged relationships. The said principle is widely provided by the Article 193 of the UNCLOS requiring the states to exercise their sovereign right to exploit their natural resources in accordance with their duty to protect and preserve the marine environment<sup>30</sup> as well as by the Principles 3 and 4 of the 1992 Rio Declaration, Article 2 of the Convention on Biological Diversity, Article 2 of the UNFCCC and Article 2 (1) of the Kyoto Protocol. The role and character of the sustainability as a general principle of law are consistently identified in the case law from holding the judicial decisions in Gabčíkovo-Nagymaros Dam Case<sup>31</sup> and Iron Rhine Arbitration.<sup>32</sup>

In their turn, the provisions of specific international documents related to seabed CO<sub>2</sub> sequestration such as the 1972 London Convention, 1996 Protocol and OSPAR Convention do not contain the explicit references to the principle of sustainability. However, the objectives and purposes of the discussed international acts play a vital role in the system of sustainable development providing necessary limitations of the state sovereignty to exploit their natural resources. In this context, the provisions of the given documents restrict the sovereign rights of the states over their maritime zones in favour of the purpose to protect and preserve the marine environment for present and future generations. This idea passes through the whole scope of the specific rules devoted to the regulation of offshore CO<sub>2</sub> storage and will be identified properly below by considering the mentioned international documents in all their bearings.

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<sup>29</sup> See e.g. Birnie (2009) pp. 322-326.

<sup>30</sup> See as an example Ibid. pp. 116-118.

<sup>31</sup> Gabčíkovo-Nagymaros Dam Case, para 140.

<sup>32</sup> Iron Rhine Arbitration, para 71.

### 3.4 Judicial decisions and teachings

Due to relatively modern character of international legal margin for offshore CO2 storage regulation there has been a lack of procedures for dispute settlement and, hence, absence of final judicial decisions and teachings in the discussed sphere. Anyhow, among the judicial decisions which can implicitly be relevant to the process of CO2 sequestration it is worth to note Trail Smelter Arbitration (1939),<sup>33</sup> Lac Lanoux Arbitration (1957)<sup>34</sup> and the International Court of Justice's Advisory opinion on the Legality of the Threat or Use of Nuclear Weapons (1996).<sup>35</sup> On the other hand, the legal works by Lise Siverts,<sup>36</sup> Anders Matheson Hegna,<sup>37</sup> Gustav Haver and Hans Christian Bugge<sup>38</sup> are among few ones which can be considered in the present context.

After clarification of the scope of international legal sources related to the offshore CO2 storage regulation it is necessary to refer to the legal content of the analyzed relationships in the field of offshore CO2 storage.

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<sup>33</sup> Trail Smelter Arbitration (1938).

<sup>34</sup> Lac Lanoux Arbitration (1957).

<sup>35</sup> International Court of Justice's Advisory opinion on the Legality of the Threat or Use of Nuclear Weapons (1996).

<sup>36</sup> See supra note 12.

<sup>37</sup> See supra note 13.

<sup>38</sup> G. Haver and H.C. Bugge, *Transboundary chains for CCS: Allocation of the rights and obligations between the state parties within the climate regime*. Vol. 4, Number 5 (2007) JEEPL, pp. 367-377.

#### **4 Legal rights of the states with respect to CO<sub>2</sub> storage into the sub-seabed geological formations**

The legal dimension of the relationships in the sphere of CO<sub>2</sub> sequestration is quite polarized. Generally, it consists of the two contradictory components of the sovereign right of the state to exploit natural resources in its exclusive economic zone and continental shelf and its obligation to protect and preserve the marine environment. This position is clearly explained through the principle of sustainable development that is partly formalized in the Article 193 of the UNCLOS and can be characterized by the close interplay between the state sovereignty and its environmental obligations. The given obligations essentially limit the state right to exploit its natural resources that may lead to the full ban of certain state activities including, inter alia, offshore CO<sub>2</sub> storage. The thorough analysis of close interaction between the envisaged legal components will assist to clarify properly the international regime of sub-seabed CO<sub>2</sub> sequestration.

##### **4.1 Right of the state to store CO<sub>2</sub> in the sub-seabed geological formations**

The rule of state sovereign right to exploit its natural resources in many instances determines the right to store CO<sub>2</sub> in the sub-seabed geological formations. At the same time the UNCLOS does not contain a unified norm regulating CO<sub>2</sub> sequestration. It provides different rules depending on the particular maritime area where the activity is made. To this reason the norms facilitating the right of state to store CO<sub>2</sub> into the sub-seabed geological formations are specialized in their application to the concrete maritime area such as internal waters and territorial sea, exclusive economic zone, continental shelf and Area. In this sense it is vital to define whether the state activity for CO<sub>2</sub> sequestration is determined by the legal provisions of UNCLOS related to the particular maritime area, or not. For this purpose it necessary to analyze the relevant provisions of UNCLOS.

#### 4.1.1 Right of the state to store CO<sub>2</sub> in its internal waters and territorial sea

Article 2 (1) and (2) of the UNCLOS guarantees to the coastal state a full sovereignty over its internal waters, territorial sea and their bed and subsoil. In this relation it is safe to conclude that coastal state has a sovereign right to store CO<sub>2</sub> into the subsoil of internal waters and territorial sea.

#### 4.1.2 Right of the state to store CO<sub>2</sub> in its exclusive economic zone

The state activity in its exclusive economic zone is regulated by the Article 56 of the UNCLOS that contributes to the coastal state the sovereign rights to exploit ñatural resources [í ] of the waters superjacent to the seabed and of the seabed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zoneö (Article 56 (1)(a) of the UNCLOS). The UNCLOS does not give any definition of the discussed category in respect to the legal regime of exclusive economic zone. Anyway, taking into account the normative context of the Article 56 (1)(a) provision, the term of ñatural resourcesö can be interpreted as all types of economic resources in the exclusive economic zone.<sup>39</sup> Thus, the category of ñatural resourcesö can also cover the capacity of the sub-seabed geological formations to be a storage place for the liquid CO<sub>2</sub>.

However, a strict reading of the wording ñatural resourcesö under the Article 56 (1)(a) of the UNCLOS paying particular attention to the derivation of the resources from the exclusive economic zone there is no evident to include into its content the state activity for the offshore CO<sub>2</sub> storage. The last point of view is promoted, for example, by Anders Matheson Hegna.<sup>40</sup>

Nevertheless, one may argue that the wording of of Article 56 (1)(a) of the UNCLOS to ñother activities for the economic exploitation and exploration of the zoneö enables the coastal state to exercise wider range of its activities in the exclusive economic zone. In this context, the CO<sub>2</sub> injection into the subsoil both for the EOR and its storage pursues the goals of commercial exploitation of sub-seabed oil reservoirs and fulfillment of the state obligation under the Kyoto Protocol to reduce or at least stabilize CO<sub>2</sub> emission into the atmosphere<sup>41</sup> respectively. There is no doubt that both of these purposes can be interpreted as being related to the economic exploitation of

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<sup>39</sup> See e.g. Churchill (1999) 166-167.

<sup>40</sup> Hegna (2004) p. 164.

<sup>41</sup> Article 3 of the Kyoto Protocol.

exclusive economic zone. Even the injection of CO<sub>2</sub> with the goal of its permanent storage in the sub-seabed naturally is a final stage of state economic activity both on land and sea that can be eventually characterized through the liquidation of its deleterious influence to the environment by decreasing the CO<sub>2</sub> atmospheric emission. By this mean, the process of CO<sub>2</sub> capture and storage should be necessarily considered as a instant phase of state economic development with regard to reducing its negative effects and, hence, as one of the essential forms of economic exploitation of the exclusive economic zone.

The given analysis based on the interpretation of the sub-seabed CO<sub>2</sub> sequestration as an activity for the economic exploitation and exploration of the zone is duly reflected in the legal researches by Anders Matheson Hegna,<sup>42</sup> Lise Siverts<sup>43</sup> and Gustav Haver and Hans Christian Bugge.<sup>44</sup>

Consequently, it is safe to conclude that under the Article 56 (1)(a) of the UNCLOS the coastal state activity for the sub-seabed CO<sub>2</sub> storage in the exclusive economic zone is covered by its sovereignty, and, hence, the coastal state enjoys a sovereign right to regulate this activity.

#### 4.1.3 Right of the state to store CO<sub>2</sub> on its continental shelf

In continuing the given analysis it is worth to refer to the identification of the coastal state rights to store CO<sub>2</sub> on its continental shelf. In this regard the Article 77 (1) of the UNCLOS proclaims the sovereign rights of the coastal state over its continental shelf for the purpose of exploring and exploiting its natural resources. In order to define whether the activity for CO<sub>2</sub> sequestration on the continental shelf is covered by the coastal state sovereignty it is necessary to interpret the category of "natural resources" used in Article 77 of the UNCLOS. The paragraph 4 of the envisaged article states that the natural resources referred to the Part VI of the UNCLOS consist of "the mineral and other non-living resources of the seabed and subsoil together with living organisms belonging to sedentary species". In the light of this definition there could be noted that contrary to the legal dimension of the term of "natural resources" used in Article 56 (1)(a) of the UNCLOS and thoroughly discussed above the given category is outlined much narrower. The analyzed definition leads to the question is whether this means that

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<sup>42</sup> Hegna (2004) p. 165.

<sup>43</sup> Siverts (2004) p. 39.

<sup>44</sup> G. Haver and H.C. Bugge (2007 JEEPL) p. 371.

natural resources in Article 77 must be understood so that it does not include the capability of the sub-seabed geological formations to be a place of CO2 storage.

According to Lise Siverts, the geological formations could be interpreted as "natural resources" under the Article 77 (4) of the UNCLOS.<sup>45</sup> The argumentation can be divided into two parts corresponding to purposes of CO2 injection such as whether it is injected for the EOR or for the goal of its permanent storage. In the first situation the argument why the sub-seabed CO2 injection is covered by the state sovereign rights to exploit its natural resources is grounded on the statement that petroleum resources extracted from the subsoil under the pressure of injected CO2 are undoubtedly the "natural resources". The same conclusion has been reached by Gustav Haver and Hans Christian Bugge in their research.<sup>46</sup> However, the given statement cannot be considered as an instant reason to spread the term of "natural resources" on the geological formations as a capacity for the petroleum resources and as a place for storing CO2.

On the other hand, the analysis of situation in the Lise Siverts' research where the CO2 injection is carried out for its permanent storage is mainly based on the arguments of coastal state special position with respect to its continental shelf and economic value of the sub-seabed geological formations for the CO2 storage.<sup>47</sup> Gustav Haver and Hans Christian Bugge consider in the same way emphasizing that there are good reasons for characterizing the reservoir in the geological formations as a natural resource.<sup>48</sup> The provided argumentation does not take into account the strict definition of "natural resources" and, hence, does not have legal character. Therefore, it is more correct to conclude that in the light of current international legal regulation of the state activity on the continental shelf the reservoirs and aquifers in geological formations do not fall under the definition of "natural resources" in accordance with Article 77 (4) of the UNCLOS.

Notwithstanding the conclusion of the present research a complex analysis of the Part VI of the UNCLOS clarifies the coastal state right to regulate CO2 injection into the subsoil that is, however, beyond the category of "sovereign rights" to exploit its natural resources under the Article 77 of the UNCLOS. In this respect, the Article 81 of the UNCLOS accords to the coastal state an exclusive right to authorize and regulate drilling on its continental shelf for all purposes that can likely include drilling for CO2

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<sup>45</sup> Siverts (2004) pp. 35 ó 39.

<sup>46</sup> G. Haver and H.C. Bugge (2007 JEEPL) p. 371.

<sup>47</sup> Siverts (2004) p. 38.

<sup>48</sup> Supra note 46.



injection. Moreover, under the Article 80 of the UNCLOS in conjunction with the Article 60 of the same Convention the coastal state keeps the exclusive right to construct and to authorize and regulate the construction, operation and use of installations and structures on the continental shelf for the economic purposes that can also relate to the offshore CO<sub>2</sub> injection for the EOR or its storage.

The analyzed arguments relating to the coastal state exclusive right to drill and to authorize and regulate the construction, operation and use of installations and structures on the continental shelf were also given by Anders Matheson Hegna<sup>49</sup> in favour of the coastal state right to regulate CO<sub>2</sub> storage on its continental shelf. Additionally the author points out that the coastal state activity for the CO<sub>2</sub> storage in the sub-seabed reservoirs and aquifers can be regulated by analogy with the provisions of Article 77 of the UNCLOS.<sup>50</sup> This argument cannot be supported due to the cardinal difference of the relationships in exploitation of natural resources and offshore CO<sub>2</sub> storage. In this sense it is more appropriate to spread on the given activity the provision of the Article 56 (1)(a) of the UNCLOS facilitating coastal state sovereign right with regard to other activities for the economic exploitation of the zone. The author also notes the possibility to apply to the relationships for CO<sub>2</sub> storage on the continental shelf the regime of the freedom of high seas.<sup>51</sup> This position does not correlate with the coastal state exclusive rights to drill and to authorize and regulate the construction, operation and use of installations and structures on the continental shelf which necessarily determine the process of offshore CO<sub>2</sub> storage. This conflict is realized by the author in his further research.

Besides that, the essential point is to keep the balance between the legal regimes of continental shelf within the limits of exclusive economic zone provided by the Part V of the UNCLOS and of the same area beyond 200 nautical miles from the baselines under the Part VI of the UNCLOS. The envisaged balance implies the equal rights of the coastal state to exploit the continental shelf regardless whether it is located within or beyond 200 nautical miles. Bearing in mind the identified positions it is safe to conclude that the coastal state has exclusive right to regulate CO<sub>2</sub> storage on its continental shelf under the Part VI of the UNCLOS.

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<sup>49</sup> Hegna (2004) p. 169.

<sup>50</sup> Ibid. pp. 169 ó 170.

<sup>51</sup> Ibid. pp. 168, 170.

#### 4.1.4 Right of the state to store CO<sub>2</sub> in the Area

The last maritime zone which is intended to be analyzed in terms of states' rights to store CO<sub>2</sub> in the subsoil is the Area. Following to the Article 1 (1)(1) of the UNCLOS "Area" means the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction. The activities in the Area shall be governed by the provisions of the Part XI of the UNCLOS (Article 134 (2) of the UNCLOS). They include all activities of exploration for, and exploitation of, the resources of the Area (Article 1 (1)(3) of the UNCLOS). For the purpose to organize and control activities in the Area, particularly with a view to administering its resources, the International Seabed Authority (ISA) was established by the Part XI of the UNCLOS implemented through the 1994 Implementation Agreement.<sup>52</sup> The general regime for governing the Area and its resources is characterized by the legal concept of common heritage of mankind (Article 136 of the UNCLOS). The given concept can be clarified by the provisions prohibiting any claims and exercise of sovereignty or sovereign rights over any part of the Area or its resources (Article 137 (1) of the UNCLOS); promoting international cooperation and mutual understanding in relation to the Area (Article 138 of the UNCLOS) and requiring the making of the activities in the Area for the benefit of mankind as a whole (Article 140 (1) of the UNCLOS).

As it was mentioned above the legal regime of the Area covers the activities for the development of resources which means all solid, liquid or gaseous mineral resources in situ in the Area at or beneath the seabed, including polymetallic nodules (Article 133 (a) of the UNCLOS). In this context the activity for CO<sub>2</sub> sequestration in the Area cannot be interpreted as an activity for exploitation of mineral resources under the Article 133 (a) of the UNCLOS and, hence, cannot be governed by the International Seabed Authority.

In this regard it is essential to note that not all activities in the Area are governed by the ISA. Several types of the Area utilization such as pipeline and cable laying (Article 112 of the UNCLOS) and scientific research (Articles 143 and 256 of the UNCLOS) can be facilitated by the states except the ISA competence. However, it does not mean that the states may store CO<sub>2</sub> in the Area by themselves. The activities which can be authorized by the states themselves without the ISA's permission are directly pointed out in the UNCLOS. In its turn the activity for the CO<sub>2</sub> sequestration

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<sup>52</sup> Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982.

in the Area is not provided by the relevant provisions of the UNCLOS and 1994 Implementation Agreement and cannot be clarified through their interpretation.

In spite of this finding the legal concept of the common heritage of mankind with regard to the Area does not provide an application of the regime of freedom of high seas to the CO<sub>2</sub> storage in the Area. The given concept proclaims the international cooperation in the Area that explicitly affects to and excludes the freedom of high seas from the Area. Therefore, in the light of the dominating regime based on the concept of common heritage of mankind it is necessary to give a conclusion that activity for the CO<sub>2</sub> storage in the Area cannot be carried out by any state until the given option will be established through the international law-making process or interpretation of the existing provisions of international law. The current international legal regime of the Area does not support the alternative point of view.

By summarizing the discussed positions there is obvious to note that sovereign (exclusive) right of the coastal state to store CO<sub>2</sub> into the subsoil of its internal waters, territorial sea, exclusive economic zone and continental shelf prevails over the rights of other states under the UNCLOS. It means that the coastal state may authorize and regulate the given activity by, inter alia, permitting the other states to store CO<sub>2</sub> into the subsoil of the mentioned maritime zones. On the contrary, the envisaged activity in the Area is not provided by its current international legal regime.

#### 4.2 Other rights of the states in relation to the CO<sub>2</sub> storage in the sub-seabed geological formations

The other state rights which can be related to the CO<sub>2</sub> sequestration in the sub-seabed geological formations include the right to authorize and regulate drilling; the right to construct and to authorize and regulate the construction, operation and use of installations and structures and, finally, the right to lay submarine cables and pipelines.

As it is provided by the relevant provisions of the UNCLOS, the coastal state has a sovereign (exclusive) right to drill (Articles 2 (1) and (2), 56 (1)(a), 81 of the UNCLOS) and authorize and regulate the construction, operation and use of installations and structures (Articles 2 (1) and (2), 56 (1)(b)(i) and 60, 80 of the UNCLOS) within the limits of maritime areas under its jurisdiction. Besides that, the

coastal state has a sovereign right to lay submarine cables and pipelines in its internal waters and territorial sea and equal right with other states to exercise this activity in its exclusive economic zone and continental shelf and in the Area (Articles 2 (1) and (2), 58 (1), 79, 87 (1)(c) and 112 of the UNCLOS).

## **5 Legal obligations of the states with respect to CO<sub>2</sub> storage into the sub-seabed geological formations**

Notwithstanding the coastal state sovereign (exclusive) right of the offshore CO<sub>2</sub> storage in the maritime areas under its jurisdiction as it is reflected in the UNCLOS and was thoroughly discussed above, the envisaged jurisdiction can be limited by the general obligation to protect and preserve the marine environment in accordance with the Article 192 of the UNCLOS. The given provision is specified in the two scopes of legal norms devoted respectively to the obligation of the states to take all measures to prevent, reduce and control pollution of the marine environment (Article 194 of the UNCLOS) and other state obligations which are related to the offshore CO<sub>2</sub> storage including, inter alia, obligation of cooperation for the protection and preservation of the marine environment (Section 2, Part XII of the UNCLOS), obligation to use the best available techniques (Article 194 (1) of the UNCLOS, Article 2 (3)(b)(i) of the OSPAR Convention applied to the region of North-East Atlantic) and best environmental practice (Article 2 (3)(b)(i) of the OSPAR Convention with regard to the regulation on the regional level), etc. The mentioned positions are intended to be discussed in the following research.

### **5.1 Obligation to take all measures to prevent, reduce and control pollution of the marine environment with respect to the sub-seabed CO<sub>2</sub> storage**

The obligation of the states to take, individually or jointly as appropriate, all measures [ ] that are necessary to prevent, reduce and control pollution of the marine environment from any source is established by the Article 194 (1) of the UNCLOS. For the purpose to apply the given provision the question which needs to be clarified is however, whether or not the offshore CO<sub>2</sub> sequestration falls under the definition of pollution of the marine environment in UNCLOS.

Under the Article 1 (1)(4) of the UNCLOS the pollution of the marine environment means the introduction by man all the types of substances and energy into the marine environment which results or is likely to result in such deleterious

effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities. The similar definitions are contained in the Article 1 (10) of the 1996 Protocol and Article 1 (b) of the OSPAR Convention. The given provisions pay attention to the deleterious effects, existing or potential, of human activities to the marine environment.<sup>53</sup> Taking into account that offshore CO<sub>2</sub> storage can potentially lead to the harmful effects of marine environment due to accidents and unpredictable leakages of CO<sub>2</sub> from the sites of its storage there is obvious to note that CO<sub>2</sub> storage in the sub-seabed geological formations can be defined as a pollution of marine environment under the relevant provisions of the UNCLOS, 1996 Protocol and OSPAR Convention.

The international legal regulation of the offshore CO<sub>2</sub> sequestration depends on the type of CO<sub>2</sub> injection into the sub-seabed geological formations that was discussed properly above. In this context the CO<sub>2</sub> injection for its storage from the offshore installations and structures falls under the legal provisions devoted to the dumping (Article 210 of the UNCLOS, 1972 London Convention, 1996 Protocol to the London Convention, Article 4 of the OSPAR Convention) in conjunction with the provisions regulating pollution from seabed activities subject to national jurisdiction (Article 208 of the UNCLOS, Article 5 of the OSPAR Convention). On the other hand, if the CO<sub>2</sub> storage is facilitated from the land directly to the sub-seabed formations by pipelines the given type of the CO<sub>2</sub> injection is covered by the provisions related to the pollution from land-based sources (Article 207 of the UNCLOS, Article 3 of the OSPAR Convention). Due to specific regulation of the activities in the Area the CO<sub>2</sub> storage in the mentioned maritime zone is determined by the legal rules devoted to the pollution from activities in the Area (Article 209 of the UNCLOS). The further consideration of the state legal obligation to take all measures to prevent, reduce and control pollution of the marine environment will be constructed on the basis of the envisaged gradation with its specification.

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<sup>53</sup> See in detail Birnie (2009) pp. 188-189.

## 5.2 Sub-seabed CO2 storage as a dumping

The first issue that needs to be discovered is clarification of the legal definition of dumping under international law in the light of consistent legal development.

### 5.2.1 Definition of dumping under international law

In accordance with Article 1 (1)(5)(a) of the UNCLOS the dumping means any deliberate disposal of wastes or other matter from vessels, aircraft, platforms or other man-made structures at sea [as well as] any deliberate disposal of vessels, aircraft, platforms or other man-made structures at sea. However, as it is mentioned in the Article 1 (1)(5)(b) of the UNCLOS the definition of dumping does not include

í (i) the disposal of wastes or other matter incidental to, or derived from the normal operations of vessels, aircraft, platforms or other man-made structures at sea and their equipment, other than wastes or other matter transported by or to vessels, aircraft, platforms or other man-made structures at sea, operating for the purpose of disposal of such matter or derived from the treatment of such wastes or other matter on such vessels, aircraft, platforms or structures; [as well as] (ii) placement of matter for a purpose other than the mere disposal thereof, provided that such placement is not contrary to the aims of this Convention.

In this respect, it is essential to define whether the injection of CO2 into the sub-seabed geological formations for EOR or its storage is covered by the definition of dumping provided in UNCLOS, or not. The facilitation of the CO2 injection for its storage from the offshore installations and structures gives a reasonable argument to include this activity into the legal scope of dumping.

At the same time the injection of CO2 for the EOR formally falls under the rule of the Article 1 (1)(5)(b)(ii) of the UNCLOS that directly excludes from the definition of dumping the placement of matter for a purpose other than the mere disposal. However, as it was explicitly mentioned above the activity of CO2 injection for the purpose of EOR pursues eventually the goal of the CO2 storage in the depleted oil reservoirs. To this reason the given activity cannot be considered in the context of the 1 (1)(5)(b)(ii) of the UNCLOS and, hence, falls under the regulation of dumping. It is necessary to note that the definition of the dumping provided by the UNCLOS does not mention particularly the place of disposal. This ignorance can be interpreted in a way that the analyzed definition of dumping under the UNCLOS includes the disposal of wastes into the sea as well as on the seabed and its sub-soil. Thereby, the

injection of CO<sub>2</sub> into the sub-seabed both for its storage and EOR is covered by the definition of "dumping" reflected in the Article 1 (1)(5) of the UNCLOS.

The global regime of the UNCLOS for dumping in the Article 210 (4) stimulates the states to establish global and regional rules, standards and recommended practices and procedures to prevent, reduce and control such pollution. The global rules devoted to this problem are compiled in the 1972 London Convention and 1996 Protocol to the London Convention. The regional rules are exemplified by the singular provisions of OSPAR Convention related to the North-East Atlantic.

The definitions of the "dumping" reflected in the 1972 London Convention and 1996 Protocol differ from the relevant definition of the UNCLOS and among themselves. In this regard the Article III (1) of the 1972 London Convention contains the nearly identical definition with one exception relating to the notation that the deliberate disposal is to be carried out "at sea". "Sea" can be characterized as all marine waters other than internal waters of states under the Article III (3) of the 1972 London Convention. The given interpretation can be considered as narrowing of the legal dimension of dumping under the 1972 London Convention in comparison with the UNCLOS's definition that leads to the possible exclusion of the disposal of wastes into the sub-seabed geological formations from the regulatory scope of the 1972 London Convention. For instance, the said point of view is highly promoted by Elizabeth J. Wilson and Andrew J. Gibbons<sup>54</sup> as well as by Ray Purdy and Ian Havercroft<sup>55</sup> in their common researches.

However, the envisaged position is not supported by the results of the proper interpretation of the term of "dumping" under the 1972 London Convention. It is necessary to bear in mind that the London Convention was enacted in 1972 when the technologies for sub-soil storage of wastes and other matter were out of development. Therefore, it was impossible to take account of the given technologies at the time of the London Convention's conclusion. In this respect, the literal interpretation of the "dumping" under the 1972 London Convention will lead to the deformation of the states-parties' will. In such cases the international courts (tribunals, arbitrations) examining the provisions of "old" international treaties applied the principle of

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<sup>54</sup> Elizabeth J. Wilson and Andrew J. Gibbons. *Deploying Carbon Capture and Storage in Europe and the United States: a Comparative Analysis*. Vol. 4, Number 5 (2007 JEEPL), p. 350.

<sup>55</sup> R. Purdy and I. Havercroft. *Carbon Capture and Storage: Developments under European Union and International Law*. Vol. 4, Number 5 (2007 JEEPL), p. 355.



effective interpretation of the terms used in such treaties.<sup>56</sup> The application of this principle is directly supported by the Article 31 (1) of the 1969 Vienna Convention on the Law of the Treaties requiring to interpret the treaties in the light of its object and purpose. The object and purpose of the 1972 London Convention are formulated in its preamble and refer to the regulation of pollution by dumping for the protection of marine environment. In this regard the limitation of the martial scope of the 1972 London Convention by its application to the only marine waters is far from the states-partiesø will to regulate dumping complexly. Hence, taking into account the envisaged arguments it is obvious to note that the term of òdumpingö under the 1972 London Convention refers not only to the marine waters but also to the seabed and its sub-soil.

Moreover, at the first sight, the provision of Article III (1)(c) of the 1972 London Convention can exclude from the regulatory scope of the given international document the CO2 injection beneath the seabed for EOR. In accordance with the mentioned provision the legal rules of the 1972 London Convention do not cover the disposal of wastes or other matter directly arising from, or related to the exploration, exploitation and associated off-shore processing of seabed mineral resources. By using the effective approach for interpretation of the noted rule thoroughly characterized above, Anders Matheson Hegna spread this exception not only to the exploration and exploitation of seabed mineral resources, but extended it to petroleum resources.<sup>57</sup> This wide interpretation does not result from the complex analysis of the discussed provision of the 1972 London Convention in conjunction with the relevant provisions of the 1996 Protocol. In fact, the rule of the Article III (1)(c) of the 1972 London Convention is literally reflected in the Article 1 (4.3) of the 1996 Protocol that gives clear evidence of invariable meaning of the considered provision related only to the exploration and exploitation of seabed mineral resources.

In the light of the given analysis it is necessary to conclude that offshore CO2 injection into the sub-seabed geological formations for its isolation and storage as well as for EOR falls under the regulatory power of the 1972 London Convention.

Contrary to the 1972 London Convention the 1996 Protocol avoids any uncertainties by defining the category of òdumpingö. The òdumpingö under the Article 1 (4) of the 1996 Protocol along with deliberate disposal into the sea explicitly includes any storage of wastes or other matter in the seabed and the subsoil. In comparison with

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<sup>56</sup> See, for example, Iron Rhine Arbitration, 2005.

<sup>57</sup> Hegna (2004) pp. 260 ó 261.

the definition of *ōseaö* under the 1972 London Convention the legal content of the given term fixed in the Article 1 (7) of the 1996 Protocol has been also extended by including the seabed and the subsoil.

The definition of *ōdumpingö* provided by the Article 1 (f) in conjunction with Article 1 (a) of the OSPAR Convention is quite similar with the relevant definition under the UNCLOS. It does not specify the place of dumping and points out all the maritime areas recognized by international law as well as seabed and sub-soil within the limits of North-East Atlantic.

By summarizing the mentioned conclusions it is safe to note that the envisaged international mechanism for regulation of dumping proclaimed generally by the UNCLOS and specified in the 1972 London Convention, 1996 Protocol and OSPAR Convention is fully applicable to process of CO<sub>2</sub> injection into the sub-seabed geological formations whether it is carried out for the purpose of EOR or its permanent storage.

#### 5.2.2 Regime of dumping CO<sub>2</sub> under the 1972 London Convention

The analyzed mechanism for regulation of dumping is quite variable from 1972 London Convention to the 1996 Protocol and OSPAR Convention. The following question that needs to be examined is the identification of the similarities and differences in current international regime of dumping as an essential legal framework for the offshore CO<sub>2</sub> storage.

As it was mentioned earlier in the paragraph 3.1.3 of present research the concept of the 1972 London Convention is grounded on the coastal state sovereign right to exploit its natural resources and, as a consequence, to dispose any waste into the sea which is in some degree restricted by the conventional regulation and exceptions. The main exceptions from the rule of the coastal state right to dump in the sea are chiefly formulated in the Article IV (1)(a) of the 1972 London Convention that prohibits dumping of a certain set of wastes or other matter exhaustingly listed in the Annex I to this convention. It is a time to consider the envisaged legal instrument carefully in relation to the offshore CO<sub>2</sub> sequestration.

The Annex I to the 1972 London Convention comprises the wastes and other matter the dumping of which is prohibited. The given list has been amended in 1993<sup>58</sup>

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<sup>58</sup> Adoption: 12 November 1993, Entry into force: 20 February 1994.

by prohibiting the dumping of industrial waste. Annex I (11) to the Convention defines the industrial waste as the waste materials generated by manufacturing or processing operations with some exceptions. In this respect the question is whether, or not, the CO<sub>2</sub> storage in the sub-seabed geological formations falls under the definition of industrial waste and, hence, prohibited by the 1972 London Convention. Bearing in mind the sources of CO<sub>2</sub> emission which have mainly industrial generation (the coal, oil and gas power plants, cement and chemical factories, etc.<sup>59</sup>) the CO<sub>2</sub> can be referred to the category of industrial waste. Moreover, in 1999 during the 21<sup>st</sup> consultative meeting of states-parties to the 1972 London Convention the Scientific Group provided a report where the CO<sub>2</sub> produced from the fossil fuels should be covered by the definition of industrial waste.<sup>60</sup> Some authors, and Anders Matheson Hegna<sup>61</sup> is one of them, are more cautious in giving a final conclusion.

Anyway, in finding connection of the CO<sub>2</sub> with general category of industrial waste it is necessary to take into account the precautionary approach (principle) related primarily to the issues of marine environment protection. In accordance with the Article 31 (3)(c) of the 1969 Vienna Convention on the Law of the Treaties the terms of the treaty should be interpreted in the context of any relevant rules of international law applicable in the relations between the parties. The precautionary approach (principle) is legally wide spread and obviously relevant to the regulation of current state relationships for the protection of marine environment and, in particular, the activity for offshore CO<sub>2</sub> storage.<sup>62</sup> Contrary to the 1996 Protocol the regime of the 1972 London Convention does not provide the specific rules for appropriate regulation of the offshore CO<sub>2</sub> sequestration that may lead to significant damage to the marine environment. Precisely to this reason the application of the precautionary approach (principle) and prohibition of the offshore CO<sub>2</sub> storage as a dumping of industrial waste under the Annex I to the 1972 London Convention will facilitate the sufficient legal level of marine environment protection.

After the identification of the ban to store the CO<sub>2</sub> into the sub-seabed geological formations under the 1972 London Convention there is no interest of the work to continue the present research in this way any longer. In this case the attention

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<sup>59</sup> See in details paragraph 2.2 of the present research.

<sup>60</sup> Report of the twenty-first consultative meeting, done 4 ó 8 October 1999, paragraph 5.18.

<sup>61</sup> Hegna (2004) pp. 266 ó 267.

<sup>62</sup> Supra Section 3.1.3.

should be turned to the clarification of the legal mechanisms provided by the 1996 Protocol and OSPAR Convention.

### 5.2.3 Regime of dumping CO<sub>2</sub> under the 1996 Protocol

The present work in its paragraph 3.1.3 gave a conclusion that in contrast to the 1972 London Convention the regulatory power of the 1996 Protocol is based on the general prohibition of dumping of any waste with exception of those which are fully listed in the Annex 1 to the 1996 Protocol (Article 4). The given treaty concept is specified through the set of vital legal instruments. Firstly, the Article 4 (1.1) of the 1996 Protocol prohibits dumping of any wastes or other matter with exception of those listed in the Annex 1 to this Protocol and potentially allowed to be dumped. Secondly, the Article 4 (1.2) of the 1996 Protocol establishes the requirement of obtaining a permit for the dumping of wastes or other matter listed in the Annex 1 to the analyzed Protocol. And thirdly, the same provision of the Article 4 (1.2) of the 1996 Protocol formulates the rule to follow the criteria governing the issue of permits for the dumping of the matter at sea under the Annex 2 to the Protocol. The discussed legal instruments should be examined thoroughly with regard to the process of the offshore CO<sub>2</sub> storage.

Annex 1 to the 1996 Protocol contains the exhaustive list of wastes or other matter permitted to be dumped including, inter alia, dredged material, sewage sludge, fish waste, etc. In 2006 it has been amended by the permission to dump carbon dioxide streams from carbon dioxide capture processes for sequestration.<sup>63</sup> The given decision is mainly caused by the high concentration of GHG in the atmosphere and, as a consequence, the increased global warming process. In this regard the CO<sub>2</sub> capture and sequestration is one of a portfolio of options to reduce levels of atmospheric CO<sub>2</sub><sup>64</sup> and fulfill the state obligations under the Kyoto Protocol.

The offshore CO<sub>2</sub> sequestration is to be determined by the issue of permit under the Article 4 (1.2) of the Protocol. The given provision specifies that states-parties to the Protocol shall adopt national administrative or legislative measures to ensure the issuance of permits and their conformity to the national permit conditions. The envisaged criteria for permit issue should correspond to the requirements of Annex 2 to the Protocol.

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<sup>63</sup> Resolution LP.1(1), 2 November 2006, of the 28<sup>th</sup> Consultative Meeting/1<sup>st</sup> Meeting of Contracting Parties to the 1996 Protocol to the Convention on the Prevention of the Marine Pollution by Dumping of Wastes and Other Matter 1972.

<sup>64</sup> Ibid., Preamble.

The legal conditions for the permit issuance are formulated partly in the Annex 1 and mostly in the Annex 2 to the 1996 Protocol detailed in a number of specific guidelines.<sup>65</sup> In this respect, for instance, the Annex 1 of the 1996 Protocol has been also added by the paragraph 4 that gives the necessary requirements for CO<sub>2</sub> streams such as 1) the disposal is to be carried out into the sub-seabed geological formation; 2) the CO<sub>2</sub> streams are to consist overwhelmingly of carbon dioxide and 3) no wastes or other matter are to be added for the purpose of their disposing. In its turn, Annex 2 focuses on the preliminary scientific analysis of the conditions for dumping referred as well as to the sub-seabed CO<sub>2</sub> sequestration. The envisaged conditions determine the issuance of permit to dump and include, inter alia, chemical, physical and biological properties, dump-site selection, assessment of potential effects to environment, monitoring and reporting requirements, waste prevention audit. These criteria are the reflection of precautionary approach (principle) in the text of the 1996 Protocol. The given requirements commits the states to make the attempts to reduce the necessity for dumping by applying the alternative techniques of waste prevention and reduction such as product reformulation, clean production technologies, process modification, input substitution and on-site, closed-loop recycling.

The rules of Annexes 1 and 2 of the 1996 Protocol are in details described in the Specific guidelines for assessment of carbon dioxide streams for disposal into sub-seabed ecological formations<sup>66</sup> which deal with the risks of CO<sub>2</sub> storage in the sub-seabed geological formations and operate with the potential effects to the marine environment. Another specific document that is necessary to be mentioned is the Risk assessment and management framework for CO<sub>2</sub> sequestration in sub-seabed geological structures (CS-SSGS).<sup>67</sup> It provides guidance for identifying the risks to the marine environment from the offshore CO<sub>2</sub> sequestration and collecting information to improve the management plans of the sub-seabed CO<sub>2</sub> storage.

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<sup>65</sup> Guidelines for the assessment of wastes or other matter that may be considered for dumping adopted by the 19<sup>th</sup> Consultative Meeting of Contracting Parties to the 1972 London Convention in 1997; Specific guidelines for assessment of carbon dioxide streams for disposal into sub-seabed ecological formations adopted by the 2<sup>nd</sup> Meeting of Contracting Parties in November 2007; Risk assessment and management framework for CO<sub>2</sub> sequestration in sub-seabed geological structures (CS-SSGS), adopted at the joint session of the 28<sup>th</sup> Consultative Meeting of Contracting Parties under the London Convention and the 1<sup>st</sup> Meeting of Contracting Parties under the 1996 Protocol (30 October ó 3 November 2006).

<sup>66</sup> Ibid.

<sup>67</sup> Ibid.

#### 5.2.4 Regime of dumping CO<sub>2</sub> under the OSPAR Convention

The regulatory mechanism of the CO<sub>2</sub> sequestration in the sub-seabed geological formations under the 1996 Protocol is principally duplicated in the OSPAR Convention. For instance, the Article 4 of the OSPAR Convention contains the general obligation of the states to take all possible steps to prevent and eliminate pollution by dumping that is mainly developed in the Annex II of the OSPAR Convention. As well as the relevant provisions of the 1996 Protocol, the Article 3 (1) of the Annex II of the OSPAR Convention prohibits the dumping of all wastes or other matter with exception of those listed in the paragraphs 2 and 3 of the given article. The list of the wastes or other matter figured out for the most part in the paragraph 2 has been amended by the sub-paragraph (f) permitting a storage of the carbon dioxide streams from carbon dioxide capture processes.<sup>68</sup> As it is pointed out in the Article 1 of the Annex II the provisions of Annex II are mainly related to the dumping of CO<sub>2</sub> from vessels. Additionally, in respect of CO<sub>2</sub> disposal from offshore installations the same permission to dump the carbon dioxide streams is clarified in the Article 3 (3), Annex III of the OSPAR Convention covering, therefore, all known techniques of offshore CO<sub>2</sub> injection with exception of its direct disposal from land by pipelines.

In its turn, similar to the regulatory scheme of the 1996 Protocol the Article 4 of the Annex II and Article 3 (4) of the Annex III of the OSPAR Convention formulate the requirement for the states to ensure the proper authorization of the dumping by their competent authorities in accordance with the relevant criteria, guidelines and procedures adopted by the OSPAR Commission. By continuing the normative specification of the rules related to the CO<sub>2</sub> storage in the North-East Atlantic the discussed provisions of the Annex II and III of the OSPAR Convention are in details clarified in the OSPAR Guidelines for Risk Assessment and Management of Storage of CO<sub>2</sub> Streams in Geological Formations<sup>69</sup> enforced by the OSPAR Decision 2007/2 on the Storage of Carbon Dioxide Streams in Geological Formations.<sup>70</sup> The aims of the given Guidelines correlate principally with the aims of the Risk assessment and

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<sup>68</sup> The amendment to the Annex II was agreed at the Meeting of the OSPAR Commission held in 25 ó 29 June 2007.

<sup>69</sup> OSPAR Guidelines for Risk Assessment and Management of Storage of CO<sub>2</sub> Streams in Geological Formations were adopted in 2007, Ref. No Agreement 2007-12.

<sup>70</sup> OSPAR Decision 2007/2 on the Storage of Carbon Dioxide Streams in Geological Formations was adopted at the Meeting of the OSPAR Commission held in 25 ó 29 June 2007.

management framework for CO<sub>2</sub> sequestration in sub-seabed geological structures (CSSGS) under the 1996 Protocol mechanism.

Summarizing the considered issues it necessary to note that in present time there are two types of global international legal regime for regulating the sub-seabed CO<sub>2</sub> storage from vessels, platforms or other man-made structures at sea defined as a "dumping". The first type can be identified through the provisions of 1972 London Convention that does not provide the appropriate legal basis for the CO<sub>2</sub> dumping process. Moreover, the proper interpretation of the category of "industrial waste" under the Annex I to the 1972 London Convention leads to the conclusion that the 1972 London Convention formulates the full prohibition of the envisaged activity in the sea. Contrary to the rules of the 1972 London Convention the 1996 Protocol entitles its states-parties to store the CO<sub>2</sub> streams into the sub-seabed geological formations. This approach is in many ways mirrored in the regional regulatory system of OSPAR Convention relating to the sub-seabed CO<sub>2</sub> storage in the North-East Atlantic.

The given dualism in the international legal regime of the CO<sub>2</sub> dumping does not pursue the main purpose of CO<sub>2</sub> dumping regulation to mitigate the adverse effects of climate change. Besides that, this duality leads to the imbalance between the scopes of international law determining the measures to reduce climate change effects under the UNFCCC and Kyoto Protocol and regulating the pollution of marine environment by dumping in accordance with the relevant provisions of the UNCLOS, 1972 London Convention and 1996 Protocol. The identified disadvantages of the international regulation of CO<sub>2</sub> dumping will be considered thoroughly in the Part 6 of the thesis.

### 5.3 Sub-seabed CO<sub>2</sub> storage as a "pollution from land-based sources"

All the types of CO<sub>2</sub> injection into the sub-seabed geological formations are not fully covered by the legal provisions regulating pollution by dumping. For this reason the next question that needs to be considered is what is the legal basis for the CO<sub>2</sub> storage that is carried out from the land directly to the sub-seabed formation by pipelines.

The given type of the CO<sub>2</sub> injection is authorized by the provisions devoted to the pollution from land-based sources under the Article 207 of the UNCLOS. Besides the general state obligation to adopt laws and regulations to prevent, reduce and control

pollution of the marine environment from land-based sources the Article 207 of the UNCLOS in its paragraph 4 contains a reference to global and regional rules, standards and recommended practices and procedures intended to determine marine pollution from land. In this regard, the global international documents regulating pollution of the marine environment by dumping such as 1972 London Convention and 1996 Protocol authorize only the CO<sub>2</sub> injection into the sub-seabed from the vessels, platforms or other man-made structures at sea and, hence, do not relate to the process of CO<sub>2</sub> sequestration from the land by pipelines. To this reason the lack of detailed international environmental regulation of the offshore CO<sub>2</sub> injection from land is relatively compensated by the coastal state jurisdiction to establish appropriate national rules and regulations which frequently cannot take account of the vital interests of other states to prevent, reduce and control the transboundary effects of the marine pollution. The identified inconsistency of international law regarding to the regulation of the offshore CO<sub>2</sub> storage whether it is carried out from the vessels, platforms or other man-made structures at sea or directly by pipelines from the land provides a disproportion between the states' right to facilitate any activity within the limits of national jurisdiction and their obligation to protect and preserve the marine environment.

Having clarified the legal situation at the global level, it may be questioned how this is dealt with at the regional level. In its turn, the OSPAR Convention authorizing prevention and elimination of pollution in the North-East Atlantic region specifies in some sense the provisions of the Article 207 of the UNCLOS. For instance, Article 3 of the OSPAR Convention in conjunction with its Annex I proclaims to use best available techniques and best environmental practices for the land-based sources as well as requires to authorize or regulate the waste discharges to the maritime area and releases into water or air which reach and may affect the maritime area by the competent authorities of the states-parties to the OSPAR Convention. However, a complex analysis of the Annexes II and III amended by the references to the CO<sub>2</sub> storage in the sub-soil geological formations gives an evidence that Annex I of the OSPAR Convention does not provide legal basis for the storage of CO<sub>2</sub> into the sub-seabed from land-based sources by pipelines. In this respect the OSPAR Convention as well as 1972 London Convention and 1996 Protocol stays indifferent to the specific regulation of the process of CO<sub>2</sub> sequestration from land. The legal consequences of the given gap will be discussed in the final part in a proper way.



#### 5.4 Regime of sub-seabed CO<sub>2</sub> storage in the Area

By describing the international regulation of dumping CO<sub>2</sub> in the Area it is necessary to come back to the previous analysis and to emphasize that in accordance with the current international regime of the Area none of the states has a right to inject CO<sub>2</sub> into the sub-seabed in the Area. Moreover, the concept of the common heritage of mankind applied to the Area and its resources does not support the extension of the regime of freedom of high seas to the Area as it was properly discussed in the foregoing research.

Notwithstanding to the fact that the present international law does not provide appropriate legal basis for the sub-seabed CO<sub>2</sub> injection in the Area the states under the Article 209 of the UNCLOS are committed to adopt laws and regulations to prevent, reduce and control pollution of the marine environment from activities in the Area in conformity with the international rules, regulations and procedures adopted in accordance with Part XI. Pursuing to the Article 145 of the UNCLOS the given rules, regulations and procedures related to the protection of marine environment in the Area are within the competence of the ISBA. Therefore, the analyzed scope of the UNCLOS's provisions creates the legal environmental frame for the current and possible activities in the Area including, inter alia, sub-seabed CO<sub>2</sub> sequestration as a feasible activity in the Area in future. In fact, the pollution from some activities in the Area such as drilling, excavation, construction and operation or maintenance of installations and pipelines which partly determine the offshore CO<sub>2</sub> storage are likely to be regulated by the ISBA under the Article 145 (a) of the UNCLOS. In this respect, in the case of extension of the types of activities permitting in the Area including sub-seabed sequestration of the CO<sub>2</sub> the normative basis for the regulation of hazards to the marine environment can be found in the Articles 145 and 209 of the UNCLOS. Undoubtedly, in the event of development of the state activity in the Area the considered provisions are needed to be specified through the law-making competence of the ISBA to adopt appropriate environmental rules, regulations and procedures under the Article 145 of the UNCLOS.

### 5.5 Other state obligations related to the offshore CO2 storage

The main state obligation that can be mentioned in the first place is formulated in the Article 194 (2) of the UNCLOS and Principle 2 of the 1992 Rio Declaration specifying the duty of the states to prevent transboundary pollution arising from the incidents or activities under their jurisdiction or control and causing damage to other states and their environment or spreading beyond the limits of national jurisdiction. The given obligation is to be fulfilled by the states in the case of transboundary location of aquifers and reservoirs used for the CO2 sequestration. In this situation, carrying out the injection of CO2 into the sub-seabed geological formations the states should take all the measures to prevent transboundary damage to the interests of neighboring states or international community as a whole.

Another state obligation relevant to the process of offshore CO2 storage is figured out in the Article 195 of the UNCLOS in conjunction with the Article 3 (3) of the 1996 Protocol. The provisions of the mentioned international documents establish the obligation of the states not to transfer damage or likelihood of damage from one part of the environment to another or transform one type of pollution into another. Taking into account the technology of the sub-seabed CO2 sequestration it is essential to note that the discussed legal norms can be applied to the envisaged activity. Certainly, the capture of CO2 from the atmosphere, its transportation and storage in the sub-seabed geological formations can be interpreted as a transfer of damage from one part of environment to another as well as, with some particularities, the given process of CO2 capture and storage can be determined as a transformation of atmospheric pollution by the CO2 emission into the pollution of marine environment by the CO2 injection. However, notwithstanding the normative power of the considered provisions directly prohibiting the offshore CO2 storage, the given activity can be operated due to its express legal indication in the Annex 1 to the 1996 Protocol and Annexes II and III of the OSPAR Convention. In this respect, the rules of the mentioned Annexes can be interpreted as *lex specialis* and, hence, have priority over the general provisions of Article 195 of the UNCLOS and Article 3 (3) of the 1996 Protocol.

For the purpose to ensure the prevention of transboundary negative effects of marine pollution the Article 197 of the UNCLOS formulates the state obligation to cooperate on a global or regional level, directly or through competent international organizations, in adopting appropriate international rules, standards and recommended

practices and procedures. The cooperation can be expressed, inter alia, through the procedure of notification of imminent or actual damage under the Articles 198 and 199 of the UNCLOS and Article 21 of the OSPAR Convention, carrying out the mutual studies and programmes, exchange of information and data in conformity with Articles 200 and 201 of the UNCLOS, Article 14 of the 1996 Protocol and Article 9 of the OSPAR Convention, scientific and technical assistance with preferences for developing states in accordance with Section 3 of the UNCLOS, Article 13 of the 1996 Protocol and Article 8 of the OSPAR Convention.

Besides that, the 1996 Protocol in its Article 18 contains a specific mechanism for state cooperation formalized in Meetings (Special Meetings) of Contracting Parties dealing with review and adoption of amendments to the Protocol, promotion of cooperation with competent international organizations concerned with the prevention and control of pollution, etc. In its turn, in order to enforce state cooperation on the regional level the Article 10 of the OSPAR Convention establishes special body named Commission (OSPAR Commission) with the functions of operational work by following to the purpose and objectives of OSPAR Convention. The given international instruments under the 1996 Protocol and OSPAR Convention are fully relevant to the activity for CO<sub>2</sub> storage in the sub-seabed geological formations authorized in conformity with the provisions of envisaged international documents.

Finally, it is needed to mention the duty of the states to require the use of best available techniques and best environmental practice which are implicitly formulated in the Article 194 (1) of the UNCLOS and expressly in the Article 2 (3)(b) of the OSPAR Convention and Article 2 of the Annex III of the given Convention. The considered requirements also stimulate the states to facilitate, where appropriate, the use of clean technologies which are necessarily to be applied in the process of offshore CO<sub>2</sub> storage.

The analysis of international legal regime of CO<sub>2</sub> sequestration in the sub-seabed geological formations that was carried out in the context of indentifying the states rights and obligations under the global and regional international treaties clarified a set of legal gaps and disadvantages which are necessarily to be discussed in the next part.

## **6 Legal gaps and disadvantages in international governance of CO<sub>2</sub> storage into the sub-seabed geological formations**

Through the analyses of the rights and obligations some legal gaps can be identified. The significant disadvantages, whether pointed out previously or not yet, will be summarized by taking account of the legal findings and interim conclusions done in the foregoing research.

As it was mentioned in the introduction to the present work, this analysis deals with the observation of current international legal regime of sub-seabed CO<sub>2</sub> storage and identification of its legal gaps consciously ignoring the issue of how the identified legal disadvantages should be addressed. To this reason in the present part the legal shortcomings will be merely explicitly highlighted and outlined excluding the further proposals for their possible addressing.

First of all, the discussion will be focused on the examination of contradictory regimes of offshore CO<sub>2</sub> storage provided by the 1972 London Convention and 1996 Protocol in conjunction with OSPAR Convention. In this respect, there will be also analyzed the negative impact of the given polarized legal regimes on the global climate. The second and third sections will be respectively devoted to the clarification of the existing shortcomings in the scope of state legal rights and obligations in the sub-seabed CO<sub>2</sub> storage. And finally, the research will be completed by the discussion on a question of civil liability for the pollution of marine environment from the activity of sub-seabed CO<sub>2</sub> storage that was not considered previously due to the lack of its appropriate international regulation.

### **6.1 Duality of the regime of sub-seabed CO<sub>2</sub> storage**

The international legal determination of the offshore CO<sub>2</sub> storage differs by its dual global regime provided by both the 1972 London Convention and 1996 Protocol. As it was concluded above, in the words of the 1972 London Convention the sub-seabed CO<sub>2</sub> storage falls under the category of "industrial waste" and, hence, is to be prohibited by the Annex I of the Convention. At the same time the provisions of the

1996 Protocol enable the states to carry out the envisaged activity. The given duality of the international regime for offshore CO<sub>2</sub> sequestration leads to a set of legal consequences needed to be discussed.

On the one hand, the existence of two opposite global regimes of the sub-seabed CO<sub>2</sub> storage can be excused by the considerations to protect marine environment. Indeed, the regulation of 1972 London Convention does not provide the detailed legal requirements for facilitating specifically offshore CO<sub>2</sub> sequestration as it is contrarily ensured by the numerous guidelines under the provisions of 1996 Protocol. Moreover, in accordance with Article 23 of the 1996 Protocol it pursues the aim to supersede the 1972 London Convention between the states which are contracting parties to both international documents. This situation excludes any conflicts between the highlighted regimes and prevents possible overlapping of the regulatory powers of the envisaged treaties. In the context of the given duality it is also vital to note that the state wishing to carry out the sub-seabed storage of CO<sub>2</sub> and being the party to the 1972 London Convention will have to implement the provisions of the 1996 Protocol and follow its precaution and prevention approaches. The last consequence will keep the marine environment from the irreversible damage caused by the unregulated state activity of CO<sub>2</sub> sequestration and ensure the compliance of the states with a set of precautionary measures under the existing regime of 1996 Protocol.

On the other hand, the identified duality of the international CO<sub>2</sub> storage regulation makes in a certain sense the barriers for the fulfillment of the states obligations to protect climate system in conformity with the requirements of the UNFCCC and Kyoto Protocol. The legal inability of the states to facilitate the offshore CO<sub>2</sub> storage within the regulatory scope of 1972 London Convention and, at the same time, their technological incapability to carry out the analyzed activity under the high requirements of the 1996 Protocol in some manner block the promotion, development and increased use of carbon dioxide sequestration technologies in accordance with the Article 2 (1)(a)(iv) of the Kyoto Protocol. The given circumstance is likely to be considered as one of the reasons of the fact that the discussed technology of CO<sub>2</sub> injection into the sub-seabed geological formations is not getting world spread through the state practice. In this regard the state interests to combat climate change and its negative effects came into collision with the high level requirements of the current international law to protect and preserve the marine environment. The identified

inconsistency of the different but interrelated scopes of international law directly leads to the inconsistent law enforcement by the states and, therefore, the aims of the climate change legal margin and marine environmental law cannot be effectively reached.

Recognizing the given disproportion between the current environmental regulation of sub-seabed CO<sub>2</sub> storage and regime of climate system protection it is essential to resolve this problem in a proper way by modifying the legal scope of 1996 Protocol and OSPAR Convention and, if it is necessary, by lifting the ban of CO<sub>2</sub> dumping under the 1972 London Convention for further development and use of this technology among the more states.

## 6.2 Disadvantages in the scope of legal rights of the states with respect to the sub-seabed CO<sub>2</sub> storage

The legal rights of the states to store CO<sub>2</sub> into the sub-soil under the UNCLOS are allocated in accordance with the maritime area where the given activity is carried out. The CO<sub>2</sub> sequestration in the maritime areas under the national jurisdiction of coastal state such as internal waters, territorial sea, exclusive economic zone and continental shelf, are fully covered by the coastal state sovereign (exclusive) right to exploit the respective maritime area. In contrast, the regime of offshore CO<sub>2</sub> storage in the Area is quite uncertain and needed to be clarified.

As was shown above, the current regulation of the activity in the Area does not provide the legal ground for CO<sub>2</sub> sequestration in the Area. Moreover, the concept of common heritage of mankind distributed to regulate the discussed relationships does not support facilitation of any activity in the Area except those explicitly listed in the relevant international documents. The identified international legal ignorance in governing the sub-seabed CO<sub>2</sub> storage in the Area can be explained by the reason of lack of respective technologies to carry out the given activity in the conditions of deep water and high water pressure on the ocean floor. In spite of that, the continuous technological development will obviously raise the issue of CO<sub>2</sub> storage in the Area in front of the international community. In this case the modification of legal regime of the Area will become the topical item in the international agenda.

### 6.3 Disadvantages in the scope of legal obligations of the states with respect to the sub-seabed CO<sub>2</sub> storage

The discussion in this section is primarily based on the considerations of the part of this work devoted to the clarification of legal obligations of the states with respect to CO<sub>2</sub> storage into the sub-seabed geological formations. The previous legal findings will be widely used for identification of the obvious shortcomings in the regime of sub-seabed CO<sub>2</sub> sequestration related mostly to the regulation of CO<sub>2</sub> injection from land-based sources by pipelines and weak sides of regulation of state cooperation in prevention of transboundary negative effects of marine pollution.

#### 6.3.1 Legal gaps in regulation of pollution from land-based sources with respect to the sub-seabed CO<sub>2</sub> storage

The analysis done in the preceding part of the work shows that the process of the sub-seabed CO<sub>2</sub> sequestration is mainly regulated by two margins of international law devoted respectively to the determination of dumping and pollution from land-based sources. The procedure of dumping is in details regulated by the provisions of current international law both on the global and regional levels. Contrary to that, the injection of CO<sub>2</sub> into the sub-seabed geological formations from land by pipelines is out of regulatory field of international law that inevitably leads to the expansion of the coastal state jurisdiction to authorize the given issue.

The dominating of the coastal state jurisdiction in regulating the CO<sub>2</sub> storage directly from land by pipelines may explicitly affect the interests of other states to preserve the marine environment in maritime areas under their national jurisdiction as well as in the high seas and Area. Indeed, the physical and chemical properties of the CO<sub>2</sub> injected whether from vessels, platforms or other man-made structures at sea or by pipelines from land may equally cause the negative effects to the marine environment in the areas within and beyond the limits of national jurisdiction. For instance, the potential CO<sub>2</sub> leakage can give rise to the ocean acidification and other spillover negative consequences which are subject of vital interests of the international community as a whole.

Taking into account the eventual significant damage to marine environment that can be caused by the process of subsoil CO<sub>2</sub> injection from land by pipelines the envisaged activity should be determined by the international law no less than procedure

of dumping. The international regulation of the given activity should include, inter alia, necessary and sufficient requirements for the CO<sub>2</sub> injection from land by pipelines, formal procedures of international cooperation in the transboundary issues, etc. In this respect, the international rules and standards will ensure the safety of CO<sub>2</sub> injection from land and stimulate the states to implement the basic level of legal safeguard by adopting their national legislation to regulate the envisaged activity.

### 6.3.2 Legal gaps in regulation of state cooperation in prevention of transboundary negative effects of marine pollution

Notwithstanding the provisions of Section 2, Part XII of the UNCLOS formulating the obligation of the states to cooperate in the cases of transboundary marine pollution, studies, research programmes and exchange of information and data specified in the relevant rules of 1996 Protocol and OSPAR Convention, the mentioned specific international documents does not give any requirements for the state cooperation in the case of transboundary location of the aquifers and reservoirs used for the CO<sub>2</sub> storage.

The envisaged moment can be quite essential. The location of aquifers and reservoirs exploited for the CO<sub>2</sub> injection in the maritime zones of several coastal states can likely affect the interests of other states. Moreover, even if the site of CO<sub>2</sub> storage is supposed to be in close vicinity to the maritime zones of other states the existing possibility of leakage from aquifers and reservoirs or injecting equipment as well as physical capacity of the liquid CO<sub>2</sub> to move in the sub-seabed geological formations from one area to another can also cause a significant damage to the interests of the neighboring states.

Therefore, the given issue should be properly regulated by the international law including, inter alia, the identification of type and formal procedure of the state cooperation. The requirements of prior notification of the interested states on the planned project to store CO<sub>2</sub> in the aquifers and reservoirs located partially on or in close proximity to their maritime zones, specific rules on exchange of information and data, etc. can also be reflected in such cooperation scheme.



#### 6.4 Liability for the damage to marine environment from the activity of sub-seabed CO<sub>2</sub> storage

The issue of liability for the damage to marine environment caused by the process of sub-seabed CO<sub>2</sub> storage is not fully discovered in the international law. At the same time the given moment may have an essential character due to potential of leakages in the chain of offshore CO<sub>2</sub> sequestration. For instance, the leakage can occur either during the operational part of the process of sub-seabed CO<sub>2</sub> storage such as leakages from pipelines and sea transport or in the post-injection stage expressed through the leakage from aquifers and reservoirs.<sup>71</sup>

The considered division of leakages in the chain of offshore CO<sub>2</sub> storage directly determines a gradation of short-term and long-term liabilities. The short-term liability arising by the reason of leakages from transporting and injecting facilities in time of operational disposal of the liquid CO<sub>2</sub> into the sub-seabed, can be likely defined through the liability of operator carrying out the CO<sub>2</sub> transportation or injection in the sea. On the other hand, the long-term liability due to the leakages of CO<sub>2</sub> from aquifers and reservoirs after completing the process of CO<sub>2</sub> injection cannot be determined only by the operator's liability and, hence, needs to be covered by the special international compensation mechanisms.

Both the short-term and long-term liabilities are not appropriately regulated by the current international law related to the offshore CO<sub>2</sub> storage. It contains merely the general provisions not having taken further development in specific international documents. In this respect, Article 235 (1) of the UNCLOS establishes the rule of state liability for the damage caused by pollution of the marine environment in accordance with international law. In its turn, paragraph 3 of the same article constitutes the state obligation to cooperate in the implementation and further development of existing international law relating to liability continuously clarifying the possible fields of state cooperation, such as assessment of and compensation for damage, settlement of related disputes, development of criteria and procedures for payment of adequate compensation through the compulsory insurance or compensation funds.

The mentioned provisions of the UNCLOS have not been getting further specification in international law. For example, Article 15 of the 1996 Protocol is restricted by the reference of state necessity to develop procedures regarding liability

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<sup>71</sup> See in details Gustav Haver and Hans Christian Bugge (2007 JEEPL), pp. 370 ó 373.

arising from the dumping at sea of wastes or other matter. It is obvious that the given provision is not sufficient to cover all the issues of liability for damage caused by the activity of sub-seabed CO<sub>2</sub> storage.

Therefore, the attention of international community should be turned to the course of fulfilling the identified gaps relating to liability by adopting the international rules devoted to the assessment of damage and compensation rate, criteria and procedures for payment of adequate compensation and other issues related to those mentioned above.

By this means, the obvious shortcomings discussed in present part make the international legal regime of sub-seabed CO<sub>2</sub> storage quite imperfect which can negatively influence on the national legislation of the states and their law enforcement practice. Ultimately, due to spacing international rules in the considered field the final purposes of the complex international regulation of climate change and protection and preservation of the marine environment cannot be entirely reached. For the most part, the identified legal gaps can be assessed as a one of the reasons for blocking the world spreading of the discussed technology for CO<sub>2</sub> isolation and combating the global warming process. The overcoming of clarified disadvantages will activate the wide utilization of the analyzed technology with simultaneous application of sufficient standards of marine environmental protection.

## 7 Conclusion

In the conclusion it is necessary to emphasize that the international legal regime of CO<sub>2</sub> storage into a sub-seabed geological formations consists of the two contradictory parts. On the one hand, in accordance with the relevant provisions of UNCLOS the states are granted with sovereign (exclusive) right to authorize the storage of CO<sub>2</sub> in the sub-seabed of maritime zones within the limits of their national jurisdiction such as internal waters and territorial sea, exclusive economic zone and continental shelf. The similar state right with respect to the Area cannot be derived from the current international regulation. On the other hand, the coastal state sovereign (exclusive) right to exploit the maritime zones under their jurisdiction is significantly restricted by the legal requirements devoted to the protection and preservation of marine environment. The last aspect is thoroughly developed through the specific global and regional international regimes covering the regulation of pollution by dumping in conjunction with determination of pollution from seabed activity and pollution from land-based sources.

The main international global documents in the discussed sphere are represented by the 1972 London Convention and 1996 Protocol to that which are relevant to the regulation of sub-seabed CO sequestration in the context of dumping. The proper interpretation of the provisions of Annex I of the 1972 London Convention done previously supports one of the alternative positions stating that the CO<sub>2</sub> falls under the category of "industrial waste" and, therefore, its dumping is prohibited under the 1972 London Convention.

Contrastingly, the 1996 Protocol in its Annex 1 explicitly provides a legal basis for dumping of CO<sub>2</sub> with the numerous compulsory legal and technical requirements describing the issuance of permit to dump CO<sub>2</sub> and including, inter alia, attention to the chemical, physical and biological properties, criteria for dump-site selection, rules of assessment of potential effects to environment, monitoring and

reporting requirements, need for waste prevention audit, etc. detailed in specific guidelines.<sup>72</sup>

The bright example of regional international regime of sub-seabed CO<sub>2</sub> storage discussed in present paper is established by the OSPAR Convention regarding the area of North-East Atlantic. Similar to the rules of 1996 Protocol the provisions of OSPAR Convention provide the legal possibility to store CO<sub>2</sub> in the sub-seabed geological formations with particular attention to the necessary conditions to facilitate the envisaged activity specified also in guidelines.<sup>73</sup>

Notwithstanding the considered global and regional legal determination of sub-seabed CO<sub>2</sub> sequestration it has a set of principal shortcomings which may potentially destroy the existing regulatory system. First of all, it is necessary to emphasize the current duality of offshore CO<sub>2</sub> storage regime caused by the ban to store CO<sub>2</sub> beneath the seabed under the provisions of 1972 London Convention and permission to facilitate the envisaged activity provided by the regime of 1996 Protocol and OSPAR Convention. This situation creates an inconsistent international policy relating to the CO<sub>2</sub> isolation as a considerable aspect of the strategy to combat global warming process.

Second obvious gap that is vital to mention relates mainly to the scope of legal rights of the states with respect to the sub-seabed CO<sub>2</sub> storage. In particular, the present international regulation does not cover the issue of CO<sub>2</sub> sequestration in the Area that can become a constraining factor of developing the envisaged technology in nearest future.

Third group of significant gaps discussed in present paper is formalized through the inappropriate specification of relevant state legal obligations and consists of the lack of regulation of CO injection from land-based sources into the subsoil by pipelines and defect in regulation of state cooperation in prevention of transboundary negative effects of marine pollution. The given situation raises the unnecessary barriers for the further utilization of new techniques of sub-seabed CO injection and unfoundedly supports the legal ignorance to prevent transboundary marine pollution respectively.

Finally, the whole picture of offshore CO<sub>2</sub> storage regulation cannot be completed without specification of the liability issues. In fact, the noticeable feature of

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<sup>72</sup> Supra note 65.

<sup>73</sup> Supra note 69.

the present regime of sub-seabed CO<sub>2</sub> sequestration becomes nearly a total absence of the rules defining the sufficient criteria for application of liability measures. Therefore, the adoption of the detailed provisions regarding liability for the damage from the activity of sub-seabed CO<sub>2</sub> storage will eventually accomplish the international legal system for regulation of envisaged activity.

The current legal regime of CO<sub>2</sub> storage into the sub-seabed identified in this thesis with a complex of various shortcomings needs to be developed for the future. In this regard, the present work can be considered as a guideline for the concrete political steps in the international decision making process. Moreover, the legal findings of this thesis can be taken into account in following theoretical researches in the sphere of normative determination of the process of offshore CO<sub>2</sub> storage and can be also helpful for the practical moves of the states carrying out the given activity and needed by this term for the appropriate legal advice.

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## **Treaties**

Statute of the ICJ		Statute of the International Court of Justice, 26 June 1945
Vienna Convention		Vienna Convention on the Law of the Treaties, Vienna 23 May 1969
1972 Declaration	Stockholm	Declaration of the United Nations Conference on the Human Environment, Stockholm 16 June 1972
1972 Convention	London	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, London 13 November 1972
Barcelona Convention		Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, Barcelona 16 February 1976
UNCLOS		United Nations Convention on the Law of the Sea, Montego Bay 10 December 1982
Noumea Convention		Convention for the Protection of Natural Resources and Environment of the South Pacific Region, Noumea 24 November 1986
Helsinki Convention		Convention on the Protection of the Marine Environment of the Baltic Sea Area, Helsinki 9 April 1992
Bucharest Convention		Convention on the Protection of the Black Sea Against Pollution, Bucharest 21 April 1992
UNFCCC		United Nations Framework Convention on Climate Change, New York 9 May 1992
CBD		Convention on Biological Diversity, Rio de Janeiro 5 June 1992
1992 Rio Declaration		Rio Declaration on Environment and Development, Rio de Janeiro 14 June 1992
OSPAR Convention		Convention for the Protection of the Marine Environment of the North-East Atlantic, Paris 22 September 1992
1994 Agreement	Implementation	Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982, New York 28 July 1994
1996 Protocol		Protocol to the Convention on the Prevention of Marine

	Pollution by Dumping of Wastes and Other Matter, London 2 May 1996
Kyoto Protocol	Kyoto Protocol to the United Nations Framework Convention on Climate Change, Kyoto 11 December 1997

**Other international instruments**

Dumping guidelines under the 1972 London Convention	Guidelines for the assessment of wastes or other matter that may be considered for dumping adopted by the 19 <sup>th</sup> Consultative Meeting of Contracting Parties to the 1972 London Convention in 1997
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Report of the twenty-first consultative meeting of states-parties to the 1972 London Convention	Report of the twenty-first consultative meeting of states-parties to the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, done 4 ó 8 October 1999
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Draft articles	Draft articles on Prevention of Transboundary Harm from Hazardous Activities, International Law Commission, 2001
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Risk Assessment and Management Framework for CS-SSGS	Risk Assessment and Management Framework for CO <sub>2</sub> Sequestration in Sub-seabed Geological Structures adopted at the joint session of the 28 <sup>th</sup> Consultative Meeting of Contracting Parties under the London Convention and the 1th Meeting of the Contracting Parties under the London Protocol (30 October ó 3 November 2006)
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Resolution LP.1(1)	Resolution LP.1(1), 2 November 2006, of the 28 <sup>th</sup> Consultative Meeting/1 <sup>st</sup> Meeting of Contracting Parties to the 1996 Protocol to the Convention on the Prevention of the Marine Pollution by Dumping of Wastes and Other Matter, 1972
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Specific guidelines under the 1996 Protocol	Specific guidelines for assessment of carbon dioxide streams for disposal into sub-seabed geological formations adopted by the 2 <sup>nd</sup> Meeting of Contracting Parties under the 1996 Protocol in November 2007
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OSPAR Guidelines	OSPAR Guidelines for Risk Assessment and Management of Storage of CO <sub>2</sub> Streams in Geological Formations were
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adopted in 2007, Ref. No Agreement 2007-12, and enforced by the OSPAR Decision 2007/2 on the Storage of Carbon Dioxide Streams in Geological Formations at the Meeting of the OSPAR Commission held in 25 ó 29 June 2007

### **International court decisions**

Trail Smelter Arbitration Tribunal under the Convention for the Settlement of (United States of Difficulties Arising from Operation of Smelter at Trail, done America v. Canada) in Ottawa 15 April 1935, decision done at 16 April 1938

Lac Lanoux Arbitration Arbitral Tribunal set up under a Compromise dated 19 (France v. Spain) November 1956, pursuant to the Arbitration Treaty done at 10 July 1929 between the case-parties, decision done at 16 November 1957

Advisory opinion on the Legality of the Threat or Use of Nuclear Weapons International Court of Justice, The Hague, 8 July 1996

Gabcikovo-Nagymaros International Court of Justice, The Hague, 25 September Dam Case (Hungary v. 1997 Slovakia)

Iron Rhine Arbitration Permanent Court of Arbitration, The Hague, 24 May 2005 (Belgium v. the Netherlands)

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<http://www.ccsassociation.org.uk/index.htm> Official website of the Carbon Capture and Storage Association

<http://www.co2captureproject.org/index.html> Official website of the CO<sub>2</sub> Capture Project

<http://www.zeroemissionsplatform.eu> Official website of the European Technology Platform for Zero Emission Fossil Fuel Power Plants (ZEP)

[www.bellona.org](http://www.bellona.org) Official website of the Bellona Foundation

## Annex 1

### Summary of regulatory scope of international treaties related to the CO<sub>2</sub> storage into the sub-seabed geological formations

Treaty	Right of the state to store CO <sub>2</sub> into the sub-seabed geological formations				Obligation to take all measures to prevent, reduce and control pollution of the marine environment		
	<i>Internal waters and territorial sea</i>	<i>Exclusive economic zone</i>	<i>Continental shelf</i>	<i>Area</i>	<i>Sub-seabed CO<sub>2</sub> storage as a dumping</i>	<i>Sub-seabed CO<sub>2</sub> storage as a pollution from land-based sources</i>	<i>Regime of sub-seabed CO<sub>2</sub> storage in the Area</i>
<b>UNCLOS</b>	Provided	Provided	Provided	Not provided	Not specified	Not specified	Not specified
<b>1972 London Convention</b>	-	-	-	-	Not provided (ban)	Not provided	Not provided
<b>1996 Protocol</b>	-	-	-	-	Provided	Not provided	Not provided
<b>OSPAR Convention</b>	-	-	-	-	Provided	Not provided	Not provided