Radioactive Waste Management in the European Union

LL.M. Paper for the Masters of Law in the European Law

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“The stuff we are dealing with can’t go away until it decays. You can containerize it, solidify it, immobilize it and move it, but you can’t make it go away.”

James D. Werner, Scientific American, May 1996
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<th>Abbreviation</th>
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<tr>
<td>ACER</td>
<td>Agency for the Cooperation of Energy Regulators</td>
</tr>
<tr>
<td>ALARA</td>
<td>As Low as Reasonably Achievable</td>
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<tr>
<td>DG</td>
<td>Directorate General</td>
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<td>DG ENER</td>
<td>Directorate General for Energy</td>
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<td>DNA</td>
<td>Deoxyribonucleic Acid</td>
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<td>EACI</td>
<td>Executive Agency for Competitiveness and Innovation</td>
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<td>EEC</td>
<td>European Economic Community</td>
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<td>EC</td>
<td>European Community</td>
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<td>ECOSOC</td>
<td>Economic and Social Committee</td>
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<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<td>ENSREG</td>
<td>European Nuclear Safety Regulators Group</td>
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<td>EREC</td>
<td>European Renewable Energy Association</td>
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<td>EU</td>
<td>European Union</td>
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<td>EURATOM</td>
<td>Treaty Establishing the European Atomic Energy Community</td>
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<td>EWEA</td>
<td>European Wind Energy Association</td>
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<td>HLW</td>
<td>High-Level Radioactive Wastes</td>
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<td>IAEA</td>
<td>International Atomic Energy Agency</td>
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<td>ICRP</td>
<td>International Commission on Radiological Protection</td>
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<td>ILW</td>
<td>Intermediate-Level Radioactive Wastes</td>
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<td>ITLOS</td>
<td>International Tribunal for the Law of the Sea</td>
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<td>LDC</td>
<td>London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter</td>
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<td>LLW</td>
<td>Low-Level Radioactive Wastes</td>
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<td>NEA</td>
<td>Nuclear Energy Agency</td>
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<td>NGO</td>
<td>Non-Governmental Organization</td>
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<td>NPP</td>
<td>Nuclear Power Plant</td>
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<td>OECD</td>
<td>Organization for Economic Co-operation Development</td>
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<td>OJ</td>
<td>Official Journal of the EU</td>
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<td>SDR</td>
<td>Special Drawing Rights</td>
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<tr>
<td>SEA</td>
<td>Strategic Environmental Assessment</td>
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<tr>
<td>TFEU</td>
<td>Treaty on the Functioning of the European Union</td>
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<td>UK</td>
<td>United Kingdom</td>
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<td>UN</td>
<td>United Nations</td>
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<td>UNCLOS</td>
<td>United Nations Law of the Sea Convention</td>
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<td>UNECE</td>
<td>United Nations Economic Commission for Europe</td>
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<td>VLLW</td>
<td>Exempt Waste &amp; Very Low Level Radioactive Wastes</td>
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1. INTRODUCTION

A number of controversial issues have been put forward up since nuclear energy started being used in commercial purposes in the middle of the 20th century. Although the commercial expansion of nuclear energy has become quite significant, it appears that at the very beginning it had its period of stagnation that ran from 1970 till 2002 when a small number of nuclear installations was constructed. The so called nuclear renaissance has started with the coming of a new century as a result of the growing need for electricity, raised issues of energy security and independence and the need for lower carbon emissions. For all these reasons nuclear energy has gained on its importance. The usage of nuclear energy has increased simultaneously pushing the problem of generated waste into the focus. The enormous advantage of nuclear energy is low emission of carbon dioxide that concurrently means a very little influence on climate change. The relevant technology is also readily available together with the possibility of generating a large amount of electricity by only one nuclear power plant, while on the other hand the problem of nuclear waste, especially spent fuel, which is highly dangerous, and high-level radioactive waste have raised a lot of controversy regarding the usage of nuclear energy. So, at the same time its big economical, social and environmental advantages turn also into disadvantages because, on the one hand, there is relatively cheap production of high amount of energy and carbon dioxide free installations, while on the other hand, possible nuclear incidents and detrimental management of radioactive waste and spent fuel may have devastating consequences to the environment and human health, not to mention huge costs of restoring the environment and human health or long-term consequences for them. All this makes the issue more controversial.

Therefore, the safe and sound radioactive waste and spent fuel management is a necessary and important factor in the protection of humans and the environment. In order to show how radioactive waste and spent fuel have been managed at the international level and at the European Union level, this paper will present an important legal framework composed of conventions, agreements, guidelines at the international level and mostly directives, framework programmes at the European Union level.

This paper will give an idea of the real nature of radioactive waste, its toxicity, the problems faced when the waste has to be managed in a proper way, the adverse effects of radiation on humans and the environment. The paper will also discuss the international and the European Union legal framework for managing radioactive waste and spent fuel at stages from the beginning of the use of nuclear energy until the final disposal of waste. Therefore, the conventions, agreements and directives regarding the constructing of nuclear installations for producing electricity and also managing radioactive waste, civil liability in case of accidents and nuclear incidents, importance of informing public thereof and right to be informed and participating in decision-making process will be explained. The accent is put on the two important legal instruments regarding the management of radioactive waste and spent fuel. At the international level this instrument is the Joint Convention on the Safety of Spent Fuel Management and on the Safety of
Radioactive Waste Management (1997) and at the European Union level a Council Directive (Euratom) on the Management of Spent Fuel and Radioactive Waste proposed on 3 November 2010 by the European Commission. The two most important legal instruments followed by other legal instruments dealing with the issue confirm the awareness of all stakeholders that the field of radioactive waste and spent fuel should be properly regulated and may give an answer to the question of whether radioactive waste and spent fuel have been managed in a proper way so far. In addition, these instruments will show if there are some new possibilities that could reinforce the management so as to protect human health and the environment on the higher level and in a sustainable way. Radioactive waste appears to be a very unique, special and exceptional issue and this is obvious from the fact that the trans-boundary transport of radioactive waste does not make a part of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (1989) as exclusively stressed in Article 1 of the Convention that “wastes which, as a result of being radioactive, are subject to other international control systems, including international instruments, applying specifically to radioactive materials, are excluded from the scope of this Convention”.

2. WHAT ARE WE DEALING WITH?

2.1. Radioactive Waste

In this part of the paper radioactive waste as such will be presented, as well as its toxicity, where the activities of radioactive waste arise from, the types of radioactive waste and its complexity.

To begin with, one has to remember that radioactive waste is produced all over the world and in the European Union as well. It is a product of human activities, nuclear power generation and the various stages of the nuclear fuel cycle, and also of the use of radioactive materials in industry, medicine, agriculture and research. All countries produce and generate radioactive waste especially those which use nuclear power stations to generate electricity.

If radioactive waste is compared to other toxic industrial waste, it can be concluded that the amounts of industrial toxic waste per year are much higher than those of radioactive waste. However, it should be taken into account that the harmfulness of radioactive waste has more serious toxic influence on the environment and human health unlike other types of waste.

So, what is a definition of radioactive waste? In short, radioactive waste “is a material deemed no longer useful that has been contaminated by or contains radionuclides. Radionuclides are unstable atoms of an element that decay, or disintegrate spontaneously, emitting energy in the form of radiation”.4 In addition, according to the IAEA’s Radioactive Waste Management Glossary radioactive waste is defined for legal and regulatory purposes as “waste that contains or is contaminated with radionuclides at concentrations or activities greater than clearance level as established by regulatory body”.5

Radioactive waste can result from the three types of activity:

- Nuclear electricity generation, including related research and the decommissioning of obsolete plants.6
- Uses of radiation and radioactive materials in medicine, agriculture, industry and research.7
- Processing of materials that are naturally radioactive such as uranium ores and phosphate fertilizers.8

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7 ibid
8 ibid
Radioactive waste can be distinguished as:

**Exempt Waste & Very Low Level Wastes (VLLW)** This kind of wastes are radioactive waste containing radioactive materials which are not harmful to people and to the environment. This type of radioactive waste is consisted of demolished material such as bricks, concrete, metal, plaster etc. These demolished materials are products of rehabilitation or dismantling operations on nuclear industrial sites. However, it is important to mention that other industries also produce VLLW. These industries such as, food processing, steel and chemicals production use certain minerals in their manufacturing processes which contain certain level of natural radioactivity. This kind of waste is disposed with domestic refuse, but it should be stressed that some countries, such as France, are currently developing facilities to store VLLW in special disposal facilities. \(^9\)

**Low-Level Wastes (LLW)** These wastes embrace products from hospitals, industry and nuclear fuel cycle. This type of radioactive waste contains small amounts of radioactivity which is mostly short – lived radioactivity. The materials which comprise low-level radioactivity are clothing, tools, paper, filters, etc. During the handling and transporting of LLW it is not required to use shielding. LLW are allowed to be buried in shallow land, but are usually compacted or incinerated before disposal. LLW make up some 90% of the volume and has only 1% of the radioactivity of all radioactive waste. \(^10\)

**Intermediate- Level Wastes (ILW)** This group of wastes have higher amounts of radioactivity and some of them need shielding, usually of lead, concrete or water. ILW usually contain the chemical sludges, resins, metal, fuel cladding and contaminated materials from the reactor decommissioning. Some small items of ILW may be solidified in concrete or bitumen for disposal. “ILW make up some 7% of the volume and have 4% of the radioactivity of all radwaste.” \(^11\)

**High-Level Wastes (HLW),** as the most harmful type of radioactive waste, are highly radioactive and hot, so they need cooling and shielding. These wastes are a result of the “burning” of uranium fuel in nuclear reactors. HLW contain the fission products and transuranic elements generated in the reactor core. HLW accounts for at least 95% of total radioactivity waste, but no more than 3 % of its total volume. There are two kinds of HLW: used fuel itself in fuel rods and separated waste from reprocessing the used fuel. \(^12\)

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10. ibid
11. ibid
12. ibid
2.2. Radiation Effects

Every day every inhabitant on the planet is exposed to the natural radiation from the cosmic rays of the Sun and stars, radioactive materials in soil and rocks, radionuclides naturally incorporated into body tissues and other materials which are inhaled. However, inhabitants of the planet are also exposed to artificial radioactive materials which are man-made, mostly through medical procedures like those applied in X-rays and radioactive therapies in curing cancer. Although inhabitants are exposed to this kind of radiation which is low radiation, inhabitants of the planet may also be exposed to intermediate, and high level radiation from nuclear plants and nuclear processes producing radioactive waste harmful to human health and environment as such. Large doses of radiation in the history of the planet for example came from nuclear bombs dropped on Hiroshima and Nagasaki and from nuclear power plant accidents, such as in Chernobyl and Fukushima I and II, Onagawa, Tokai, Rokkasho which took place recently (March 2011). High doses of radiation have a great impact on the tissue and cells of the living beings and they change DNA structures. Potential biological effects depend on how much and how fast the dose of radiation was incorporated in the body, that's why it can be distinguished as acute dose and chronic dose of radiation. Radiation effects are divided into somatic and genetic effects. Somatic effects can be delayed effects having a potential to develop a cancer. Acute somatic effects include skin burns, loss of hair, vomiting, and blood changes. Chronic somatic effects include development of cancer. On the other hand, the genetic effects appear in the future generations of the beings who were exposed to radiation.\(^\text{13}\)

The mentioned effects show how radioactive materials may be dangerous and harmful. That is why it is important to protect the environment from radiation, especially human made radiation, and to control how radioactive waste is harmful and to take proper care of.

It has to be mentioned that only in 1994 the world’s 431 nuclear reactors created more than 130,000 tons of radioactive waste which is a high-level radioactive waste with number of tons increasing over the years.\(^\text{14}\) Today it is estimated that the average annual global disposal rate for all radioactive waste is approximately 2.8 million m\(^3\) per year and one should remember that today there are 442 nuclear power plants in the world with the potential of constructing more nuclear power plants in the future.\(^\text{15}\) The number of nuclear power plants under construction (January 2010) amounted to 65 (see Table 1, p. 21). Therefore, the conclusion is that growing rate of nuclear power plants requires strict radioactive waste management in order that human health and the environment may be protected and preserved for present and future generations.

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\(^{13}\) K R.Rao (n.6) p.1538.


3. RADIOACTIVE WASTE MANAGEMENT

Radioactive waste management is defined by the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management* \(^{16}\) (1997, hereinafter the Joint Convention). The Joint Convention makes distinction between radioactive waste management and spent fuel management. Therefore, radioactive waste management “means all activities, including decommissioning activities relative to the handling, pre-treatment, treatment, storage or disposal of radioactive waste, excluding off-site transportation. It may also involve discharges.”\(^{17}\) Spent fuel management is defined as “all activities that relate to the handling or storage of spent fuel, excluding off-site transportation. It may also involve discharges.”\(^{18}\)

The specificity of the waste and its radiation risks require long-term planning, i.e. long-term risk management. Radioactive waste management introduces a specific time dimension regarding long-term radiation risk management and also takes into account technical and socio-political aspects. It is important to stress that radioactive waste management is not a conventional industry, where demand and supply can be well matched, therefore the long time scales are one of the important factors in safe and proper functioning of radioactive waste management.\(^{19}\) In this sense James D. Werner argues that “the stuff we are dealing with can’t go away until it decays. You can containerize it, solidify it, immobilize it and move it, but you can’t make it go away” \(^{20}\) so one should take into account the necessity of the proper spent fuel and radioactive management. Thus, this specific management has to consider both ethical and safety matters in order to serve to humans and the environment as such. However, the present generation has to consider the possible future evolution when planning the strategies of the management of this specific waste. The present generation has to plan it according to present safety standards and handover its safe legacy to the future generations. Therefore, the concept of sustainable development must be met, meaning meeting the needs of present generations without jeopardizing the ability of future generations to meet their own needs.

It may be concluded that the intergenerational and intra-generational ethic concepts have to be considered. Intergenerational concept considers equity and fairness between generations and intra-generational concept considers equity and fairness within contemporary generations.\(^{21}\)

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\(^{17}\) ibid art. 2 i

\(^{18}\) ibid, art. 2 o


\(^{21}\) Current Issues in Nuclear Energy (n.19)
3.1. Major Players in Radioactive Waste Management at the International Level

Managing radioactive waste and spent fuel that are generated from the nuclear power plants and from other sources requires agencies as drivers engaged on provisions, guidelines and other actions in order that this type of waste is managed in a safe and sound manner. Attention will be paid to the International Atomic Energy Agency (hereinafter IAEA) and Nuclear Energy Agency (hereinafter NEA).

The IAEA was created in 1957 as a response to the discovery and use of nuclear energy as a source that wasn’t explored enough. Therefore, the creation of the IAEA was a necessity in order to keep down fears and expectations of the new discovered energy source. According to Article 2 of the IAEA Statute:

The Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world. It shall ensure, so far as it is able to, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose.\(^{22}\)

As an international organization with its own Statute, the Agency has a connection with the UN in a way that has to report to the UN General Assembly and Security Council. Its headquarters are in Vienna. The main bodies of the Agency are the Board of Governors, the General Conference and the Secretariat.\(^{23}\)

The work of the IAEA may be divided in the three pillars: safety and security, science and technology, safeguards and verification. In its work the Agency enhances the need of safe, sound and efficient use of nuclear energy and at the same time promotes the programmes for safe and strong global nuclear protection from the harmful effects of ionizing radiation. With its promoting of and contributing to the world’s peace and safety, a number of important conventions, guidelines and other agreements were adopted under its aegis. They are respected and form a part of the national legal frameworks of the contracting parties.\(^{24}\)

The NEA as a special agency within the Organisation for Economic Co-operation and Development (hereinafter OECD) was established in 1958 and is based in Paris, France. As the IAEA was established after the Second World War when the need for the energy source increased and the new energy source (nuclear energy) was introduced to the world. The NEA currently has 29 Member States from Europe, North America and Asia-Pacific region which accounts for nearly 85 % of the world’s nuclear installations. The NEA closely cooperates with the IAEA and the European Commission and is the only intergovernmental nuclear energy organization whose members come from the developed countries. The main objectives of the NEA are to assist the member countries in ensuring high nuclear safety followed by the strong regulations, to support the development of

\(^{22}\) IAEA Statute <http://www.iaea.org/About/statute_text.html> accessed 15 April 2011
\(^{23}\) IAEA Our work <http://www.iaea.org/OurWork/> accessed 16 April 2011
\(^{24}\) ibid
nuclear energy in a way to promote cooperation and exchange of information and technologies, to provide strong assistance to the member countries in order to develop safe, sound, sustainable and socially acceptable policies and approaches in managing radioactive waste.\(^{25}\) Additionally, as it stands for the IAEA, the NEA/OECD has also an important role as to conventions and agreements which are adopted under its aegis, especially the conventions regarding the civil liability in the cases of nuclear damages.

### 3.2. Major Players in Radioactive Waste Management at the EU Level

The European Union policy making in nuclear matters is governed by the Euratom Treaty\(^ {26}\). According to the Treaty, the institutions involved in decision-making process regarding the nuclear energy and so the radioactive waste provisions, are the European Parliament (advisory and supervisory powers, Title III, Chapter 1, Section 1 of the Treaty), the Council as intergovernmental body (Title III, Chapter 1, Section 2 of the Treaty), the Commission (Title III, Chapter 1, Section 3 of the Treaty). Other institutions are the Court of Justice and the Court of Auditors.

An important and essential authority at the EU level in nuclear issues is the European Commission’s Directorate – General for Energy (DG ENER). As a part of the Commission it is responsible for developing, establishing and implementing the EU energy policies. In the area of nuclear energy and so in the area of radioactive waste management it is responsible for developing an advanced legal framework in the area of nuclear policy regarding safety, security, sustainability, reinforcement of the infrastructure necessary for the proper and safe functioning of the use of nuclear energy from the beginning to the end where the radioactive waste, as result after the relevant process, has to be disposed in a proper and sustainable way. The work of the DG is also reinforced by the EACI and the ACER which is operational from March 2011.\(^ {27}\)

### 3.3. Steps in Managing Radioactive Waste

The issue of managing spent fuel and radioactive waste as an important matter imposes some basic steps in order to properly manage both spent fuel and radioactive waste. Hence, managing radioactive waste may be divided into predisposal step (pre-treatment, treatment, conditioning, storage) and disposal step. In short, predisposal phase considers all stages of managing radioactive waste prior to disposal.\(^ {28}\) As regards predisposal step, a few factors have to be taken into account in order to manage radioactive waste in the safe manner. These factors are “nature and amount of

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\(^{25}\) OECD the NEA Mission <http://www.oecd-nea.org/nea/> accessed 16 April 2011
radioactive waste, occupational and public exposures, environmental effects, human health and safety and economic considerations. Usually in predisposal stage the factor of time is an issue. The decisions about pre-treatment, treatment and conditioning of radioactive waste have to be adopted when facilities are not in function or not available or the radioactive waste is to be stored for the longer period of time, meaning for the extended period of time opposite to usual storage period. When managing the phases of predisposal stage, chemical, physical, radiological and biological characteristics of radioactive waste have to be considered.

Pre-treatment stage that occurs after waste generation includes collection, segregation, chemical adjustment and decontamination of radioactive waste. Two main points of this stage are to reduce amounts of the radioactive waste which would be subject to additional stages and disposal and to make remaining radioactive waste as far as possible amenable to additional stages of predisposal and finally disposal. It depends on the characteristics of radioactive waste and conditions imposed by national programmes of every country which deals with radioactive waste management if all the phases of pre-treatment would be used.

Treatment as a second stage has the goal to enhance the safety on the short term and long term basis. The first one includes improvements of the characteristics of waste and long term basis includes facilitation for next stages of the predisposal step. In this stage safety is extremely important. Therefore it is an overriding consideration.

Conditioning stage includes immobilization and packaging of radioactive waste. The main goal of the conditioning is to produce a solid packaged waste form. This form has to be compatible to the requirements of selected disposal option, eventual transport and storage. Solid packages have to be constructed in a way to shield humans and environment in normal conditions and accident conditions which may occur in handling, transport, storage or disposal.

The storage of radioactive waste in general includes the placement of waste in the storage nuclear facility where the conditions of isolation and monitoring are fulfilled. The IAEA Safety Standards regarding predisposal management of radioactive waste point out that:

Storage as a stage may take place between and within the basic radioactive waste management steps. Storage may be used to facilitate the next step in radioactive waste management, to act as a buffer within and between radioactive waste management steps, or in awaiting the decay of radionuclides until authorized discharge, authorized use or clearance can be allowed.

29 ibid, p.10.  
30 ibid  
31 ibid, p.12.  
32 ibid  
34 ibid
In other words, storage is used to secure that radioactive waste could be properly discharged, used, processed or disposed at the later time.

Disposal as a final step of radioactive waste management includes acceptance criteria which are imposed by regulatory bodies. The waste and packages set to disposal have to be processed in a way to fulfil these acceptance criteria for disposal. Imposed criteria determine radiological, biological, mechanical, chemical and physical characteristics of the waste and of packages.\textsuperscript{35}

### 3.4. Managing Low-Level and Intermediate-Level Radioactive Waste

According to the statement made at the \textit{Third Review Meeting of the Joint Convention On the Safety of Spent Fuel Management and On the Safety of Radioactive Waste Management (1997)}\textsuperscript{36}(hereinafter the Third Review Meeting) held in May 2009 the managing of low-level and intermediate-level waste was well established and organized worldwide.

In practice during the pre-treatment stage sorting of waste is the first step. This waste then is sorted into combustible material, waste suitable for decontamination, compactable waste and non-compactable waste. The three methods are usually used for decontamination process: mechanic, chemical and ultrasonic methods. The first one includes water, steam and or sand blasting, second one acid or alkalis and the third one vibrating liquid bath.\textsuperscript{37}

In the treatment stage the most widespread way of managing waste is volume reduction. In the case of liquid waste the most common way to reduce the volume is evaporation, incineration, ion exchange, precipitation, reverse osmosis or filtration. In the case of solid waste the incineration or mechanical volume reduction techniques are used. Mechanical volume reduction techniques embrace baling, shredding or compaction/super-compaction. In this stage usual reduction ratio is 10:1.\textsuperscript{38}

The conditioning stage includes solidification process. Usually waste is mixed with special solidification agents in order to be solidified inside of the disposal container. Widespread solidification agents are asphalt, cements, polymers and molten glass. Which of the agents will be used depends on the structure and characteristics of the waste which could be liquid, slurry, sludge, wet solid or dry solid.\textsuperscript{39}

The final disposal of the processed waste is done in special repositories. These repositories can be above-ground, near-surface underground, intermediate depth and deep

\textsuperscript{35} ibid, p.14.
\textsuperscript{36} IAEA (n.15)
\textsuperscript{38} ibid
\textsuperscript{39} ibid, p. 109.
underground facilities. The above ground repositories are usually reinforced concrete vaults or buildings constructed on the ground (e.g. Drigg repository in the UK). The near surface repository includes trenches or bunkers in the deep of 10 meters (e.g. The Centre de L’Aube in France). The mines or holes made in the earth’s surface by augers are usually used as the intermediate deep repository (e.g. Baita-Bihor in Romania). The deep repositories are excellent structures which form perfect barriers for the migration of radionuclides into the environment. These kinds of repositories are perfect for high-level radioactive waste disposal but some countries, such as the UK, Germany and Sweden use them for low and intermediate level wastes. The only disadvantage of this type of repositories is a huge cost (Estimates of the cost of constructing the deep repository range from 1.5 billion $ to 1.7 billion $).40

### 3.5. Managing High-Level Radioactive Waste

*The Third Review Meeting* concluded that the storage of spent fuel and other high level radioactive waste is well established and organized worldwide. In spite of the well established storage process worldwide the problem of disposal still stays a major issue which is required to be well implemented. New developments in science and technology have recognized a deep geological disposal as the best solution to manage spent fuel and other high-level radioactive waste (reprocessed high-level waste). Since the decay period of high-level waste is quite long (tens of thousands to millions of years), the only solution to dispose of waste is a deep (500 meters) geological repository. The main issue of deep geological disposal is to find a perfect geological site which will isolate waste from the ground water and have long term geological.41

How are spent fuel and high level waste managed in practice today?

In practice some countries use on site interim storage of spent fuel and high level waste. After spent fuel is discharged from the reactor, it needs to be cooled on site for several years in deep water pools. The problem is that these pools are slightly loosing their capacity. Another option is on site dry interim storage where spent fuel or high level waste is put in specially designed casks. This solution is not a long term solution, it is estimated that it may last for about another 50 years.42

Some countries do not use interim storage at all, they reprocess spent fuel. Reprocessing as a chemical procedure for separating plutonium or fissionable uranium from spent nuclear fuel is a dangerous business. Therefore:

> First the fuel is chopped up, by remote control, behind heavy lead shielding. These chopped-up pieces are then dissolved in boiling nitric acid, releasing radioactive gases in the process. The plutonium is separated from the acid solution

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40 ibid, p. 110.
41 ibid
42 ibid, pp. 110-112.
by chemical means, leaving large quantities of high-level radioactive liquid waste and sludge behind. After it has cooled down for several years, this liquid waste will have to be solidified for ultimate disposal, while the separated plutonium is fabricated into nuclear fuel or nuclear weapons.\textsuperscript{43}

For example France (La Hague) and the UK (Sellafield) reprocess spent fuel from their own nuclear power plants and also from Germany, Belgium, Netherlands, Sweden, Switzerland and Japan. Russian Federation reprocesses spent fuel from its own nuclear power plants and from the countries which use Russian design of nuclear power plants. The USA reprocesses spent fuel only for military purposes. Some countries like the USA, Canada and Spain use direct disposal of spent fuel. Today, several countries are advanced in developing and choosing deep geological repositories. One of them, the United State of America has already built a repository of that kind at the Yucca Mountain Site in Nevada and near Carlsbad in New Mexico.\textsuperscript{44}

As it is mentioned, today the deep geological disposal is recognized as being the best solution for the final disposal of high level radioactive waste. But are there any other solutions as well? A few solutions were proposed throughout past few decades and some of them have been still under development and some abandoned. These solutions include:

**Deep borehole disposal** considers disposal of waste into deep boreholes more than 2 km deep. This solution doesn’t imply excavation of large volumes of rock. The main disadvantage of this solution is non phased approach as in the case of deep geological disposal and low level waste retrievability. In general the same result may be accomplished by a deep geological disposal.\textsuperscript{45}

**Direct injection** includes injection of liquid radioactive waste directly into a layer of rock very deep underground. This concept has been practiced by Russia.\textsuperscript{46}

**Rock melting** is a concept where the melting of waste is done in the adjacent rock. The main point is to produce immobilized mass of waste. This technique is reserved exclusively for heat-generated waste. The heat generated waste basically melts the rock and radionuclides enter the matrix of the rock. Once, when the rock is cooled, its matrix immobilizes and captures all radionuclides.\textsuperscript{47}

**Ice sheet disposal** has not been searched and developed enough. The main point is to dispose waste into ice which is a slowly changing environment. The best candidate for

\textsuperscript{43} Gordon Edwards, ‘What is Reprocessing’ \textlangle http://www.ccnr.org/AECL_plute.html\textrangle accessed 27 March 2011
\textsuperscript{44} Cutoiu (n.37), p. 112.
\textsuperscript{45} Mladen Juračić, ‘Radioaktivni otpad’ (PMF, 2008) <geol.pmf.hr/~mjuracic/.../Geol.zastite.okolisa/08.Radioakt.otpad.pdf> accessed 29 March 2011
\textsuperscript{46} ibid
\textsuperscript{47} ibid
this concept would be Antarctica. Antarctica is excluded from this kind of activities by the international agreement.\footnote{Antarctic Treaty, December 1, 1959, 402 UNTS 71, art. 5}

**Sea disposal** in history was used by countries such as the United Kingdom, Belgium, and The Netherlands. The concept was simple dumping of waste packages on the seabed. The alternative was to place waste below the seabed into deep boreholes. The weakest point of this solution refers to a grave problem of finding a geologically stable area regarding the Earth’s plates. Thus, this concept has been forbidden and abandoned today.\footnote{Mladen Juračić (n.45)}

**Disposal into Space** is technically possible and was continually considered in the past. This concept has potential to isolate and dispose radioactive waste permanently from the biosphere. Although it has a great potential, the costs would be very high and the risk of launching the rocket into the Space is present. Although the launching risk is estimated to be 1%, it should be taken into account that only one accident may have a great adverse effect to the environment and human health, hence the radiological risk can be unacceptably high.\footnote{ibid}
4. MEASURES AT THE INTERNATIONAL LEVEL

4.1. The Birth of New Energy Source and Current Situation

The period before the World War II saw the introduction of first nuclear fission (process of splitting atoms) experiment by Otto Hahn in Germany in 1939. During the World War II the political situation in the world required a fast development of nuclear weapons technology in the United States of America. Hence, on 2 December 1942 the first controlled nuclear chain reaction was performed in an experiment called Chicago Pile 1 under the leadership of Enrico Fermi. After this experiment nuclear technology was used only for military purposes.51

The period after the World War II, marked by the use of first atomic bomb, was characterized by the expansion of nuclear engineering. With the development of nuclear weapons at that time, there was also a development and widespread deployment of radioactive materials and nuclear energy for peaceful purposes: industrial, energy, medicine, research and development laboratories. In 1946 the United States of America adopted Atomic Energy Act enabling the use of nuclear energy for peaceful purposes. In 1951 the first four electric bulbs were illuminated by nuclear energy followed by the first nuclear submarines in 1953 and start-up of first nuclear power plants in the ex Soviet Union (Obininsk, 1954) and the United States of America (Shippingport, 1956 and Dresden near Chicago 1960). The first power plant built in France started to produce energy in 1965. Hence the period of commercial use of nuclear energy has started in its full intensity. At this moment there are more than 400 nuclear power plants functioning in the world and producing about 17 % of the world’s electricity (see Table 1, p. 21).52 With these activities the question of radioactive waste management becomes important and crucial issue. Although all activities have been always accompanied by appropriate measures of protection in accordance with the level of scientific and technological development, the risk of nuclear radiation effects has become a part of these activities. According to Greenpeace data basically there was no day without some kind of nuclear radiation as a result of nuclear accident in the past 55 years. However, most of them did not have any significant impact on human health and the environment except for the Chernobyl catastrophe.53

In March 2011 the earthquake and tsunami caused major nuclear accidents in Japanese nuclear power plants Fukushima I and II, Onagawa, Tokai, Rokkasho. The real adverse effects of these major accidents on present and future generations have been still hard to predict. These data clearly confirm that, according to the warnings by many experts, technical and technological shortcomings of some nuclear facilities, coupled with human

52 ibid
factors (insufficient measures, ignorance, negligence, error, failure to comply with protective measures) pose a continuing risk of radiation effect. The ability to use radioactive material for terrorist purposes further complicates the problem.

The importance of safe spent fuel management and radioactive waste management is recognized as a crucial issue that requires a lot of efforts for improvement. *The Third Review Meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (1997)*\(^5^4\) took place in May 2009 and estimated that the average annual global disposal rate for all radioactive waste was approximately 2.8 million cubic meters per year. Storage and disposal of low and intermediate radioactive waste is well organized and established. Storage of spent fuel and high level radioactive waste is also well established worldwide, but disposal of this specific waste requires to be implemented. With development of science and technologies the geological disposal has been recognized as a new venture in taking care of highly hazardous waste.\(^5^5\)

The usage of nuclear energy, all the possible risks that may occur, need for safe and sound management of radioactive waste have led to adopting a number of agreements and conventions.

With regard to the radioactive waste management at the international level there are a number of agreements and conventions concluded between countries in order to protect human health and environment from unwanted radiation effects and thus they have an effect on the management of radioactive waste. The important ones shall be presented in this part of paper.


\(^{55}\) ibid
<table>
<thead>
<tr>
<th>Country</th>
<th>In operation</th>
<th>Under construction</th>
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<tr>
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<td><strong>Total</strong></td>
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4.2. The Beginning of a Nuclear Project

When one would like to begin with a nuclear project in a way of constructing nuclear installations (e.g. store facilities or disposal facilities for radioactive waste or spent fuel), he has to be aware of the three international (regional) UNECE agreements with obligations that have to be respected by governments and nuclear operators. They are the major conditions that should be satisfied to begin with any nuclear project.

Firstly, *The Aarhus Convention on Access to Information, Public Participation and Access to Justice in Environmental Matters*\(^{(1998, \text{hereinafter the Aarhus Convention})}\) as a new kind of environmental convention is based on the right to information and in that way connects environmental rights and human rights. The Aarhus Convention points out the importance of access to information by public, public participation in decision-making and access to justice in environmental matters in order to ensure the protection of present and future generations to live in the sound and safe environment (the Preamble). It stresses that the sustainable development can be only reached if all the stakeholders are included in taking care of the environmental issues, it acknowledges the importance of cooperation between public, public authorities and governments (the Preamble). In this way it imposes obligations to governments to listen what public has to say regarding the environmental matters, so that the environment could be preserved not only for present, but for future generations, too.

The Aarhus Convention goes beyond the concept of just freedom to information because it provides legally enforceable right to information (Articles 4 and 5). This Convention constitutes a step forward to environmental protection in a way that it gives public an opportunity to be heard and to be involved in curtailing of environmental activities. As to all the numbered reasons the Aarhus Convention is a step forward in the environmental management and so in radioactive waste management where public especially NGOs have enforceable right to information of how radioactive waste is managed. Today, when undertaking the activities relating to radioactive waste management (especially when constructing disposal facilities) more and more countries use formal and informal consultation and communication with public. Consultation and communication on a local level have been increasingly developing every day. There is a general consensus that public should be involved in decision-making when siting radioactive waste facilities which may lead to changing or even abandoning of related projects. Involving public in decision-making process demonstrates openness and transparency which is often accompanied by legislation.\(^{57}\)

Secondly, the *Convention on Environmental Impact Assessment in a Transboundary Context*\(^{(Espoo, 1991, \text{hereinafter the Espoo Convention})}\) and the additional *Protocol*

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\(^{56}\) *Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, June 25, 1988, 38 ILM 517 (1999)*


\(^{58}\) *Convention on Environmental Impact Assessment in a Transboundary Context, February 25, 1991 30*
on Strategic Environmental Assessment\textsuperscript{59} (Kyiv, 2003, hereinafter the Kyiv Protocol) contain provisions for protection of the environment and sustainability as well. Although the Espoo Convention was adopted before the Kyiv Protocol, it should be stressed that strategic environmental assessment (hereinafter SEA) has been undertaken much earlier than environmental impact assessment (hereinafter EIA), therefore the importance of the Kyiv Protocol is going to be presented herein before the Espoo Convention. Therivel points out that:

Strategic environmental assessment is a systematic process for evaluating the environmental consequences of a proposed policy, plan or programme initiatives in order that surely they are fully included and appropriately addressed at the earliest appropriate stage of decision making on par with economic and social considerations.\textsuperscript{60}

The importance of SEA lies in the fact that it is an instrument for improving and developing strategic actions that usually involve the national legislation, economic policies, fiscal planning, budgets, sectoral development, plans and programmes of a specific sources (e.g. nuclear materials, radioactive waste management, forest management, water management), plans and programmes for achieving social benefits, etc. Therefore, SEA may influence strategic actions in a way that they may be changed regarding the objectives, financial means, implementation methods. Furthermore, SEA promotes participation of all stakeholders in a decision-making process, identification of the best option for strategic actions, minimizing the negative effects of plans and programmes on the environment and human health.\textsuperscript{61}

Nonetheless, it must be pointed out that SEA’s significance lies in the fact that it comes much earlier than EIA because it involves improvement of strategic actions which basically lead to and shape concrete projects.\textsuperscript{62} Moreover, since SEA includes strategic actions, it may consider lots of difficulties and problems that may occur at the project level before the potential project is undertaken, i.e. SEA deals with multiple projects and their impacts on the environment and human health unlike individual EIA’s ones which concern only individual projects and their impacts.

SEA applies to plans and programmes that are likely to have significant environmental, including health, effects (Article 4 (1) of the Kyiv Protocol). The plans and programmes that have to be assessed according to the Protocol include agriculture, forestry, energy, fisheries, transport, mining, regional development, waste management, tourism, telecommunications etc. (Article 4 (2) of the Kyiv Protocol). Although nuclear installations are not mentioned in Article 4, the same Article refers to Annexes I and II of the Kyiv Protocol that explicitly refer to nuclear installations including radioactive waste

\textsuperscript{59} Philipe Sands and Paolo Galizzi, Documents in International Environmental Law (2\textsuperscript{nd} edn, CUP 2004) pp. 1042-1061.


\textsuperscript{61} ibid, p. 8.

\textsuperscript{62} ibid
facilities. Therefore, Annexes (Annex I points 2 and 3, Annex II point 16) include projects regarding nuclear power stations and other nuclear reactors, installations designed for the production or enrichment of nuclear fuels, for the reprocessing of irradiated nuclear fuels or for the storage, disposal and processing of radioactive waste.

In addition, SEA also includes and points out the importance of the inclusion of public in a decision making process (Article 8 of the Kyiv Protocol), followed by consultations between a State that considers to implement plans and programmes, that may have significant trans-boundary effects, and a State that may be significantly affected by implementation of these plans and programmes (Article 10 of the Kyiv Protocol). The obligation is to notify a would-be affected state before plans and programmes are adopted. According to Article 12 of the Kyiv Protocol the States that are parties to the Protocol have an obligation to monitor the implementation of plans and programmes so as to prevent potential adverse affects of these plans and programmes at an early stage. It may be concluded that SEA is an important instrument for protecting the environment and human health that cannot be avoided in the preparation of policies and legislation that may have significant effect on the environment and human health.

After SEA and adoption of the policies and legislations, the individual projects may be undertaken. When one wants to undertake and adopt an individual project, the project has to be assessed. In this case the Espoo Convention applies. The Espoo Convention imposes to Parties an obligation to conduct assessment of certain activities at an early stage of planning regarding the impact to the environment (Article 2(3)). The states are also obligated to notify and consult each other on all the activities and projects that are likely to have a trans-boundary significant adverse effect on the environment (Article 2(4)). In addition, countries are obligated to cooperate, exchange documents and inform public (Article 2(6)). Regarding the radioactive waste management, in its Appendix I and II the Espoo Convention explicitly mentions individual nuclear projects that should be assessed.

A good example in the applying of the Espoo and additional Kyiv Protocol is a Finish case in conducting the projects of building nuclear power plants Loviisa, Olkiluoto, Fennovoima. The whole procedure under the Espoo Convention and the Kyiv Protocol was observed, from notification and transmittal of information by the Party of origin and effected Party (Article 3 of the Espoo Convention), from carrying out the environmental impact assessment, programmes and plans prepared for the waste management and energy (Article 4 of the Kyiv Protocol), preparing the environmental report (Article 7 of the Kyiv Protocol) all the way to public participation, especially public of the affected Party which in this case was Estonia. 63

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63 Nuclear power plants in Finland
4.3. Civil Liability at OECD/NEA Level

The Paris Convention on Third Party Liability in the Field of Nuclear Energy (1960, hereinafter the Paris Convention) was adopted under the auspices of the OECD/ Nuclear Energy Agency and was the first convention whose aim was the regulation and harmonization of laws regarding liability in case of nuclear incidents which concerned nuclear fuel, radioactive products and waste. According to Article 3 of the Paris Convention the operator of the land-based nuclear installation shall be liable for the damage to or loss of life of any person or of any property which is other than the nuclear installation or property which is used in a connection with the nuclear installation. This damage has to be a result of nuclear accident in nuclear installation or caused during the transport of nuclear substances to and from nuclear installations. The main principle of this Convention regarding the liability is absolute liability of the operator of the nuclear installations, meaning that there is no need to establish the fault of the operator (Article 6). Furthermore, the operator is exclusively liable for the accidents (Article 6). Therefore, these two principles simplify the procedure and actions for damages by victims. The liability imposed upon the operator of the nuclear installation is limited under Article 7 of the Paris Convention. Limitation considers time and the amount. Therefore the maximum liability for the damage caused by the operator shall be 15 000 000 SDRs. However, the same Article points out that this amount may be greater or less, but not less than 5 000 000 SDRs. Under Article 8, the right to compensation is limited for the period of ten years of the nuclear accident. In addition, the operator is obligated to cover the liability insurance or some other financial security equivalent to the amount of the liability (Article 10). The Paris Convention was signed by 18 countries, but still Austria and Luxembourg have not ratified it yet.

In 1963 the Convention was supplemented by the Brussels Supplementary Convention to the Paris Convention (hereinafter the Brussels Convention) and provided for supplementary funds for the damage in the situation where the Paris Convention funds where insufficient. Therefore, public funds where established and financed not only by the installation State, but also by other parties of the Brussels Convention. The result was the creation of financial solidarity system of the parties. The revision of both the Paris Convention and the Brussels Convention in 1982 and 2004 increased the amount of the

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65 SDR is Special Drawing Right defined by the International Monetary Fund and is calculated on the basis of a basket of currencies of five of the most important trading nations. SDRs <http://www.imf.org/external/np/exr/facts/sdr.htm> accessed 2 April 2011
compensation for the suffered damage (e.g. after the revision the amount of a nuclear operator's liability was increased from 15 million SDRs to the amount of not less than €700 million/US$ 935.45 million\(^69\)).

### 4.4. Civil Liability at IAEA Level

The Vienna Convention on Civil Liability for Nuclear Damage\(^70\) (hereinafter the Vienna Convention) was signed in 1963 and entered into force on 12 November 1977 under the auspices of the IAEA. The Vienna Convention shares concept and main principles with the Paris Convention, but unlike the Paris Convention, it has worldwide application. Therefore, the liability of the operator of nuclear installations is absolute and exclusive and also limited in time and in financial means (Article 2 and 6). Unlike the Paris Convention the upper ceiling is not set regarding limitation of liability in financial means but the lowest amount is fixed on 5 million $ (Article 5). The limitation of liability in time is the same in the both of conventions. Therefore, the action for the compensation has to be brought within ten years from the date of the nuclear incident (Article 6). The time limit may be shortened by the national law but not less than three years. The Paris Convention prescribes two years. The operator of nuclear installations has also an obligation to cover the liability by sufficient insurance or other financial security. If the insurance is not sufficient enough, the Installation State (a State within whose territory nuclear installations are situated or a State under the authority of which the nuclear installations are operated if they are not situated within its territory) covers up the difference (Article 7). Both conventions have non-discriminatory principle of victims on the grounds of nationality, domicile or residence.

The provisions of the Paris and Vienna Conventions show how the effort to protect human health and environment from unwanted nuclear incidents in the first part of the twentieth century was arranged. One should take into account that at that time there was no major nuclear incidents in the world. But after the Chernobyl incident in 1986 and its adverse trans-boundary impact on human health and the environment, the IAEA took the initiative for adopting the Joint Protocol to the Paris and Vienna Conventions\(^71\) in 1988. This protocol was a result of the joint effort by the IAEA and OECD/NEA in order to improve these two basic conventions on liability and to establish a comprehensive liability regime. This Protocol combines both the Paris and Vienna systems in a way:

1. to establish a link between the Vienna Convention and the Paris Convention by mutually extending the benefit of the special regime of civil liability for nuclear damage set forth under each Convention and to eliminate conflicts arising from the simultaneous applications of both Conventions to a nuclear incident.\(^72\)

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\(^70\) Vienna Convention on Civil Liability for Nuclear Damage, May 21, 1963, 1063 UNTS 265

\(^71\) Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention, September 21, 1988, 1672 UNTS 302

\(^72\) ibid, Preamble, point 5
In September 1997 under the aegis of the IAEA two new instruments were adopted, *the Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage*\(^{73}\) and *the Convention on Supplementary Compensation for Nuclear Damage*\(^{74}\). The latter one is a new instrument which provides for an extra compensation for the victims of damage. Moreover this Convention applies to states that are parties to both Paris and Vienna Conventions (Articles 1 and 2).

The presented conventions show how the liability for nuclear damage is dealt with at the international level. Provisions of the mentioned conventions include radioactive waste as well. The main principles connecting all the liability conventions are strict and exclusive liability of the operator of a nuclear installation, mandatory financial coverage of the operator’s liability, right to compensation without discrimination, limitation of liability in time and amount and exclusive jurisdiction of the courts of the states where the nuclear damage occurred. Therefore, it can be seen that all the conventions are deemed to protect human health and environment in a way to impose strict rules on the operator of a nuclear installation. Nonetheless, it must be pointed out that nuclear incident in 1986 in Chernobyl was a trigger to amend and revise these conventions because the adverse effect of these incidents is a trans-boundary one, and therefore the effects are not staying only between the borders of the state where incident occurred, but it spreads to other states. Thus, it seemed reasonable to amend and revise liability conventions in a way to prescribe extra compensation.

### 4.5. Transport of Radioactive Waste

Although the risk of an accident should be small, but when one occurs, it may have devastating effects to human health and environment, also the amount of trans-boundary transport of radioactive waste should not be forgotten and the risk of this kind of transport as well. The proper and safe transport of radioactive waste is a responsibility of national authorities. Although responsibility lies primarily on the national authorities, almost 60 countries use *the IAEA Regulations for the Safe Transport of Radioactive Materials*\(^{75}\). This document serves as a uniformed instrument which standardizes and harmonizes the practices of safe transport of nuclear materials and radioactive waste as well. In addition, the International Civil Aviation Organization and International Maritime Organization also incorporate and use these regulations. Basic principle of these regulations is packaging of the nuclear material regardless of how it is transported. The principle of proportionality is used in requirements and control in packaging of nuclear materials, thus the level of requirements and control depends on hazard presented by the specific nuclear material. Regarding spent fuel and high-level radioactive waste, the rules are strict, so they have to be shipped in high integrity containers designed in a way to shield humans

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\(^{73}\) Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage, September 12, 36 ILM 1454 (1997)

\(^{74}\) Convention on Supplementary Compensation for Nuclear Damage, September 12, 1997, 36 ILM 1473 (1997)

and ensure that severe and extreme accidents during transport do not damage them in a way that may have adverse affect to the human health and environment. Transport of spent fuel and radioactive waste is also covered by the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management which is mentioned in part 4.7 of this paper.

4.6. The Marine Environment and Radioactive Waste

The concern of dumping and discharging radioactive waste into the seas also raised the question of regulatory uniform issue. First dumping operations into the sea started in 1946 by the USA at a site in the North Pacific Ocean, 80 km from the coast of California and the latest took place in 1993. During this long period of 48 years, 14 countries used more than 80 sites to dispose the radioactive waste into the sea usually into the Pacific, Atlantic and Arctic Oceans. Therefore, the need for a uniform system was born. Number of assessments, recommendations, methods of surveying and monitoring radioactivity, resolutions, agreements and treaties were adopted, especially under auspices of the IAEA because the unsafe and unlawful discharge of radioactive waste has an enormous influence on the environment and on human health.

The international regime that regulates protection of the marine environment includes a few important instruments regarding the protection of seas from pollution by radioactive wastes. These instruments are:

- the United Nations Law of the Sea Convention (1982, hereinafter UNCLOS) as a central global convention that concentrates on the pollution of the seas from all sources,
- the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972, hereinafter LDC) as a global international agreement that focuses on a specific issue,
- a number of other agreements that include protection of the seas at the regional level (e.g. Oslo Convention on Waste Dumping at Sea (1972) and the Paris Convention on the Prevention of Marine Pollution from Land-Based Sources (1974)). The first one refers to how the sea may be polluted by many sources.

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79 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, December 29, 1972, 1046 UNTS 120

80 Oslo Convention for the Prevention of Marine Pollution by Dumping from ships and Aircraft, February 15, 1972, 932 UNTS 3

especially by dumping from the ships and aircrafts. Therefore the states should use the best means to prevent that kind of pollution. The Paris Convention points out the importance of the use of all available technologies in order to decrease radioactive discharges from land-based sources. Both of the conventions were effectively replaced by the 1992 Ospar Convention on the Protection of the North Sea and North-East Atlantic\textsuperscript{82} which prohibited disposal of all low and intermediate radioactive waste.

The UNCLOS was adopted in 1982 and entered into force in 1994. Importance of the Convention lies in the fact that the focus is put on the prevention of marine pollution and the protection of marine living resources. The Convention in its Article 194 (2) imposes on states the obligation to conduct all the measures necessary to ensure that actions under their jurisdiction do not cause damage to the environment. This provision makes a significant obligation, imposed to the states in order to protect the environment from all sources of pollution. The importance of the UNCLOS in radioactive waste management can be seen in the famous MOX Plant case. In this case, on 25 October 2001 Ireland claimed that the UK violated obligations under the UNCLOS regarding the authorization of the operation of the reprocessing plant built in the UK on the coast of the Irish Sea. The case was brought before the International Tribunal for the Law of the Sea (hereinafter ITLOS). Ireland specified that the UK did not cooperate with Ireland regarding the measures for protection and preservation of the Irish Sea (Articles 123 and 197 UNCLOS), also that the UK did not undertake prior environmental assessment of the effects of the plant (Article 206 UNCLOS) and moreover that the UK did not undertake all measures in order to protect, preserve and control further pollution of the Irish Sea. On 3 December 2001 the ITLOS issued an Order prescribing the parties to co-operate and engage into consultation including the exchange of information, monitoring risks and devise measures to prevent marine pollution. The case also ended up before the Permanent Court of Arbitration in Hague. Finally, Ireland notified Arbitral Tribunal of the withdrawal of its claims against the UK on 15 February 2007 and therefore the Arbitral Tribunal issued an Order terminating proceedings in 2008.\textsuperscript{83}

Although Ireland did not succeed in its claims, one should keep in mind that the ITLOS issued its Order prescribing the parties (Ireland and the UK) to co-operate and therefore created a document which gives non-nuclear countries the right to curtail nuclear activities. As Riley argues, this case shows how a neighbouring and non-nuclear country can use the international law and therefore be involved in a process of curtailing of nuclear activities.\textsuperscript{84}

\textsuperscript{82} Convention for the Protection of the Marine Environment of the North East Atlantic , September 22, 1992, 32 ILM 1069 (1993)

\textsuperscript{83} Case No. 10, ITLOS/Press 62 <http://www.itlos.org/cgi-bin/cases/case_detail.pl?id=10&lang=en> accessed 1 May 2011

The LDC as a global convention, important for the radioactive waste management lays down provisions to regulate pollution by dumping at sea. Regarding the dumping of radioactive waste the LDC prohibited the disposal of high-level radioactive waste into the sea. Therefore, the absolute ban of dumping high-level radioactive waste into the sea was already determined in 1972. Further development of the Convention resulted by the adoption of a resolution for the prohibition of dumping of all types of radioactive waste in 1982. In 1983 the LDC adopted a two year moratorium on dumping of all types of radioactive waste. In 1985 the 9th LDC Consultative Meeting concluded that scientific and technical reports did not find dumping of low-level radioactive waste at sea environmentally dangerous, hence the moratorium was extended. In addition, the moratorium on low-level radioactive waste was triggered by Japan and its decision of dumping low-level radioactive waste in the Pacific Ocean. Countries that left open the possibility to dump radioactive waste were France, the UK, Belgium, Japan and the USA while opposed countries were Finland, Norway, Spain, Iceland, Ireland and Pacific islands. In 1993 the LDC was amended in a way that the moratorium on radioactive waste became legally binding and should be reviewed every 25 years. Nevertheless, in November 1993 the 16th LDC Consultative Meeting adopted, by a majority vote, the prohibition of dumping of all radioactive wastes at sea. Therefore, a result of the meeting is that today all types of radioactive wastes are included in the so called black list (Annex 1) of the LDC.


Despite a number of treaties and agreements which were signed and adopted, Riley argues that safety of handling the nuclear materials is still criticized for failing to achieve a solid, tight and comprehensive control over the major concern which is called major trans-boundary risk. A number of small nuclear accidents which are not in a whole presented to public takes place every year. One can always argue whether the conventions and protocols are enough to protect human health and the environment for the present and future generations. On one hand there are big multinational companies and strong nuclear lobby represented in the countries and on the other hand, lots of NGOs (Greenpeace, Bellona) exist which are in their essence against the use of nuclear power. In spite of all these confronted sides the effort to achieve a balance between these sides and to protect the environment as much as it can be possible, OECD/NEA and IAEA try to be a connection between the opposite sides in order to satisfy their demands and to achieve solid legal ground to protect human health and the environment under their auspices. All the important radioactive waste management agreements mentioned before represent the effort of putting the radioactive waste management on the unique, uniform

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86 Riley (n.84)
level, so that management and trans-boundary risks could be minimized as much as possible.

Therefore, under the aegis of the IAEA the *Convention on Nuclear Safety (1994)*\(^{88}\) and the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (1997)*\(^{89}\) (hereinafter the Joint Convention) were adopted.

The *Convention on Nuclear Safety* is based on internationally agreed fundamental nuclear principles. There are ten fundamental principles in nuclear safety combined of fundamental principles regarding safety of nuclear installations, radioactive waste management principles and principles on radiation protection and the safety of radiation sources. Ten combined fundamental principles constitute a basis for nuclear safety in general and also constitute a basis for safe radioactive waste management. Therefore, the objective of the principles is headed towards all installations, facilities (their planning, design, manufacturing, operation, decommissioning and closure), radioactive materials, their handling and activities regarding their use and also the proper and safe radioactive waste management. Principle 1 on responsibility for safety constitutes the prime responsibility of the licensee, the person or organization responsible for nuclear installation and activities. Regarding the waste management the licensee is responsible for ensuring that radioactive materials are handled safely and all radioactive waste that is generated is properly and safely controlled. Government authorities have a major role in the countries in a way that they have to be involved in every step of nuclear activities (Principle 2). That’s why every country should have a special authority responsible for managing nuclear activities, especially those related to programming, planning, radiation monitoring, impact on the environment and disposal of radioactive waste. Furthermore, leadership and management for safety have to be effective and on a high level in order to ensure the support of safety culture (Principle 3), constructing and developing of nuclear facilities has to be justified and provide an overall benefit (Principle 4), nuclear facilities have to be protected on a high level in a way that protection can be accomplished reasonably (Principle 5), measures undertaken in order to limit radiation risks have to assure that no individual suffers from adverse effects of radiation (Principle 6). Principle 7 stresses how the radioactive waste management has to be proper and safe in a way that no undue burden is imposed on future generations. The generation of radioactive waste has to be kept on the minimum levels. Moreover, efforts must be made in order to prevent eventual accidents from the nuclear facilities and activities (Principle 8), but if a nuclear accident occurs, governments, licensees have to be prepared for emergency cases in order to mitigate any adverse effects to the environment and human health (Principle 9). Finally, the actions aiming at decreasing the existing or unregulated radiation risks have to be prepared and justified (Principle 10).\(^{90}\)

\(^{88}\) Convention on Nuclear Safety, June 17, 1994, 33 ILM 1514 (1994)


It can be concluded that these combined principles give a unique instrument for nuclear safety and also radioactive waste management which has to be respected by all the states that have nuclear installations and generate radioactive waste. All the principles in one unique and uniformed document present a step forward in regulating nuclear actions. In other words, this means that simplifying and putting all these fundamental principles which have a big impact on nuclear actions form a unique basis for further and future safe and sound handling of radioactive materials from their use, transport to their disposal.

The Joint Convention was adopted on 5 September 1997. This convention recognizes importance of regulating spent fuel management which is generated by nuclear installations and other generated radioactive waste. The Joint Convention also takes into account the necessity of safe and environmentally sound management of radioactive waste as a key to achieve and maintain high level safety and ensure effective system against potential hazards to individuals and environment in a way to keep present and future generations away from harmful effects. In other words this Convention is the first legal instrument which concerns radioactive waste management issues on a global scale.\(^91\) Thus it seems reasonable to give major importance to this convention regarding the issues and problems of radioactive waste management.

First of all, one should see why this Convention is important. The Joint Convention applies to the safety of spent fuel management and radioactive waste management (Article 3). In other words, it applies to the spent fuel as a result of operation of civilian nuclear reactors and to the radioactive waste as a result of operation of civilian applications, but not to the waste that contains only natural radioactive materials. Furthermore, it doesn’t apply to the spent fuel and radioactive waste management within military and defence programmes. However, it will apply to this kind of management if military and defence waste is declared for the purposes of the Joint Convention and by the Contracting parties and if such material is transferred and managed within exclusively civilian programmes (Article 3 (3)). It should be stressed that this application of the Joint Convention meant an approach to military and defence programmes regarding spent fuel and radioactive waste management if one takes into account that military and defence programmes of major military countries such as the USA and the Russian Federation use big amounts of radioactive materials in their defence programmes and thus make a lot of radioactive waste harmful for human health and the environment.

Regarding the waste management the Joint Convention divides spent fuel from other radioactive waste and thus gives a meaning to spent fuel as a waste that has been moved from the core reactor which some states find as a valuable resource that my be reprocessed and others choose to dispose it. For example, some countries such as the United Kingdom, Japan and France find spent fuel as a resource when recycled, however others such as Sweden, Finland or the United States of America find it as a waste. Hence the different interpretation and definition depend on national policy related to scientific

Therefore, the different definitions of the spent fuel between the countries borne the necessity of regulating this matter on a uniformed, worldwide level, especially because of the reason that spent fuel may have a great adverse impact on the environment and human health as well as other radioactive waste has. In spite of different definitions of spent fuel and spent fuel management as well as radioactive waste and radioactive waste management, this convention defines them all (Article 2). Moreover, the Joint Convention imposes obligations on the states regarding general safety requirements, waste management facilities and their designation, design, construction, assessment of their safety, radiation protection from them according to the law as reasonable achieved principle (Articles 4-17). All the states are obligated to co-operate and exchange practices and information in the process of the spent fuel and radioactive waste management. The trans-boundary movement is covered by this convention as well, that is to say the spent fuel and radioactive waste is transported from the country of origin when it is authorized and only with the prior notification and consent of the state of destination (Article 27). Transit states are subject to the international obligations which are relevant to the modes of transport. The State of origin is obligated to ensure the conditions of re-entry of the waste if trans-boundary movement cannot be performed as it should be (Article 27 (1) v). The shipment of the spent fuel and radioactive waste is forbidden to a destination south of latitude 60 degrees South (Article 27 (2)). Moreover, the Joint Convention imposes obligation of reporting upon the states, hence every state shall submit national report to each review meeting of the contracting parties (Articles 29-34).

So far it is has been shown how the Joint Convention imposes obligations on the States in order to protect the environment and human health from hazardous effects of the radioactive and spent fuel waste. All the numbered characteristics of the convention (safety measures, spent fuel and radioactive waste facilities conditions, trans-boundary movement of the matter, obligation to submit reports etc.) present the uniformed and global scale legal instrument aiming at protecting the environment and human health in the best and proper way from the possible nuclear incidents that may result from spent fuel and radioactive waste. Therefore, the big step has been made by regulating spent fuel and radioactive waste management in one regulatory instrument.

In spite of positive steps regarding spent fuel and radioactive waste management that this convention provided, one should also consider its flaws and disadvantages as well.

So, what are the flaws and disadvantages of the Joint Convention if there are any? First of all, one should consider a few criteria in order to elaborate disadvantages and flaws if they exist at all.

The first criterion is legal enforceability. According to Article 26 of the Vienna Convention on the Law of the Treaties current every treaty in force is binding upon the parties to it and must be performed by them in good faith. So the Joint Convention is legally binding according to basic civil law and international law principle of “pacta sunt

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92 Current Issues in Nuclear Energy (n.57), p.4.
servanda” (“agreements must be kept”) in a way that obligations binding upon the parties must be respected. This basic rule gives a meaning and strength to the Joint Convention. However, one should take into account that the Joint Convention does not stress any sanctions or some other mechanisms in order to enforce it. In other words, this convention is based on the common interests of all the parties as to achieve the main objective hence no sanctions are imposed in the case of non-compliance with the Joint Convention. In fact, there is a bona fide compliance accompanying voluntary cooperation of the contracting parties through peer pressure without any control and sanctions in the case of non-compliance. Moreover, the Preamble of the Joint Convention expressively mentions the incentive character of the Joint Convention, that is to say that “ultimate responsibility for ensuring the safety of spent fuel and radioactive waste management rests with the State.”

Fundamental obligations of the contracting parties, specified in Articles 30 and 32 of the Joint Convention relating to reporting other contracting parties about implementation of the Joint Convention, seeking clarification on National Reports by other contracting parties, discussing the National Reports during Review Meetings are in principle based on peer review process which in fact means that all the contracting parties must rely on accuracy of the information provided by one contracting party and must also rely on answers provided during the meetings. Therefore, the efficiency and accuracy of the reporting process is rather weak because inaccurate information could be provided by a contracting party and no sanction can be determined against this party. Moreover, it should be stressed that IAEA Guidelines regarding the Form and Structure of National Reports under the Joint Convention provide for that “each Contracting Party may submit a report with the form, length and structure it believes necessary in order to describe the measures taken to implement its obligations under the Convention” In other words states have exclusive freedom or discretion in providing data, the way how they will provide it and what they will provide to other states and vice versa. These provisions create uncertainty in cooperation and exchange information process that may lead to devastating results for the environment and human health if spent fuel management and radioactive waste management are not managed in a proper way.

Secondly, relating to drafting, one should remember that the Joint Convention was drafted by a group of legal and technical experts, hence all the stakeholders and citizens did not have a chance to express their opinions and views during the analysis and elaboration of the document. Once more, the question of uncertainty is raised, that is to say the issue of spent fuel and radioactive waste management is a worldwide matter and may have serious consequences on the environment and human health unless managed in

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96 ibid, part II. art. 3a
97 Commission Staff Working Document, (n. 94), pp. 48-49.
a proper way and stakeholders and citizens have not been consulted. Thus it seems reasonable to wonder if these legal and technical experts did all appropriate surveys in order to create strong legal instrument.\(^{98}\)

Thirdly, the Joint Convention in Article 34 imposes obligation to the contracting parties to make available a document about issues and matters discussed during the official meetings, hence the summary reports are intended to be made public. The issue regarding the publication of National Reports could be a problem. Although states are only encouraged to publish them, the official and formal obligation does not exist, thus the discretion of the contracting parties is the instrument to provide information to public. The conclusion may be that public is not involved enough in spent fuel and radioactive management. Furthermore, the Joint Convention does not comprise provisions on public participation in decision-making processes, hence public is excluded from any participation and influence in spent fuel and radioactive management. In other words, there are no explicit provisions on the participation of public or interested observers during the Review meetings and other decision-making processes.\(^{99}\)

As regards the amendment procedure, Article 41 of the Joint Convention provides for the need of consensus and, if in absence of the consensus, convening a Diplomatic Conference requires two-thirds of majority vote of the contracting parties, but conditions require that at least one half of the contracting parties is present. The conclusion is that the amendment procedure relies on the consent of third countries if it is proposed by other countries. This situation may bring difficulties. Basically the amendment process couldn’t be carried out if some contracting parties which are more developed and have high environmental standards would like to amend the convention on relevant and reasonable arguments.\(^{100}\)

It should be mentioned that the Preamble of the Joint Convention takes into account the IAEA Safety Principles of radioactive waste management (1995) but those are now revised and combined with other safety principles in the IAEA Safety Fundamental Principles (2006)\(^{101}\), thus this part of the Convention is not up to date.

Although the Joint Convention shows an effort and attempt to create a unique legal instrument in order to protect the environment and human health from unwanted effects from weak spent fuel and radioactive waste management, it is presented that the Joint Convention has a number of weaknesses and flaws which may create uncertainty in the field of very specific waste management.

Achieving and maintaining the high level of safety worldwide for present and future generations, ensuring that all stages of this specific management are done in an effective


\(^{100}\) ibid

\(^{101}\) Safety Fundamental Principles (n. 90)
way against potential hazards, preventing accidents with radiological effects as main objectives of this convention present major step in the field of protecting the human health and environment as such. Unfortunately, the Joint Convention showed a number of weaknesses. Besides, the lack of enforceability and no specific requirements imposed on the contracting parties regarding the development of the national programmes on the long-term level, the lack of transparency and exclusion of public, observers, stakeholders in the decision-making process, possible difficulties in the amendment process and the implementation shows certain flaws as well. The problem of formal compliance without entailing any sanctions for non-compliance, too formal character of review meetings and questionable submitted national reports mean that contracting parties like to present its own excellence entailed with the self-defence approach during the meetings with the possibility of not ensuring the opportunities for real development and improvement by the states. Thus, in short, it can be concluded that the Joint Convention is an incentive instrument without a possibility for infringements to be followed up therefore, this situation calls for the best efforts to be made by international nuclear community to promote increased participation in the Joint Convention so as to achieve synergistic and harmonized management of spent fuel and radioactive waste.
5. MEASURES AT THE EU LEVEL

5.1. The Birth of New Energy Source and Current Situation

Nuclear energy in the European Union (hereinafter the EU) is a big issue. The importance of nuclear energy is a matter of sheer discussion in the context of energy supply, which, especially after heavy damage from oil spills and the deleterious impact of fossil fuels to the environment, has become almost a question of survival in the EU. Recently, the Finnish Parliament accepted to build new nuclear reactors. Although Finland already has two nuclear power plants, on the west of Finland in front of the place Eurajoki, there is a small island where two active nuclear reactors exist and function and the third one is under construction. The energy obtained in such a way in principle helps Finland to remain an energy independent country of the Russian gas. Not depending on imported energy is also a main goal of other Member States. Therefore, one solution to achieve the goal of energy independence in the EU is the use of nuclear energy. The recent example is the announcement of a plan to build 15-20 new nuclear power plants in Europe by 2020. In addition, it is planned to build 30 new nuclear power plants in the second phase of investment in nuclear power plants. In the past 50 years of commercial use of nuclear energy, especially in production of electricity, two major events triggered the construction of new power plants. The first one was the oil crisis in 1973 which initiated the construction of nuclear power plants in order that dependence on oil imports might be reduced. The second one was the disaster in Ukraine's Chernobyl nuclear power plant in 1986 which was a turning point in slowing, stopping and reducing the nuclear programs in many countries. Today, after the disaster in the Gulf of Mexico, Member States are increasingly returning to the idea to actuate their extinguished power plants or building new ones. Nevertheless, it should be stressed that recent nuclear accidents in Japan could change this idea or at least to reinforce implementation of important legislation provisions on the use of nuclear energy as much. What serious steps to take regarding this question is the issue we have to see in the future.

It should be stressed that Europe had its first contract for civil use of atomic energy dated in 1957, one of the oldest conventions that was adopted within the EU. The convention is known as the Euratom Treaty which was a part of the Treaty of Rome when the organization was founded as a precursor of today's EU. Opponents of nuclear energy claim that nuclear energy is too expensive and too dangerous by comparison with relatively cheap alternatives, like fossil fuels (oil, gas). In addition, others claim that nuclear energy is not profitable or good for the environment and people. The fact is that many European countries have nuclear power plants and they want to retain producing energy using nuclear power. One Member State which most intensively exploits nuclear power is France (two thirds of its electricity is produced by using nuclear power). After the Russian-Ukrainian conflict over the distribution of gas, nuclear energy became

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increasingly interesting for the new EU Member States such as Slovenia, Poland, Baltic countries, Slovakia and Bulgaria.\textsuperscript{103}

That is why the EU 27 (EU member states which have nuclear installations on their territory) keeps the atomic energy as an integral part of the "energy mix" (a diverse use of coal, nuclear energy, gas and renewable sources) the aim of which is to encourage and support energy diversity in order to protect the EU from eventual external energy crises and achieve a long-term environmental sustainability. Each Member State is allowed to independently decide how the "energy mix" should look like and what kind of energy sources will be used in order to cover its own needs. Although every Member State is free to choose its own "energy mix", one should bear in mind that the EU has been increasingly getting involved in defining energy sources by setting various targets. This can be seen in the Commission’s 2006 Green Paper on energy stating that every Member State may choose its own "energy mix" but it is inevitable that these choices would have impacts on other Member States and on the EU as a whole. Therefore, the involvement of the EU institutions is necessary. The best example is the natural gas crisis in January 2006 when Russian Gazprom cut off supplies to Ukraine and therefore Hungary, Slovakia and Austria were down at the shortage levels. For that reason the EU was forced to intervene. This example proves the importance of involving the EU in defining the use of energy sources in Member States because if one Member State relies exclusively on external energy sources, then this may have significant effect on other neighbouring countries.\textsuperscript{104}

The Commission’s stand is that nuclear power is an important carbon-free source in producing energy for the EU. However, a global plan is to produce one third of the EU electricity from renewable sources till 2020 and according to the Commission’s “New Energy Infrastructure for a 21\textsuperscript{st} century Europe" renewable sources have to contribute 20% in final energy consumption.\textsuperscript{105} With regard to the use of nuclear power there are two opposite sides. The major business lobby in Europe, BusinessEurope, claims that the nuclear power is an important source in contributing to decrease the levels of CO2 in the process of producing energy. Therefore, the use of nuclear power in producing energy should be increased from 32% today to 40% till 2030. According to the BusinessEurope this would decrease the price of electricity in a number of sectors and will also have an impact on competitiveness of energy-intensive industries. On the other hand EREC, Greenpeace, EWEA and the European Petition Campaign against Nuclear Power claim that renewable energy is a cost-effective, environmental friendly and secure source which has major energy efficiency. For example, it is stated that renewable sources could cover more than 70% of electricity production by 2050. The European Petition Campaign

\textsuperscript{103} ibid
against Nuclear Power points out how producers of nuclear energy do not bear all the costs regarding the radioactive waste management.\textsuperscript{106}

However, today in many Member States nuclear power plants have a majority share in electricity production. According to the European Nuclear Society data regarding the electricity generated by nuclear energy in 2009 Lithuania holds the first position with a share of 76.2\% (due to EU-regulations shutdown of the Lithuanian NPP Ignalina on December 31, 2009) followed by France with 75.2\%, Slovakian Republic with 53.5\%, Belgium with 51.7\% and Sweden with 42\%. In addition, the European Nuclear Society identified 143 nuclear power plants in 14 Member States and 6 of them have been under construction (Bulgaria 2, Finland 1, France 1, Slovakian Republic 2).\textsuperscript{107} Therefore, there is a big concentration of nuclear power plants in Member States that results with a serious concern of whether all these nuclear power plants function in an environmental friendly manner so as to protect not just the environment as such but also human health, meaning present and future generations.

Pressure put on Member States regarding the security of energy supply, greater energy independence, stabilization of greenhouse gas emissions, preservation of the reasonable costs of electricity, usage of the sources in an environmentally sustainable way, protection of human health, has turned Member States to the nuclear energy option which can be seen only in the fact that 6 new nuclear power plants have been under construction and in the fact that in the EU nuclear energy covers about 38\% of the electricity needs. It should be pointed out that according to the European Nuclear Society data there are 11 nuclear power plants under construction in the Russian Federation and 2 in Ukraine.\textsuperscript{108} These facts show an increasing trend of the usage of nuclear energy very near the EU borders. These facts also mean that the EU should consider its involvement externally in order to protect the environment and human health, because the problem of the closeness of nuclear waste and eventual radiation risks is basically always present at the borders. Chernobyl taught us that nuclear accidents and radiation effects did not recognize territorial borders. Therefore, regional and international cooperation is important in order to accelerate proper decision-making on radioactive waste management for better protecting the environment and people.

It is known that nuclear power plants have a longer construction period and more specific investment. In normal operation, without incident, it is technically possible to resolve all issues of environmental impacts of nuclear power within the limits permitted by international laws and regulations. Regarding the impact on the climate and the environment, experts claim that nuclear power plants are considered climate neutral because there are no direct emissions of carbon dioxide in the atmosphere and this is

\textsuperscript{106} EU Renewable Energy Policy
  \url{http://www.euractiv.com/en/energy/eu-renewable-energy-policy-links dossier-188269} accessed 1 April 2011

\textsuperscript{107} Nuclear Power Plants in Europe
  \url{http://www.euronuclear.org/info/encyclopedia/n/nuclear-power- plant-europe.htm} accessed 1 April 2011

\textsuperscript{108} Černí (n.102)
considered as a clean energy. Many experts argue that the EU could not succeed in significantly reducing carbon dioxide emissions without relying on nuclear energy.\textsuperscript{109}

5.2. A Starting Point (The Euratom Treaty)

A basic legal act of the EU that promotes peaceful use of the nuclear energy is the Treaty Establishing the European Atomic Energy Community (hereinafter the Euratom Treaty)\textsuperscript{10}. This Treaty was signed in Rome on 25 March 1957 and entered into force on the 1 January 1958 together with the Treaty establishing the European Economic Community. The main point of the Euratom Treaty was the creation of an atomic energy community and the main point of the Treaty establishing the European Economic Community was creation of a common market.

The Euratom Treaty as a basic legal act indicates the importance of nuclear energy, the new exciting energy source which could facilitate producing of electricity. This Treaty accepted the nuclear energy as a source that could give benefit to all citizens of the new Europe in order to fight the shortage of energy sources in 1950s (Article 1). Indeed, nuclear energy seemed to be the best alternative energy source which could provide enough electricity for the new Europe. The Euratom Treaty in its Preamble expressively points out that “nuclear energy presents an essential source for the development” and that “only a joint effort undertaken without delay can offer the prospect of achievements”. Furthermore, in order to use nuclear energy for development purposes, the stress is also on the importance:

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\text{to create the conditions necessary for the development of a powerful nuclear industry which will provide extensive energy resources, lead to the modernization of technical processes and contribute, through its many other applications, to the prosperity of their peoples and to create the conditions of safety necessary to eliminate hazards to the life and health of public.}\textsuperscript{111}
\end{quote}

The main goal of the Euratom Treaty was promotion of the European nuclear industry, that is to say promotion and encouragement of progress and research in the field of nuclear energy\textsuperscript{112}, special funding of nuclear research\textsuperscript{113}, dissemination of information\textsuperscript{114}, investment facilitation in order to stimulate development of the investment in the nuclear field\textsuperscript{115}, safeguards\textsuperscript{116} and the creation of common nuclear market\textsuperscript{117} meaning removal of

\begin{footnotesize}
\begin{enumerate}
\item ibid
\item ibid, the Preamble
\item ibid, Chapter 1
\item ibid, art. 6
\item ibid, Chapter 2
\item ibid, Chapter 4
\item ibid, Chapter 7
\item ibid, Chapter 9
\end{enumerate}
\end{footnotesize}
all the obstacles (abolishing of all the customs duties, charges having equivalent effect and quantitative restrictions on import and export) regarding the products listed in A1, A2 and B list. Together with the indicated goals of the Treaty, the issue of radioactive waste provisions arise. Is radioactive waste the issue mentioned at all and if it was, is it enough in order to protect the environment and human health at a uniform level?

First of all it should be mentioned that Member States are large producers of radioactive waste and that the legislation of the EU in the field of radioactive waste is based on the Euratom Treaty as a primary legislative source. Only one article of the Euratom Treaty itself deals with radioactive waste management and that article stresses that:

> Each Member State shall provide the Commission with such general data relating to any plan for the disposal of radioactive waste in whatever forms will make it possible to determine whether the implementation of such plan is liable to result in the radioactive contamination of the water, soil or airspace of another Member State.\(^{118}\)

Therefore, this article imposes “obligations on Member States in a way that all plans for disposal of radioactive waste must be submitted to the Commission for suggestions on measures to be undertaken against eventual risks”\(^{119}\). Obviously the authors of the Treaty were not aware of the problems that radioactive waste could bring or they were not so much important for them. As to their awareness of the issues and risks of detrimental radioactive waste management, the Treaty shows that this issue only received a so called passing mention in the provisions of the Treaty. Nevertheless the historical background of this period should be taken into account. The shortage of energy sources and the need to create independent energy states led to acceleration of the use of nuclear energy for the benefit of all citizens. In this period of speeding up the usage of nuclear energy, which in the long term should bring cheaper electricity to all the sectors of the Community, nobody probably realized that the high risk waste would be understood as a huge and major problem by the next generation. The proof for that is only one article that deals with radioactive waste management. So, from today’s perspective this article is for sure not a sufficient provision which could maintain the protection of the environment from radioactive waste. The one fact that shows importance of developing nuclear energy in the EU is the funding. For the period of 2002 – 2006 the European Commission in its 6th Framework Programme for research\(^{120}\) provided 1.23 billon EUR for Euratom research, meaning 246 million EUR per year. On the other hand, only 96 million EUR were spent on the research on renewable sources. Therefore, it can be concluded that the nuclear lobby is rather strong in the EU and its institutions. To compare the amount of money spent on the research on radioactive waste management and other researches like

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\(^{118}\) ibid, art. 37


thermonuclear research or nuclear fission research, only 150 million EUR were spent on
the research on radioactive waste management (final storage of nuclear waste) while 300
million EUR on fission research and 750 million EUR on thermonuclear research.\textsuperscript{121}
Therefore, it is clearly shown that the amounts spent on radioactive waste management
are too small. In addition the 7\textsuperscript{th} Framework Programme of the Euratom for research
(2007-2011)\textsuperscript{122} lays down the maximum overall amount of 2 751 million EUR for the
nuclear programme. The trend of investing high amounts of financial means increases. In
support to the fact that the EU invests large amounts of financial means is the Euratom
loan facility introduced in 1977 and established by the European Council and which
already in 1994 started to approve loans to non-EU countries (e.g. 83 million EUR were
granted to Ukraine in 2004). Till today 50 loans have been granted to Member States
amounting to 2.8 million EUR\textsuperscript{123}.

In spite of just one, obviously insufficient article that deals with the radioactive waste
management and pro-nuclear development supported by the provisions of the Euratom
Treaty it would be incorrect to say that the EU does not fully support the development
and raise in radioactive waste management. One should always consider that there are
two sides that have opposite opinions on using and developing nuclear energy. On the
one side there is a nuclear lobby and on the other there is a number of organizations
fighting against the nuclear power and wanting to prohibit permanently the use of nuclear
materials. Therefore, it is obvious that nuclear energy according to all the data presented
above will be used in the future. The balance between two opposite opinions can be
achieved at the level of the EU institutions in line with their competences given by the
Treaties. So, what was done in the early days in order to protect the environment and
human health from eventual detrimental radioactive waste management? On 22
November 1973 the Council approved the Community Environmental Programme\textsuperscript{124}
which included handling and storage of radioactive waste and specified the content and
procedures of such measures. The accent was put on actions regarding inventories of
wastes, waste processes and identifying the problems related to transport of high level
radioactive waste. On 26 June 1975 the Council\textsuperscript{125} adopted a programme on the
management and storage of radioactive waste for a five year period. The main objectives
of the decision were solving technological problems regarding processing, storage and
disposal and reviewing the radioactive waste management problems which could not be
solved at the international level, so the general framework could be defined for the
implementation of radioactive waste storage and disposal. On 18 February 1980 the

\textsuperscript{121} Sixth Framework Programme of the European Atomic Energy Community (Euratom) for nuclear
\textsuperscript{122} Council Decision 2006/970/Euratom of 18 December concerning the Seventh Framework
Programme of the Euratom for nuclear research and training activities (2007-2011) [2007] OJ L 54/21, art. 3
\textsuperscript{123} Will the new EU constitution promote nuclear energy <http://www10.antenna.nl
/wise/campaigns/euconstitution/rapporteuratom.pdf> accessed 26 April 2011
\textsuperscript{124} Declaration of the Council of the European Communities and of the representatives of the Governments
of the Member States meeting in the Council of 22 November 1973 on the programme of action of the
European Communities on the environment [1973] OJ C 112
\textsuperscript{125} Council Decision 75/406/Euratom of 26 June 1975 adopting a programme on the management and
storage of radioactive waste [1975] OJ No L 178

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Council adopted a Resolution on the implementation of a Community plan of action in the field of radioactive waste\textsuperscript{126}. The plan covered the period for 12 years (1980-1992). The main points were continuous analysis of the situation, examination of measures that could solve the problem of a long-term storage of radioactive waste, consultation on practices regarding the radioactive waste management, further research and development and providing public with necessary information\textsuperscript{127}. The Plan of Action was renewed until 1999 by the Council Resolution of 15 June 1992\textsuperscript{128}. Therefore starting from 1973 radioactive waste management issues were mainly solved through research and development activities. Nevertheless, the issue of safe radioactive waste management was recognized as a point of high importance not only for Member States that use nuclear energy but also for those that do not use it. The Green Paper on security of energy supply\textsuperscript{129} in 2001 opened the debate about the issue and it was concluded that nuclear energy, although a less than perfect energy option, would remain an important source in the future if public felt that the safe radioactive waste management was performed. Moreover, the 7\textsuperscript{th} Framework Programme of Euratom for research (2007-2011)\textsuperscript{130} enhances the development and reinforcement of scientific and technical knowledge in order to improve safety, sustainability and cost-benefit of nuclear energy.

Therefore, the concern and care for the management of radioactive waste and spent fuel takes a more important place in the decision-making processes when deciding about the use of nuclear energy. Although the importance and future of nuclear energy is strongly expressed, and according to all the documents and data this kind of energy will be used in the future, one should bear in mind that the parallel development of radioactive waste management is present as well in order to protect human health and the environment from potential radiation risks.

5.3. The Euratom Treaty Based Legislation (secondary legislation)

The legislative framework, governing spent fuel management and radioactive waste management at the EU level, is created through a variety of legislative instruments. Therefore, at this point, there is still no single document that covers expressively spent fuel and radioactive waste management. In spite of that, the EU has several instruments that cover this issue. So, what is the legislative framework in the EU for spent fuel and radioactive waste management?

\begin{itemize}
  \item \textsuperscript{126} Council Resolution of 18 February 1980 on the implementation of a Community plan of action in the field of radioactive waste [1980] OJ C 51
  \item \textsuperscript{127} Community plan of action in the field of radioactive waste (1980-1999)\textsuperscript{}< http://europa.eu/legislation_summaries/other/128096_en.htm> accessed 10 April 2011
  \item \textsuperscript{128} Council Resolution of 15 June 1992 on the renewal of the Community plan of action in the field of radioactive waste [1992] OJ C 158
  \item \textsuperscript{129} Commission (EC), ‘Towards a European strategy for the security of energy supply’ (Green Paper ) COM (2000) 769 final, 29 November 2000, p.34.
  \item \textsuperscript{130} Council Decision 2006/970/Euratom (n. 122), art. 2(2)
\end{itemize}
5.3.1. The Beginning of a Nuclear Project

Firstly, there is the Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation.\textsuperscript{131} According to Article 2 the Directive applies to:

all practices which involve a risk from ionizing radiation emanating from an artificial source or from a natural radiation source in cases where natural radionuclides are or have been processed in view of their radioactive, fissile or fertile properties namely: the production, processing, handling, use, holding, storage, transport, import to and export from the Community and disposal of radioactive substances.\textsuperscript{132}

The Directive, therefore applies to any activity involving radiation risk to public, to workers and to the environment. The Directive also mentions general principles in Article 6 including three main features for dose limitations recommended by the International Commission on Radiological Protection (ICRP). Therefore, justification\textsuperscript{133} (Article 6 (2)), optimization or the ALARA principle\textsuperscript{134} (Article 6 (3)) and dose limitation\textsuperscript{135} (Article 6 (3) b) are included. This Directive is supplemented by other specific legislation for example one regarding the medical application of ionizing\textsuperscript{136} and protection of outside workers.\textsuperscript{137}

Another important instrument for managing radioactive waste and spent fuel is the Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations.\textsuperscript{138} Article 2 of this Directive applies to civilian nuclear installations approved by the competent regulatory authorities designated by the Member State regarding siting, design, construction, commissioning, operation and decommissioning of nuclear installation. Member States are obligated to establish and maintain these regulatory authorities which are specialized in nuclear

\textsuperscript{132} ibid, art.2
\textsuperscript{133} Any radiation exposure has to be proportionate to the level of exposure.
\textsuperscript{134} “As low as reasonably achievable” principle is recommended by the International Commission on Radiological Protection. The main point of the principle is to reduce radiation exposure to the lowest possible measure taking into account the costs of such reduction.
\textsuperscript{135} Sets out upper limits of the radiation that may be received.
matters and are independent from organizations that promote usage of nuclear energy (Article 5). Therefore, in order to function properly, nuclear installations have to be approved by independent competent regulatory authorities which issue licence under which nuclear installations may function. The holder of the licence (natural or legal person) has a responsibility for a nuclear installation as specified in the licence (Article 3). According to Article 3 point a of the Directive nuclear installations are “enrichment plant, nuclear fuel fabrication plant, nuclear power plant, reprocessing plant, research reactor facility, spent fuel storage facility” and according to point b of the same Article “storage facilities for radioactive waste that are on the same site and are directly related to nuclear installations listed under point a”. The Directive lays down rules in order to protect the permanent development of nuclear safety among Member States.

Therefore it is imposed to all Member States to create, develop and maintain continuously a national legislative framework for nuclear safety especially regarding the high level radioactive waste in order to protect public, workers and the environment (Article 4). In the national legal framework Member States are obligated to ensure proper functioning of the competent regulatory authorities in a way to provide financial and human resources, to ensure that enforcement powers (e.g. suspend the operation of the nuclear installation) regarding the licence holders have to comply with national nuclear safety requirements that are given as well as powers to assess and provide the right to conduct inspections (Article 6). The main requirement of the Directive is that Member States do their work in the field of creating a national legislative framework regarding nuclear safety. Regarding the radioactive waste management this Directive expressively points out the importance of safety in nuclear installations and according to the definitions in Article 3 it also includes facilities for storage of spent fuel and radioactive waste. The importance of the Directive also lies in provisions that require informing public in relation with the nuclear safety regulations and obligation of Member States and to inform the Commission on the implementation of the Directive.

When one looks at Article 3 of the Directive, it can be seen that regarding spent fuel and radioactive waste, nuclear installations include spent fuel storage facilities and radioactive waste storage facilities that are on the site. With the inclusion of just these two storage facilities it may be concluded that this Directive does not include all types of facilities or aspects within the meaning of the spent fuel and radioactive waste management. In spite of all the provisions related to nuclear safety and provisions ensuring proper and safe function of the nuclear installations in order to protect human health and the environment and the wider scope of the Directive which goes beyond the international law, one should take into account that some nuclear installations (e.g. deep geological disposal facilities) are not included, thus the gap exists in the definition of nuclear installations, and it my be concluded as well that other types of facilities for spent fuel and radioactive waste will not be included at the national levels and that independent competent authorities will not have any powers on those facilities that are not referred to in the Directive. In addition, M. Sousa Ferro argues that this Directive is “an example of how negotiations within the EU can sometimes lead to the results that are less than those
achieved at the international level. Indeed, the Directive 2009/71/Euratom does not go so far as the substantive obligations on nuclear safety foreseen in the IAEA’s NSC do”.

Regarding the radioactive waste management the Directive on the Assessment of the Effects of Certain Public and Private Projects on the environment in its Annex I and II explicitly mentions nuclear power stations, other nuclear reactors and installations designed for the permanent storage or final disposal of radioactive waste, installations for the production or enrichment of nuclear fuels, for the reprocessing of irradiated nuclear fuels and for the collection and reprocessing of radioactive waste if the relevant Member State considers that characteristics of these installations so require. Therefore it applies to all the projects regarding the mentioned installations which are likely to have an adverse effect on the environment. Additionally, projects set out in Annex I to the Directive should be assessed, but the projects set out in Annex II may be assessed when Member States consider that characteristics of the project require so.

According to Article 1 (3) the environmental impact assessment shall be performed by the national competent authority which shall be designated by the Member State. This environmental impact assessment has to be carried out before the consent to proceed with the project has been granted as well as to identify, assess and describe effects on the environment as such and human beings (Article 3). Therefore “the intention of this instrument is that the environmental impact assessment would make possible the achievement of a comprehensive overview of the environmental consequences of a proposed project as early as possible.”

Importance of the Directive lies in the fact that the consent by all authorities concerned is required before carrying out the project and public has to be informed thereof and has a right to express its own opinion before the project is initiated (Article 6). The developer of the project has to submit all the needed information in order that the project is granted (e.g. description of the project, site, design, size, measures for avoiding eventual adverse effects, data which shall identify the main effects which project may have on the environment). The exemption of some projects from this Directive is also possible but in that case a Member State is required to consider possibilities for another way to assess the impact of the project, public has to be informed and the reasons of the exemption before granting the consent have to be submitted to the Commission (Article 2).

To sum it up, the EU with this Directive imposes rules for the mandatory environmental impact assessment which has to be carried out before the consent by competent authorities and also the important information has to be submitted to the third parties

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concerned. The importance of this Directive, especially regarding the nuclear installations, lies in the fact that no nuclear project may be carried out prior to the assessment and prior consent for the project has been granted.

This Directive was amended by the Council Directive 97/11/EC which added more nuclear installations to be assessed before the project could be carried out. Thus, projects regarding the dismantling or decommissioning of nuclear power stations and other nuclear reactors, installations designed for the final disposal of irradiated fuel and installations designed for the final disposal of radioactive waste (Annex I 3b and 8b) became the subject to the amended Directive.

It can be concluded that by these provisions a majority of nuclear installations is covered. Therefore, if either public or private person wants to carry out the project regarding nuclear installations, the environmental impact assessment is a step that has to be taken before starting the project.

The purpose of The Council Strategic Environmental Assessment (SEA) Directive of 5 June 2001 is providing for high environmental protection in plans and programmes the implementation of which may produce environmental consequences. According to the Directive the plans and programmes shall be assessed and identified during their preparations and before they are adopted (Article 4). The importance for radioactive waste management projects lies in the scope of the Directive, i.e., in Article 3 of the Directive having provisions which include all the nuclear installation projects mentioned in the Directive 85/337/EEC. Member States shall ensure that all the data concerned are available to public (Article 3 (7)). The Directive also has provisions about trans-boundary consultations (Article 7), i.e., if the project has likely trans-boundary significant effect, then the effected Member State and its public have to be informed thereof and have right to propose and make comments on the project. These comments shall be also incorporated in the decision making process regarding the assessment of the certain project.

The connection of strategic environmental assessment and environmental impact assessment is that all the data covered by strategic environmental assessment shall be used in an environmental impact assessment meaning that the amount of work in the latter stage can be reduced.

The importance of this Directive lies in the fact that the uniform requirements should apply to different environmental assessment procedures in Member States in order that a high level of protection for the environment and human health is achieved.

Therefore, all the nuclear projects regarding the nuclear installations within the meaning of the Directive 85/337/EEC should be assessed according to the provisions laid down in the strategic environmental assessment and environmental impact assessment procedures.

145 Directive 85/337/EEC (n. 140)
5.3.2. Civil Liability

Analysis of current situation regarding the civil liability at the EU level shows that harmonized rules on civil liability do not exist. Although the Euratom Treaty provides provisions and basis for the adoption of the civil liability directive, the question of civil liability at the EU level has remained unsolved. The Euratom Treaty in Article 98 lays down obligation that:

Member States shall take all measures necessary to facilitate the conclusion of insurance contracts covering nuclear risks. Within two years of the entry into force of this Treaty, the Council, acting by qualified majority on a proposal from the Commission shall after consulting the European Parliament, issue directives for the application of this Article.¹⁴⁶

Till today such directive on nuclear insurance and/or nuclear liability has not been adopted. According to Dr. Tom Vanden Borre from the Leuven University this hasn’t happened because when the liability conventions were drafted both nuclear liability and nuclear insurance could not be separated. Therefore, nuclear liability without nuclear insurance wasn’t the option. In spite of the proposal in 1959 which aim was to harmonize the issue it didn’t succeed. Dr. Tom Vanden Borre argues that this process of harmonization didn’t succeed because of the difficulty to accept that harmonization of nuclear liability could facilitate conclusion of nuclear insurances and at that time Member States already joined the Paris Convention. In addition Dr. Tom Vanden Borre argues that one reason for not adopting the directive was that Member States assumed that Euratom Treaty did not cover nuclear liability.¹⁴⁷

Nevertheless, today majority of Member States are part of existing international conventions on civil liability. At this moment there are two legal instruments in the European Union which coexist regarding the liability from nuclear damages. Therefore, 13 Member States (Belgium, Denmark, Finland, France, Germany, Greece, Italy, Netherlands, Portugal, Spain, Slovenia, Sweden and the UK) are a contracting parties to the Paris Convention concluded under the aegis of the OECD/NEA and 9 Member States (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia) are contracting parties to the Vienna Convention concluded under the aegis of the IAEA. Additionally, 5 other Member States (Austria, Cyprus, Ireland, Luxembourg, Malta) are not members of any of the mentioned conventions.¹⁴⁸

Although, the two conventions have been based on similar principles, they show a number of differences (e.g. different liability amounts, territorial scope, jurisdiction

¹⁴⁶ Euratom Treaty, art. 98
¹⁴⁷ Dr. Tom Vanden Borre (Workshop on the prospects of a civil nuclear liability regime in the framework of the European Union on 17 and 18 June 2010, DG Energy, Brussels)
¹⁴⁸ ibid
conflicts, settlements etc.). Thus, the two international sub-regimes still coexist regarding this sensitive issue focused at ensuring one liability regime at the European Union level.

5.3.3. Intra Community Movement of Radioactive Materials and Waste

The completion of the internal market of the EU which led to the abolition of all barriers and borders between Member States introduced a new issue regarding the radioactive waste management. The issue opened question of the transport of radioactive waste and its safety. “In January 1988, a number of cases arose involving radioactive waste notably that between Belgium and the Federal Republic of Germany, which led to a decision by the Member States concerned to order enquiries to examine the matter in depth.”

Therefore after a period of enquiries by the European Parliament and groups of experts in the Commission who researched the issue, its aspect and provisions both at the international and the EU level, today there are present the two key instruments regarding the issue of the transportation of radioactive waste.\(^{150}\)

The first measure at the EU level is the Council Regulation (Euratom) 1493/93 of 8 June 1993 on shipments of radioactive substances between Member States\(^{151}\). The Regulation applies to the shipments between the Member States of sealed sources and other relevant sources as well as to radioactive waste shipments (Article 1). The main objectives of the Regulation are that all controls in Member States involved in the shipment (country of origin, transit, destination) are conducted in a non-discriminatory manner (Article 3), all procedures regarding notification and documentation are followed by the holder of the substances, the consignee of the substances and the competent authority of the Member State to which the shipment is to be performed before the actual shipment is conducted (Article 4 and 5). In addition it is obligatory for the holder of the substance to provide information to the competent authority of the Member State where the shipment is made in the period after the shipment was made between Member States (Article 6). The competent authorities are also obligated to co-operate between themselves in order to check if the provisions are implemented in the right manner (Article 7), as well as the obligation to notify the Commission (Article 8).

It has to be pointed out that this Regulation applies to radioactive waste covered by the Directive 92/3/Euratom which was revoked by Council Directive 2006/117/Euratom of 20 November 2006 on the supervision and control of shipments of radioactive waste and spent fuel.\(^{152}\)

Secondly, the EU legislative framework includes already mentioned Council Directive 2006/117/Euratom which expressively indicates the need “to protect human health and environment against the dangers arising from radioactive waste” in its Preamble point 11.


\(^{150}\) ibid

\(^{151}\) Council Regulation (Euratom) 1493/93 of 8 June 1993 on shipments of radioactive substances between Member States [1993] OJ L 148

This Directive revoked and replaced Directive 92/3/Euratom so as to ensure the consistency with other directives and international conventions related to spent fuel and radioactive waste management and to clarify the procedure regarding the definitions, concepts, removal of inconsistencies etc. (the Preamble, points 4, 6 and 19). In addition it also extended the scope to spent fuel either it is reprocessed or not.

This Directive applies to the system and control of trans-boundary shipments of spent fuel and radioactive waste (Article 1). With regard to the latter it introduces prior authorization and system of control in the shipment process (Article 6). The documents on the shipment of spent fuel and radioactive waste which are covered by this Directive include the point of departure, transit and destination in Member States if the quantities exceed the levels laid down in the Directive 96/29/Euratom Articles 3(2) points a and b. The shipment procedure includes the applications of a holder of waste to the competent authority of the country of origin. When the shipment is to be made to the country of destination or if it is performed through the country of transit, the prior consent of these countries is mandatory in order that a proper shipment may be conducted (Article 6). In the case of importation of radioactive waste or spent fuel into the EU the prior consent of the country of destination is also mandatory. The country of destination or the country of transit may approve or refuse the shipment (Article 9). When the country refuses the shipment, the refusal has to be justified. The shipment of radioactive waste and spent fuel to African, Caribbean or Pacific countries (according to the Cotonou Agreement), to a destination south of latitude 60 south, as well as to the third countries which do not have proper resources to manage radioactive waste or spent fuel is prohibited (Article 16). As to the conditions of the shipment, it should be noted that, if there is no compliance with the strict conditions that have to be fulfilled or the shipment cannot be completed, the shipment may be returned to the holder if no alternatives could be found (Article 13).

It can be concluded that this Directive reinforced the system of the prior authorization for shipment of radioactive waste in order to provide better and stronger protection to human health and the environment. The provisions and especially the Preamble of the Directive clearly show what clarification should have been done in order that better protection may be achieved. Adopting this Directive, the EU shows how the problems of managing radioactive waste and spent fuel are dealt with and that the need to protect properly the environment as such is one of the major concerns.

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153 ibid, art. 1(2)

More than 50 years have passed since the first nuclear reactor for electricity production became operational (1956, Calder Hall, UK) and still a permanent system for waste disposal has not been constructed in the EU.\footnote{Safety Standards for Nuclear Safety <http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/10/540&format=HTML&aged=0&language=EN&guiLanguage=en> accessed 7 April 2011}

5.3.4.1. Why New Directive?

The fact that every year 7,000 m$^3$ of high level radioactive waste is usually produced in the EU which is stored in interim storage facilities calls for a strict and prompt actions at the EU level. High level waste is a product of the processed spent fuel which cannot be used anymore, therefore it needs to be disposed and managed in a proper way. The importance and need of the temporary storage facilities in order that fuel elements and high level waste may be accumulated so as to reduce the temperature and radiation levels show their own value and they cannot be avoided as a part of the management of spent fuel and high level radioactive waste. However, this is not a long term solution because this specific waste needs constant maintenance and supervision. In addition, the practice shows that these facilities are usually close to or on the surface, and are often located in places where a high risk of accidents such as airplane crashes, fires or earthquakes may occur. According to the broad consensus among scientists and international organizations, such as the IAEA, deep geological disposal is considered as the most appropriate solution for long term storage of high-level nuclear waste.\footnote{ibid}

5.3.4.2. Current Legal Situation

According to the 2010 Commission’s Impact Assessment document\footnote{Commission (EC), ‘Commission Staff Working Document, accompanying document to the revised proposal for a Council Directive (Euratom) on the management of spent fuel and radioactive waste, Impact Assessment’ SEC (2010) 1289 final, 3 November 2010, p.10.} current legal framework in the EU which deals with managing spent fuel and radioactive waste has not been sufficient enough. This issue has not been covered in its entirety at the EU level, existing international conventions show flaws and gaps especially in the meaning of verification, enforcement and in not requiring countries to establish national programmes for the management of all types of radioactive waste. The cross-border risks of the radiation effects require much higher standards and relevant conditions in order that the environment and human health should be properly protected. The disasters in Chernobyl and now in Japan have taught us the lesson that more stringent standards and conditions should be created in order that not just our backyard but also other backyards may be properly protected.
The overall goal of the proposal is to achieve continuous political dedication to the safe management of spent fuel and radioactive waste, reinforce protection of workers and public from adverse effects of ionizing radiation beyond national borders. Moreover, in this way the undue burden on future generations would be avoided or at least reduced to a minimum.\textsuperscript{158}

5.3.4.3. What is the EU Proposing?

On 3 November 2010 the European Commission proposed a directive which set safety standards for the disposal of spent fuel and radioactive waste from nuclear power plants as well as radioactive waste which is generated from medical and research processes. When presenting the Directive, Member States are requested to submit current national programs regarding the period, surface and a way of constructing and managing repositories for the disposal of generated spent fuel and radioactive waste. It is requested that current national programs are made according to the highest safety standards. This directive with all internationally agreed safety standards shall become binding and enforceable in the EU. The fact, that radioactive waste is not produced only in Member States that use nuclear power for electricity production, but occurs in many other industries such as radiotherapy or industrial researches, demonstrates that the need for safe disposal and management of spent fuel and radioactive waste is a challenge for all Member States regardless of their attitude on nuclear energy. Although the concern on low level and medium level radioactive waste has been increasing, one should keep in mind that there is still no permanent repository for high level radioactive waste and spent fuel. Spent fuel and radioactive waste disposal facilities could be constructed between 2020 and 2025 among several Member States. At this moment only Finland, Sweden and France have plans for constructing repositories. Repositories in Finland could be operational in 2020, Sweden in 2023 and France in 2025. It is necessary that all Member States reach common and widespread agreement on the disposal of radioactive waste in a responsible and transparent way at this point of widespread usage of nuclear energy in the EU and with having in mind the fact that the nuclear energy would remain an important electricity source in the future. In addition it is also important to establish national frameworks and programs for managing all types of radioactive waste as well as that the generations, having significant benefit from nuclear energy, may take care of the waste disposal and of financial mechanisms crucial for such activities.\textsuperscript{159}

Commissioner for energy Günther Oettinger said:

Safety concerns all citizens and all EU countries, whether they are in favour or against nuclear energy. We have to make sure that we have the highest safety standards in the world to protect our citizen, our water and the ground against

\textsuperscript{158} ibid
\textsuperscript{159} Nuclear Waste, Commission proposes safety standards for final disposal

nuclear contamination. Safety is indivisible. If an accident happens in one country, it can have devastating effects also in others.\textsuperscript{160}

Therefore, the only reasonable thing to do is to create a legally binding framework which will ensure that all Member States respect and implement all nuclear standards set up by the IAEA regarding the issues of spent fuel and radioactive waste management procedures in application from the beginning of the process to the final disposal of the specific waste.

The Proposal specifically provides that:

\begin{itemize}
  \item Member States should develop national programs within four years from the date of its adoption. National programs must include plans for building and operating the landfills, the starting time of construction, a description of all relevant activities required to implement the disposal solutions, estimation of costs and production quantities and schemes for selected sources of funding.\textsuperscript{161}
  \item The present national programs should be publicly available and the final proposal of the national programs has to be submitted to all relevant institutions, so that the Commission could seek their eventual modification.\textsuperscript{162}
  \item In addition two or more Member States may conclude an agreement on joint use of the landfill in one of Member States, but in a way to prevent the export of nuclear waste to countries outside the European Union as a solution to final disposal.\textsuperscript{163}
  \item Public must be promptly notified thereof by Member States and must be able to participate in decision making about nuclear waste.\textsuperscript{164}
  \item Safety standards, prepared by the IAEA, are legally binding. They include the establishment of independent bodies to issue permits for the construction of the repository and perform testing and analysis of security for each landfill.\textsuperscript{165}
\end{itemize}

\textsuperscript{160} ibid
\textsuperscript{161} Proposal (n. 154) pp. 20- 22.
\textsuperscript{162} ibid p.21.
\textsuperscript{163} ibid p.14. point 37
\textsuperscript{164} ibid p.20.
\textsuperscript{165} ibid p.18.

In spite of the fact that the Euratom and all Member States with exception of Malta are members of the Joint Convention, one should bear in mind that this international instrument has flaws and gaps that may be solved and repaired on the European Union level meaning thus the establishment of much higher standards which will be mandatory for all Member States.

First of all, both the Joint Convention and the Euratom instrument (hereinafter the Directive), are legally binding, but the difference is that the Joint Convention does not provide any sanctions or any other mechanisms that would ensure the enforcement of the Joint Convention. Hence, no sanctions are imposed in the case of non-compliance with the Joint Convention. On the other hand, at the EU level the Treaties provide clear and strong mechanism to control how the Directive is transposed in the national legislation. The Commission has an important role in the transposition process. Member States are required to wait for the Commission’s recommendation on draft of the national legislation before it is adopted (Article 31 and 32 of the Euratom Treaty). The Commission has right to open infringement procedure against Member States before the Court of Justice of the European Union for not transposing or not properly transposing of the Directive into the national law. It is also true about the control mechanism that one Member State has a possibility to open infringement procedure against another Member State for its failure in fulfilling the obligation (Article 259 of the TFEU). The direct effect of the Directive also gives EU citizens a right to revoke the Directive in the case when a Member State has not transposed the Directive. Therefore, the system of control mechanism which is capable to sanction a Member State for not fulfilling its obligations is strong and sufficient at the EU level. Additionally, the Joint Convention also does not impose the development of the national programmes for the long-term management of all types of radioactive waste although this is an important factor in order to implement provisions properly.

Secondly, with regard to drafting the Joint Convention, one should remember that it was drafted by a group of legal and technical experts. Hence all the stakeholders and citizens did not have a chance to express their opinions and views during the analysis and elaboration of the Convention. On the other hand, all stakeholders and citizens were consulted through various mechanisms (e.g. Eurobarometar surveys, expert groups such as ENSREG, Open public Internet consultation, obligated opinion of the ECOSOC and EU Parliament).

Thirdly, as to the transparency procedure meaning informing public, the Directive follows strict requirements imposed by the Nuclear Safety Directive. It is not only the Commission that must be informed about the activities and through the Commission also

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166 Consolidated version of the Treaty on the Functioning of the European Union [2008] C 115/161
the Council, but also public and other Member States have to be informed about issues related to managing spent fuel and radioactive waste. One of the objectives in the Directive is also involving general public in the decision-making process which is not mentioned in the Joint Convention\textsuperscript{169}.

As it regards the amendment procedure, Article 41 of the Joint Convention provides for the need of consensus and, if in the absence of consensus, convening a Diplomatic Conference requires two-thirds of majority vote of the contracting parties, but conditions require that at least one half of the contracting parties is present.\textsuperscript{170} The conclusion is that the amendment procedure relies on the consent by third countries if it is proposed by other countries. This situation may bring difficulties if some contracting parties which are more developed and have high environmental standards would like to amend the Joint Convention on relevant and reasonable arguments. Basically, the amendment process could not be carried out. On the other hand, the amendment procedure in the EU is a procedure of the internal issues of Member States, thus there is no need for some third countries to give its consent to amend provisions.

When comparing important criteria which constitute basis for the strict implementation of these specific provisions, it can be concluded that the new Directive gives more strict provisions than the Joint Convention does and that the EU functioning system gives the opportunity that all Member States may respect and comply with the provisions in order to provide high safety standards in protecting the environment and human health.

\textsuperscript{169} ibid p. 48.
\textsuperscript{170} ibid, pp. 48-49.
6. CONCLUSION

Commercial use of nuclear energy as an alternative resource to oil, gas and other resources for producing electricity and other matters from which humans benefit has opened a lot of issues regarding the protection of human health and the environment. Although nuclear energy is considered as a clean and environmental friendly source of energy, if compared to other resources like oil, coal or gas, the consequences of nuclear incidents may have devastating effects on human health and the environment. Not only nuclear incidents are such that may have adverse effects on human health and the environment, but also detrimental management of radioactive waste and spent fuel, which are left after the use of nuclear materials, may produce huge adverse impacts on human health and the environment. Therefore, the controversy around nuclear energy raises a lot of issues especially those regarding the management of radioactive waste and spent fuel.

When one compares radioactive waste and spent fuel with other types of waste, it can be concluded that other types of waste are much more represented worldwide. Therefore, it appears that the percentage of radioactive waste and spent fuel is rather small if it is compared with the percentage amount of other types of waste. The main difference is that this small percentage may create worldwide adverse consequences on human health and the environment. Managing radioactive waste and spent fuel requires a lot of scientific effort and number of legal instruments in order that safe and sound management may be provided and humans and the environment properly protected. It is not only important to protect present generations but future generations, too, so that the undue burden would not strike future human beings and their environment.

The legal instruments dealing with the management of radioactive waste and spent fuel have increasingly developed from the beginnings of the commercial use of nuclear energy. These instruments have been developing both at the international and European levels. At the international level a number of conventions and other agreements were adopted in order that nuclear activities might be regulated. Immediately at the very beginning the importance of liability in nuclear activities arose and therefore, the first conventions were adopted under the aegis of the IAEA and the OECD/NEA. Liability and amount of compensation were developing over the years and created a system of strict and absolute liability of the operator of nuclear installations. The amount of compensation was rising over the years. The next step, in regulating radioactive waste, referred to the environmental impact assessment and strategic environmental assessment. They are mandatory provisions that have to be respected before undertaking the nuclear project. Projects regarding the disposal activities connected with the disposal of spent fuel and radioactive waste should be also in compliance with the very provisions. Further on the provisions of the transport of radioactive waste and spent fuel constitute important rules about packaging and transportation of radioactive waste and spent fuel. All the conventions valid at the international level have been followed at the EU level.

At the EU level basic legal instrument is the Euratom Treaty which is an “umbrella” and starting point in the management of radioactive waste and spent fuel. All the directives and framework programs developed and adopted at the EU level have followed
international legal and scientific developments. Therefore, the EU legislation constitutes important legal instruments for managing radioactive waste and spent fuel and does not lag behind to international conventions.

The important year for the radioactive waste and spent fuel management was 1997 when the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (hereinafter the Joint Convention) was adopted. This Convention created for the first time a unique legal instrument at international level that provides for necessary provisions in managing radioactive waste and spent fuel. The Joint Convention, therefore, imposes on the Contracting parties obligations regarding safety measures, spent fuel and radioactive waste facilities conditions, trans-boundary movement of the matter, obligation to submit reports, obligation to cooperate and exchange information and undertake assessments. The conclusion is that the Joint Convention represents the uniformed and global scale legal instrument with attention to protect the environment and human health in the best and proper way from the possible nuclear incidents that may result from spent fuel and radioactive waste.

In spite of all the obligations imposed on the Contracting parties, the Joint Convention has also flaws and disadvantages. Disadvantages such as no sanctions in the case of non-compliance, no given opportunities for all the stakeholders and citizens to express their opinions and views during the analysis and elaboration of the document, vague provisions regarding the obligation of publishing national reports about the usage of nuclear installations and problems that could occur in the amendment procedure put the Joint Convention in the inferior position. One could argue that a few important, but vague provisions of the Joint Convention are in favour of the nuclear industry and put aside all alternative sources of energy. This statement is close to international environmental NGOs' standing such as the Greenpeace, but one should bear in mind that there is a huge number of obstacles and barriers when drafting such an important document, especially when two opposite sides put the pressure on the drafters. Therefore, the nuclear industry desiring more freedom in the usage of nuclear energy and NGOs that are totally against the usage of nuclear energy make rather difficult situation in the case of laying down provisions that concern nuclear energy. Although there are flaws and vague provisions in the Joint Convention, it is also important to know that there exists a unique legal instrument that lays down provisions about radioactive waste and spent fuel management.

As the EU follows the international trends developing in the field of the nuclear energy and so radioactive waste and spent fuel management, 2010 was the year when the Commission proposed the Directive on spent fuel and radioactive waste management. The proposal constitutes all the IAEA principles regarding this specific management. The importance and advantage of the future Directive is that it is mandatory for all Member States and that there is possibility of the sanction if Member State does not transpose it in the national legislation. Therefore, the EU system as such promotes better and efficient application of the rules regarding the radioactive waste management than it is the case at the international level.
In spite of all the conventions, programmes, guidelines, frameworks and directives mentioned in this paper that regulate spent fuel and radioactive waste management in order that present and future generations may be protected, one cannot help keeping in mind the words of James D. Werner who said that “the stuff we are dealing with can’t go away until it decays. You can containerize it, solidify it, immobilize it and move it, but you can’t make it go away”\textsuperscript{171}.

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