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Financial Instruments for Environmental Risks and Damage

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FINANCIAL INSRUMENTS FOR ENVIRONMENTAL RISKS AND DAMAGE

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1. INTRODUCTION AND THE IMPORTANCE OF THE PROBLEM

Human activities modify and negatively affect natural environment. As a result, the ecological integrity of ecosystems, their resilience to external shocks and the flow of services they provide were eroded, and continue to decline. Environmental damage directly or indirectly caused by industrial activities is one of the major causes of the environmental deterioration. Since five or six decades the concerns and awareness about environment improved substantially. Considerable efforts were made to protect environment and the ecological functions of ecosystems at the global, European, and national levels.

In my thesis, I address environmental liability and the way risk financing instruments could effectively support the environmental damage prevention and restoration, the definition and the evaluation of environmental risks and the identification of remediation and compensation measures. The European Union's legislations addressed the harm inflicted on environment through the Environmental Liability Directive (ELD, Directive 2004/35/EC regarding the prevention and remedying of environmental damage) and through the "polluter-pays-principle". The insurance industry played an important role in developing instruments to answer to the new environmental liability regime. The insurers are looking for solutions to manage environmental risks and find strategies to improve the protection of environment through insurance policies and coverage. For the insurance industry, the improvement of the environmental solutions and market represents a challenge, because of the lack of historical and statistical data to properly evaluate these risks.

1.1 Importance of the problem

Environmental damage refers to impairment and loss of natural resources as a result of their overexploitation or negative externalities. Many human-related, potentially dangerous activities affect the natural environment, and can lead to temporary or permanent damage to habitats, flora and fauna, affecting the biodiversity. Pollution and contaminations derived from man-made sources (including industrial accidents) can affect the environment, causing the death of the living species in the affected area and undermining or even destroying the entire ecosystem. Many of these effects can also negatively impact human health and life, or economy, with contamination of agricultural land or drinking water reservoir, pollution of the air with toxic substances, affecting farm, agricultural products and all the economic activities related to them. Environmental damage can also compromise natural and cultural heritage, with negative effects on the tourism sector.

There are many examples of industrial accidents that caused serious damage to the environment, due to negligence or improper risk prevention at industrial plants or in dealing with the hazardous substances. On April 25th 1998, a dam for wastewater reservoir of the Los Frailes pyrite mine in Aznacòllar (Spain) collapsed. Some 5 million cubic metres of slurry contaminated with heavy metals escaped into the nearby rivers, causing a contamination of area spreading over 40 km. This led to a massive loss of fish and other aquatic life, to a contamination of around 4500 hectares of agricultural land, closure of over 50 irrigation

wells and a ban on the sale of the agricultural products and shellfish affected by the spill (BIO Intelligence Service, 2012). This event had deep impacts on the environment and economy of the region. Another similar event occurred in Hungary at the MAL Alumina Factory of Kolontàr on October 4th, 2010. A dam wall of a mud tank collapsed and around one million cubic metres of red sludge and alkaline water spilled out from the reservoir. This generated a wave of toxic water that killed or injured people, destroyed over 300 homes, contaminated 400 hectares of agricultural land and polluted the local waterways and the Tisza river, which flows through many countries, causing an important cross-border pollution (BIO Intelligence Service, 2012).

The environmental damage does not only derive from industrial incidents, but can also be caused by negligent storage and transportation of sensitive substances, or inappropriate management of areas. These events can lead to a direct catastrophic damage to the environment, but they can also affect the ecosystem services and their resilience, as occurred at the High Tatras in Slovakia. On 19 November 2004, the High Tatras area was stricken by a strong natural windstorm that damaged over 12.000 hectares of forest in and around the High Tatras National Park. The most affected area was the one composed by artificial spruce monoculture for the wood industry, while the areas in which natural forest ecosystems was preserved was affected to minor extent. To some extent the magnitude of the wind damage was caused by over-exploitation and inadequate forest management, that undermined the capacity of rest ecosystems to withstand natural hazards.

It is clear that the environment can be affected by accidents and unanticipated events that may cause immediate and large damage, part of which is the loss of ecosystem functions and services. But the environmental damage may also originate in slow-onset process and over long period of time, as a result of cumulative pollution and gradual contamination.

Environmental damage can entail very high costs in term of remediation, clean-up and restoration, and natural resources losses. It is easier to identify costs related to the corporal injury and property damages, but to estimate the full costs associated with environmental degradation and loss of natural resources may be cumbersome. The total costs of the Kolontàr and Aznacòllar accidents were estimated to 115 million and 180 million respectively (BIO Intelligence Service, 2012). These loss estimates include the health and property damage claims, the costs of remedial and restoration measures, and the compensation to farmers and other affected workers for damage on crops and physical structures. Neither the wider environmental losses such as the disrupted environmental integrity and resilience, nor the indirect impacts on human health and socio-economic activities were included in the above damage assessments. Then, when such damage occur many problems arise. The most important challenges include the quantification of damage, the identification of those liable for the damage and what should be taken into account in the evaluation of the amount of money necessary to ensure an effective remedy and restore of environmental base line conditions.

Events of similar or lower magnitude occur also in Italy. Italy has experienced a large number of cases entailing environmental damage caused by businesses' activities. An infamous case

is the Seveso accident, which occurred on 10 July 1976 at the Icmesa chemical plant in Seveso (north of Milan in the Lombardy region). The chemical reactor producing trichlorophenol exploded, causing among others accidental release of highly toxic 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD or dioxin). The ensuing contamination affected the health of residential population, evacuated in the aftermath, and a ban of agricultural and farm products. The disaster prompted adoption of the EU legislation to prevent and control of similar accidents, the Seveso Directive (Directive 82/501/EEC later revised and replaced, most recently in the 2012 by the Directive 2012/18/EU, also called Seveso III Directive). According to this Directive, industrial plant with major-accident hazards, due to the utilization of dangerous substances, are strictly controlled and registered by the authorities. In Italy, referring to the "Annuario dei dati ambientali 2014-2015" (Yearbook of Environmental Data 2014-2015) of ISPRA, 1104 potentially dangerous industrial plants are registered, 105 of which are sited in Veneto, and they have to be controlled and regulated also in the perspective of their environmental liability for environmental damage (Astorri et al., 2015).

Severe problems arise when a continuous and gradual pollution affects the environment that can be due to scarce attention and low level management. In these cases, the definition of the onset and the identification of the liable operator are not easy to determine. A recent example is the pollution of Valle del Chiampo, in the Province of Vicenza. In the town of Trissino is located the fluorine chemistry industry Miteni, which is considered liable of the huge PFAS[1] pollution affecting the area. The pollution involves an aquifer of 160 km^2 (Camera dei Deputati, 2016), that include the provinces of Vicenza, Verona and Padua, mainly affecting the river basin of Agno-Fratta-Gorzone. The situation was highlighted by the analysis conducted on the drinking water, bringing the attention on an important risk for the human health. ARPAV (the Regional Agency for the Environmental Protection of Veneto) identified the source of the pollution in the sewers of the plant and in the drain of the water cooling in the Poscola stream, arriving to the water purifier plant, which is not capable to eliminate these substances. The plant is sited in a high productivity industrial area, where there are also tanneries, but the analyses shown the plant contributes for the 97% in the PFAS pollution arriving to the purifier. Since the first surveys, a series of legal procedures started against Miteni, but any legal penalty has been taken in act yet and since 2014 the plant is working with an AIA authorization (Environmental Integrated Authorization). Miteni installed a series of barriers to stop the flow of pollution in the water, but they are still no sufficient. Analysis and controls continue and limit concentration excesses have been recorded. In May 2016, Miteni presented the remediation program for the contaminated area, but also a great number of measures to preserve the population health will take place, with a substantial cost for the public. Region and public sectors pay a serious attention to Miteni, even today, and the problem is not still solved. The remediation activities have

[1] PFAS is the acronym for Perfluorinated Alkylated Substances. They are persistent organic pollutants, because of their toxicity and long-term persistency in the wildlife and human body and there are many concerns also for their impact on the environment (https://www.regione.veneto.it/web/sanita/pfas).

started in January 2017 and ARPAV has found also waste buried in the Miteni area[2], that could date back also to the previous industrial plant.

These are only few examples of the potential consequences of an environmental damage and the measures to stop these phenomena and to remediate the damage are of great concerns at current time.

The legal system and the insurance and financial guarantees industries are working on these issues, to find a well-working solution to preserve the environment and avoid risky behaviours, both for unexpected and gradual pollution. On the legal side, at the European level, it was established, in 2004, the Environmental Liability Directive (Directive 2004/35/EC), that elects the activity's operators liable for the payment of all remediation and prevention costs related to environmental damage, following the base concept of the "polluter-pays-principle". On the other hand, the insurance companies are working on the creation of solutions that can cover the operator liabilities when accidents occur, avoiding problems of insolvency and promoting safer management of the activities for the protection of environment. The main purpose is to regulate the environmental liability both before and after the occurrence of damage, to ensure the correct implementation of all necessary measures of remediation and restoration of the environment and to promote actions of risk reduction.

1.2 Environmental damage

Environmental damage has different meanings in various legal systems. In the US for example, environmental damage is conceived as "damage for injury to, destruction of, or loss of natural resources, including the reasonable costs of assessing such injury, destruction, or loss"[3]. This definition poses an emphasis on the remediation of damage. In other legal systems, such as those of the Eastern Europe, Caucasus and Central Asia (EECCA), the environmental damage is more focused on the harm inflicted on natural resources, in term of deterioration of environmental quality and exceedance of emissions limits (OECD, 2012).

In the European Union (EU), the definition of the environmental damage as given by the Environmental Liability Directive (ELD) comprises "damage to protected species and natural habitats, which is any damage that has significant adverse effects on reaching or maintaining the favourable conservation status of such habitats or species"[4] (EC, 2004), that are regulated under the Birds Directive (Directive 2009/147/EC) and the Habitats Directive (Council Directive 92/43/EEC). The ELD embraced also the water damage, in relation with the quality status defined in the EU Water Framework Directive (WFD, Directive 2000/60/EC) and the land damage (any contaminated land that can badly affect the human

[2]News and details on the ARPAV website: http://www.arpa.veneto.it/arpavinforma/comunicati-stampa/archivio/comunicati-2017/bonifica-miteni.-trovati-rifiuti-durante-le-attivita2019-previste-dalla-conferenza-dei-servizi

[3] Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Section 107(a)(4)(C) (EPA, 1980).

[4] Article 2(1), Environmental Liability Directive 2004/35/EC.

health). There are some instances of environmental damage that are not covered by the ELD Directive, because already regulated under other legislative pieces. For example, the ELD does not specify marine damage as this is subject of the Marine Strategy Framework Directive (2008/56/EC). Environmental damage caused by "*a natural phenomenon of exceptional, inevitable and irresistible character*" (ELD, Article 4) is exempted from the scope of the Directive. The ELD holds liable both physical and natural, private and public persons. Environmental liability complements, rather than supplants, civil liability, insofar as only damage caused to the environment (i.e. protected species and habitats, water and land) is covered. Consequently, personal injuries, damage to property or economic losses incurred to third parties are not covered by environmental liability, as they are subject to civil liability claims (Mysiak and Pérez-Blanco, 2016).

The EU member states (MS) transposed the environmental damage into national legislations in different ways. In Italy, special provision of the Legislative Decree 152/2006 (also called Environmental Code) transposed the ELD into Italian legislative framework. Therein, the environmental damage is defined as "any significant and measurable, direct or indirect impairment of a natural resource or of its potential for use"[5] (Italian Parliament, 2006), assuming a meaning that is not limited to protected species and habitats.

1.3 Polluter-pays-principle (PPP).

The *polluter-pays principle* (PPP) is one of the fundamental principles in the EU environmental policies. The PPP was included in the Treaty of the European Communities[6] in 1987 and is now part of the Treaty of the Functioning of the European Union (TFEU), article 191(2). Before it was first in the OECD recommendation[7] of 1972 and included in the main principles of the Rio Declaration (1992)[8].

The "polluter-pays principle" promotes the internalization of environmental costs, holding that the polluter should bear all costs related to the recovery of the environment, with regard to the public interest. The preventive function of the PPP is based on the assumption that the operators of hazardous activities are best positioned to reduce the potential pollution and their impacts on natural resource *at the source*, aiming to reduce the costs and to enhance preserving actions. The curative function compels the polluter to cover the pollution (in term

[5] Article 300(2), Italian Legislative Decree No 152/2006.

[6] The polluters-pay-principle was included in the Treaty Establishing the European Economic Community by Single European Act as the article 135r

[7]OECD Recommendation, 26th May 1972, C (72) 128: *"The polluter should bear the expenses of carrying out the [pollution prevention and control] measures decided by public authorities to ensure that the environment is in an acceptable state. In other words, the cost of these measures should be reflected in the cost of goods and services which cause pollution in production and/or consumption. Such measures should not be accompanied by subsidies that would create significant distortions in international trade and investment"*(OECD, 1972).

[8]Principle 16, Rio Declaration, 1992: *"National authorities should endeavour to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment"*(UN, 1992).

of prevention and control measures) and the clean-up costs. Implementation of PPP is pursued by regulation (licensing procedures, prohibitions, emission limit values, administrative orders and sanctions), market based instruments (tradable permits, eco-taxes, liability rules), and soft law (voluntary agreements, labelling and environmental management system).

1.4 Normative review

1.4.1 Environmental Liability Directive

The Environmental Liability Directive (ELD; Directive 2004/35/EC) established a common framework on environmental liability with regard to the prevention and the remediation of environmental damage, based on the "polluters-pays principle".

The ELD entered into force on 30 April 2004 and required the Member States to transpose the provisions into national laws by 30 April 2007. Member States were left the discretion to impose stricter liability regulations. The transposing of the Directive varied among the MS, it was a slow process and the implementation of the Directive across the EU was only completed in July 2010.

The Directive requires preventive measures to avoid damage, and remediation measures to reinstate the damaged environment through:

- Primary remediation: return to the original or baseline conditions of the environment.
- Complementary remediation: compensation measures conducted elsewhere, when primary remediation does not result in a full restoration of damages.
- Compensatory remediation: compensation for "interim losses" (losses that impede the performance of ecological services of damaged natural resources), until the environment is fully restored.

It confers the financial liability of the measures needed to restore and prevent an environmental damage to the operator responsible of the occupational activity that caused such a damage. The occupational activities involved in the Directive include all that activities which present a risk for human health and the environment and they are listed in the Directive's Annex III.

There are two types of liabilities provided in the Directive: strict and fault based. The strict liability applies to the imminent threat of environmental damage caused by occupational activities indicated in the Directive and covers damages to all natural resources. The fault based liability, instead, regards operators that cause an environmental damage through a deliberate act, negligence or fault and applies to non-Annex III activities, which damage biodiversity, not water or land.

The implementation of ELD is due to the competent authority designated by Member States. When an imminent threat or actual, environmental damage occurs, the competent authority has the duty to find the liable operator, to evaluate the entity of damage and to identify the necessary measures to restore or prevent this damage. Confirmed the responsibility of

operator, he must pay all costs related to the recovery of damage, included the evaluation costs and the legal, administrative and implementation expenses. If the operator cannot be found or he has no the duty to pay, the competent authority has the faculty to bear the implementation of these measures. To avoid the latter situation, the Directive encourages the MS to develop financial security instruments and markets, including tools to manage the insolvency of operators, with the aim of leading the operators to use financial guarantees to cover their responsibilities.

1.4.2 ELD: The financial security

In relation to the financial security, the Environmental Liability Directive, in the article 14(2), requires to the Commission, before 30 April 2010, "a report on the effectiveness of the Directive in terms of actual remediation of environmental damages, on the availability at reasonable costs and on conditions of insurance and other types of financial security for the activities covered by Annex III" (EC, 2004), which examines different aspects related to the financial guarantees, in particular the application of a gradual approach, a maximal ceiling and the exclusion of low-risk activities, to evaluate the proposal of a harmonised mandatory financial security in the Member States.

The application of ELD was very different among the MS, also in the field of financial guarantees and it was attribute to the diverse degree of knowledge, to the available instruments and existing financial products at a national level. Only eight States in EU introduced a mandatory system of financial guarantee.

Generally, the insurance markets gave positive answers to the ELD provisions, starting to study and develop specific products and solutions for the environmental liability defined by the Directive. On the other hand, instead, business and industrial sectors pointed out a lacking knowledge about the ELD, especially by the small and medium sized enterprises. They ignore their duty and their liability, derived from the ELD, towards the environment and they have no adequate insurance cover to protect them. Those who are aware about the Directive and their responsibility have subscribed to insurance themselves and their activities for environmental damages.

The 2010 EC Report (EC, 2010) analysed the financial guarantee tools direct to the ELD, that exist and have a major diffusion. Insurance is the most popular instruments, also because the most of ELD liabilities can be covered by extensions of traditional insurance tools, like General Third Part Liability or Environmental Impairment Liability. Insurance are followed by bank guarantees and other Market Based Instruments, such as funds and bonds. There are no products that include progressive environmental damage and compensatory remediation covers.

According to the analysis of the short implementation period of the Directive, the European Commission considers inappropriate submit a mandatory financial security at an EU-wide level, given the deviation in the ELD implementation among the MS and the nonexistence of a full working financial system, also where a mandatory financial security exists.

It is hypothesized that, to achieve the application of the mandatory financial security system

in an easy way, it should be based on a gradual approach, accompanied by the exclusion of low-risk activities and the definition of ceiling for the financial guarantees. A gradual approach envisages a slow release of financial security for different kind of risk and activities covered. The definition of a price ceiling is necessary, because of any insurance company will provide unlimited liability. The maximum price should depend on the size, the frequency and the entity of the estimated damage, and it should be prized where the likelihood that a damage occurring above the ceiling threshold is low. The low-risk activities, which could be excluded from a mandatory financial security system, are those with a low potential of environmental damage and with an EMAS or ISO environmental management system. Anyway, stakeholders and expertise raised some doubts on these approaches and on the entire system, there is no a common working strategy or view, and it results still difficult suppose the introduction of a mandatory financial security system in the EU, also referring to this 3-step process.

The European Commission (EC) conducted other studies on the effectiveness of the Directive, as required by the Article 18(2), presenting a representative document on the experience gained in the application of Directive in 2014.

From the second EC Report of 2014 (EC, 2016b) emerged that a small increase in the amount of environmental insurance coverage occurred, especially for the high risk sectors, but there is still a too low demand from operators and their insolvency is still a problem. The Report highlights a big lack of data related to the environmental damage and to the insurance markets coverage, that lead to confirm the conclusions presented in the 2010 EC Report.

The REFIT of Environmental Liability Directive (EC, 2016a) reports any new element on the financial security themes. The lack of data and of a well-built financial scheme, the opposition and the doubts of stakeholders and expertise bring still to prefer a tailor-made solution at national level. At the present time, it is popular opinion, indeed, that one size insurance market does not fit at all at EU level (BIO Intelligence Service, 2012).

The European Commission, following the aforementioned studies and the “Green Paper on the insurance of natural and man-made disasters” (EC, 2013a), has taken any successive provisions in term of harmonised mandatory financial security system for environmental liability. It requests more data end experience to gain this common objective on EU-wide level.

On different level, some recommendations to achieve this purpose have been made: the alignment of ELD implementation among the Member States, a closer dialogue between the national and European competent authorities, the creation of a database on environmental damage cases and liabilities, guidelines for the evaluation and quantification of environmental damages, a deeper analysis of available financial instruments and training programs for the key users. These are only few of the possible tools suggested and that may be a starting point for new studies on the ELD financial security.

1.4.3 EU Funds for Environmental Damage

European Union Industrial Disaster Risk-Sharing Facility

After the large industrial accidents of Kolontàr, Hungary purposed to establish an "European Union Industrial Disaster Risk-Sharing Facility", funded by annual contribution from industries (BIO Intelligence Service, 2012). The proposed aim of the fund is to respond quickly to major industrial accidents that exceed 100 million, in order to remediate immediately to the environmental damage and help harmed people involved. The fund should limit the financial exposure of liable companies to a defined financial threshold, providing financial resource in form of grants and loans, and it would complement private insurance cover. The fund would solve the insolvency problems related to the major industrial accidents and, at the same time, protect employees and people that might be affected by the incidents. The EU member states could have some advantages, as well, because they have no to bear the costs of remediation, in case of insolvency.

The proposal raised some concerns. Likely, the proposed Fund would collide with the provisions of ELD and the polluter-pays principle, and may induce moral hazard. The financial system operators could reduce the standards of risk assessment and management, avoiding precautionary actions to protect the environment. Negative opinions were received also from the concerned industries. As a result, the proposal was dismissed as not necessary, given there is any evidence that the currently available financial security instruments are insufficient. The private insurance sector is well experienced in risk assessment, risk transfer and claims management and it can achieve a better position to cover industrial accident damage.

The EU Solidarity Fund

In the European Union (EU), there are examples of funds providing financial support to environmental restoration efforts. The EU Solidarity Fund (EUSF) is one of those. Established primarily for solidarity assistance to countries hit by a natural disaster, the effects of 'man-made' disasters are also eligible if they occur as a direct consequence of a natural disaster. The solidarity aid is provided in emergency situations in which severe repercussion on the living conditions, the natural environment and the economy of one or more regions in the EU. Its principal aim is to show solidarity with the people of the region concerned the damage. It was established in the 2002 and it has been activated around 70 times. It provides monetary resource in term of grants to the country affected by the direct damage for the immediate restoration of infrastructures, the provision of temporary accommodation for the population involved, to restore the damaged areas. The triggers of the aid are specified as follow: (i) major disasters occur when direct damage is over EUR 3 000 000 000 in the 2011 prices or more of 0,6% of national GNI[9]; (ii) or for regional disasters, i.e. when a direct damage exceeds 1,5% of regional GDP. The annual ceiling of the Fund amounts to a maximum of EUR 500 million (EU, 2016).

[9] Article 2(2), Council Regulation No. 2012/2002(EC, 2002).

The International Oil Pollution Compensation Funds

The International Oil Pollution Compensation Funds (IOPC Funds) provides financial compensation for damage caused by oil pollution from oil tanker spills. They comprise the 1992 Fund and the Supplementary Fund Protocol. The former fund was established in the context of International Convention on Civil Liability for Oil Pollution Damage (hereafter Civil Liability Convention, CLC) and the International Fund for Compensation for Oil Pollution (Fund Convention), after some major incidents of oil spill brought the attention on the necessary of a regime for compensation for victims of oil pollution. The latter fund was adopted in 2003, in the aftermath of the Erika and Prestige incidents[10], making available additional compensations for oil pollution damages over and above the 1992 Fund. The compensation is available to the more than 100 member states – signatory parties of the underlying international conventions. The Funds are financed by entities that receive oil by sea transport and the contributions are based on the annual quantity of the transported oil. The Funds are in force in over 100 countries all over the world and they have been involved in 149 incidents, since their establishment[11].

1.4.4 Italian Legislation

In Italy, the ELD was transposed in 2006 integrating it in the existing environmental legislations at the national level (Law 349/1986). This process brought to the establishment of additional provisions in the Italian law above the ELD: Legislative Decree No 152/2006 (known as "Environmental Code"), Title II part VI (Italian legislation transposing the ELD), and Title III part VI (Provisions on compensation for environmental damage) and part IV (Provisions on the remediation of contaminated sites). The result is a more extensive regulation, especially referring to the environmental damage definition and to the occupational activities involved.

The Italian regulation defines the environmental damage as follow: "any significant and measurable, direct or indirect impairment of a natural resource or of its potential for use"[12] (Italian Parliament, 2006). Henceforth, it is not limited to protected species and habitats but applies "polluter-pays principle" to a broader range of damage instances. As for the environmental damage, the LD 152/2006 includes a broader concept of occupational activities than in the ELD Annex III, and introduces a more general liability attributable to those holding responsibilities for the environmental damage. The operator's definition is as following: "any natural or legal, private or public person who operates or controls the

[10] The Erika incident take place in December 1999 and it saw the break of a tanker of fuel oil and the spill of 20000 tonnes of this fuel in the Bay of Biscay (France), resulting in the pollution of a 400 km stretch of France's Atlantic coast. The Prestige incident occurred in the Galician coast of Spain in 2002 and the break-up and the sinking released over 63000 tonnes of fuel polluting over 1300 km of Spain coastline (Luoma, 2009).

[11] According to the IOPC Funds website (http://www.iopcfunds.org/about-us/) and the explanatory note document "The international regime for compensation for oil pollution damage" (IOPC FUNDS, 2017), available on the IOPC Funds website (http://www.iopcfunds.org/fileadmin/IOPC_Upload/Downloads/English/explanatory_note.pdf).

[12] Article 300(2), Legislative Decree No 152/2006 and following modifications.

occupational activity having environmental relevance, or to whom decisive economic power over the technical functioning of such an activity has been delegated, including the holder of a permit or authorisation for such an activity"[13] (Italian Parliament, 2006).

The Italian Law defines two types of environmental liability: (i) a strict liability related to the remediation measures, that considers the operator liable when the pollution occurs and imposes an obligation to recover soil and water; and (ii) a subjective liability for the environmental damage of soil, water and protected species related to the European Directive, based on fault and negligence.

The Environmental Code includes also provisions related to environmental crimes. These are mainly based on violation not included in the Italian criminal Code, and they are differently regulated in relation to the different environmental compartment. Nevertheless, on 22 may of 2015 the Italian Parliament adopted a new law on crime on environment, included in the Criminal Code (Law No 68, Book II, Title VI-bis, art. 452-bis to 452-terdecies). This law rules environmental pollution, environmental disaster, trade and abandonment of radioactive material, control impediment and omitted restoration as penal crime, with monetary sanctions and detention.

The article 308 of the Legislative Decree (LD) No 152/2006 mandates the Ministry of the Environment the authority to recover from the operator the costs of prevention or restoration measures, also through guarantees over property or specific financial guarantees (guarantee on demand). According to the ELD's article 14, the article 318 of the Italian Code adopts measures to define suitable financial guarantees and to develop instruments that operators can use to cover liability. The Code does not make any obligation for these guarantees at the national level, as general rule. The legislation requests a general financial guarantee only to the waste disposal and treatment activities[14]. In particular, a financial guarantee is required for the registration to the "Albo dei Gestori Ambientali" (Bar of Environmental Managers). The registration to this bar is mandatory for the businesses that collect and transport waste, conduct trade and brokerage activities of waste produced by third-party[15] and the businesses running remediation activities[16]. The procedure and the amount have been defined only later, with the Ministerial Decree of 22 June 2011, which defined different costs for different categories of activity. The Environmental Code requires a financial guarantee for the activities working with an "Autorizzazione Integrata Ambientale (AIA)" (Environmental Integrated Authorization). They must present the guarantee to the competent Region 12 months after having issued the authorization, to cover the restoration measures, at the suspension of the activity, of a potential pollution caused by the authorised activity[17]. The procedures and amount of money required have been established only this

[13] Article 302(4), Legislative Decree No 152/2006 and following modifications.

[14] Article 208, Legislative Decree 152/2006 and following modifications.

[15] Article 212(10), Legislative Decree 152/2006 and following modifications.

[16] Article 212(11), Legislative Decree 152/2006 and following modifications.

[17] Article 29-sexies(9-septies), Legislative Decree 152/2006 and following modifications.

year with the Ministerial Decree 141 of 26 May 2016.

These guarantees are reduced when the businesses are certified with environmental label EMAS (EC 76/2001) and UN ISO 14001, respectively by the 50% and the 40%, as defined in the LD 152/2006.

Concerning these guarantees, only Veneto Region has a stricter and more regulated legislation. It is necessary for the waste disposal companies, over the surety policy, have an insurance pollution policy. It will be discussed in more detail in the Chapter 4.

Even prevention and remediation actions have been defined in the Italian law, that need specific technical evaluation to determine the best implementable actions case by case, accompanied by a cost evaluation.

However, the identification and the implementation of these measures meet some difficulties in the institutional and financial level. Coordination is necessary between different competent authorities, which control the different required actions, slowing down the restoration process and increasing the implementation costs. The amount that the States collects for the remediation measures is paid into a special fund (Rotation Fund) dedicated to different environmental actions[18].

In light of these facts, Italy requested more support from the EU, asking for the identification of specific tools to deal with the EDL provisions, such as a close dialog between the different authorities involved, a database on the environmental liability cases occurred, guidelines to support the damage evaluation and the relative measures of restoration, an analysis of the financial security available on a community level (EC, 2013b).

1.5 Scope and structure of the thesis.

The main aim of this thesis is to explore the capability and prerequisites of economic and financial instruments to reduce and/or hedge against the unintentional (or accidental) environmental harm. It covers both the instruments serving as a back-up (e.g. financial guarantees) for remedy and restoration, as well as instruments that encourage risk transfer (e.g. insurance) and reduction. To this end, I analyse what instruments are already available in Italy, or could be introduced based on a positive experience from elsewhere. I pursue a top-down approach, starting with a general-level analysis and examine then the implications in specific cases of study. First, I make an inventory of the existing economic, financial and fiscal instruments that are or could be applied to manage the environmental risks. Second, I address the effectiveness of the insurance solutions, based on interviews with financial and insurance companies. Based on my analysis I suggest potential improvement and opportunities of their better use. Third, I examine selected instruments, especially financial guarantees and insurance, and their application focusing on their application in the management of waste and harmful substances. My study focusses on the Veneto region and especially the Venice metropolitan area. Finally, all the evidence collected is summarized in

[18] Article 317(5), Legislative Decree 152/2006 and following modifications.

key recommendations meant to improve the use of economic and financial instruments to manage environmental risks.

2. FINANCIAL INSTRUMENTS AVAILABLE FOR ENVIRONMENTAL RISKS AND DAMAGE

2.1 Introduction and structure of the chapter.

Many environmental resources and ecosystem services (e.g. water purification or climate regulation) are public goods, that is goods that are both non-excludable and non-rivalrous. Environmental harm caused by industrial production such as water, air and soil pollution are external cost of production, largely explored in economic and legal science literature. External costs or externalities in general are costs resulting from the production or consumption actions taken by an economic agent, influencing the producer's costs or consumer's utility of another agent, without any compensations. The effects arising are considered as unintended by-product due to involuntary exchange interactions and they could positively or negatively affect the parties. Internalisation of these costs constitutes an incentive for a better risk prevention and management, and minimization of potential future losses. Environmental regulation and taxation are conventional instruments in this regard, and so is environmental liability. These instruments can work *ex ante*, hence before the harm is materialised or aiming at reducing the possibility that a damage occurs, for examples through some economic incentives, or *ex post*, hence covering and bearing restoration costs of pollution damage, implementing the polluter-pays-principle. This second solution can be reached and supported by the operators through different economic and financial instruments.

In this chapter, I review and discuss various economic and financial instruments that can be deployed to underpin environmental damage and liability, and, at the same time, to reduce the environmental risks. In section 2.2, I explain the potential industrial approach to the risk management strategy, allocating the more suitable instruments to different risk levels. In section 2.3, I focus on instruments that are or may be applied for financing the recovery and reparation, such as financial guarantees, risk transfer and ex-ante fiscal instruments.

Economic instruments are those that encourage better practice in the enterprises to include costs and benefits in their budget. They are based on policy and management approaches to promote better behaviour, giving positive signals on the market. Their main aim is the potential change in the behaviours of the users. The fiscal instruments are part of economic instruments that use incentives and subsidies to change the actions of companies. Financial instruments, instead, consider solely the flow of money, incomes and outcomes to support the activities and cover expenses and investments needed to the manage specific situations.

2.2 Financing risk and risk layering

Industrial operators are liable for environmental damage to the extent explained in the chapter 1. A comprehensive risk management and financing strategy is based on thorough assessment of risks exposure, identification of financial liabilities, and analysis of the cost-effective reduction of risk (Poole, 2014). Typically, industrial operators choose their strategy in relation to hazard (environmental harm) probability and magnitude of impact. Risk

layering means pairing the suitability of different instruments with level of risk and risk-bearing capacity (Mechler et al., 2014). For low-probability/low-impact risks (also called extensive risk according to a conventional terminology), companies typically decide to retain the risk or manage it through financial guarantees, deposits and funds. For higher level of risks, a better option is to choose a more articulated financial protection such as transferring the risk to insurer, in exchange for monetary compensation known as a premium, or to capital markets. Fiscal instruments, such as taxes, taxes incentives and certifications, are incentives for ex-ante risk prevention that reduce the need for financial protection as shown in Figure 2.1.

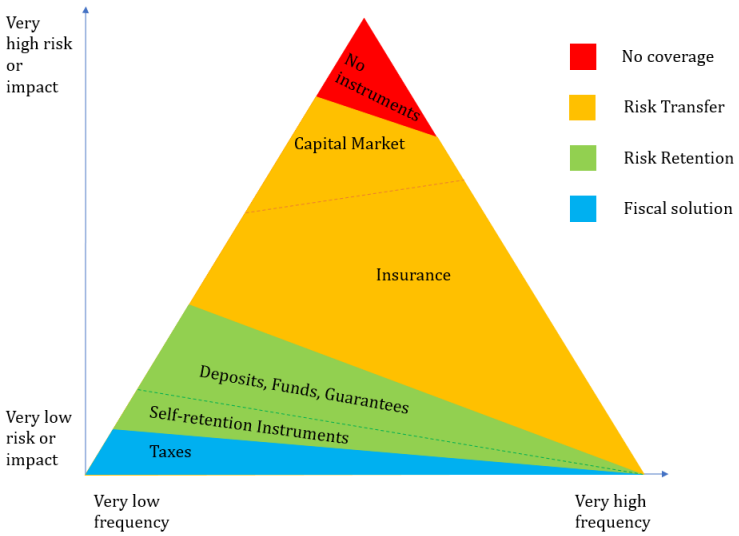


Figure 2.1 - Risk layering strategy. Allocation of financial instruments based on risk magnitude and frequency.

Very low probability risks are typically not covered even by a thorough financial strategy. In some cases, the liability is limited by regulation, as in the case of ELD. The Directive establishes some liability exceptions for damage characterized by very low probability and very high impacts, like, for example, damage caused by extreme and unpredictable natural phenomenon. The very low probability/very high impacts type of events undermine the financial viability of the businesses. Companies should develop strategies to extend the boundaries within which the different instruments operate in cost effective way. Governments also play an important role, to regulate and include all levels of risks in the legislations, developing new provisions, guidelines and instruments to administrate also the higher and unpredictable risks (OECD, 2003)

2.3 Financial instruments.

2.3.1 Risk retention instruments

Various instruments exist as a back-up for financing restoration and remediation of environmental harm (Poole, 2014). Typically, they entail accumulation of financial reserves for the case environmental damage occurs and is attributable to the operation of the

businesses held liable. They include different types of instruments which all serve the same purpose: ensuring financial security and adequate environmental remedy even in cases when the liability claims exceed the financial capacity of the liable party.

A most common instrument is a **financial guarantee**. The main purpose is giving a guarantee for the obligation of another person or company to settle their liability. Hence, the financial guarantees involve three actors: giver of a guarantee (bank or insurance company) is the guarantor, the person to whom the guarantee is given (the competent authority) is the creditor or the oblige, and the person whose payment is secured (the company) is the obligor or the principal. The mechanism of surety is based on the provision of a monetary guarantee for activities that can lead to potential harmful consequences, from a qualified institute to competent institutions that authorised the activities. It is a contract that protects the third party by means of periodic payments, not unlike insurance premiums, from the company to the bank, that supports the promise of industry obligation. If a damage occurs, the bank pays for the losses, but the liability for the damage relapses on the industry itself and the bank recovers the costs from the industry. The bank or the guarantor institution can ask for an immobilized deposit of money as a financial security for the future damage claims, in order to secure its interests.

With the function of guarantee industries can resort to **funds**, where they deposit a sum of money to assure their ability to pay in case of damage. The funds can be financed by the industries to institutions or governments as a guarantee for the responsibility of industrial actions by the liable operators. A guarantee fund aims to protect the creditor against debtor's insolvency, without benefit the liable party (Bocken 2002). The compensation submits to the condition of tort law.

In the perspective of establishing a fund to recover accidental losses, the industries can resort to another solution. A company can make an ***ex-ante*** **deposit** to deal with the potential future losses, it can periodically store an amount of money to afford unexpected outlay due to a defined risk. In this way, the industry blocks a part of its capital, managing the risk by itself. These deposits need to be regulated to work properly and to avoid bad behaviour. Rules are required to assure the availability of money when a damage occurs, they have to establish regulations for the use of those funds in the correct way and for the defined purpose, in order to avoid potential insolvency problems. They could need guarantees to be applied correctly, so industries can combine these financial instruments to have a complete risk coverage.

The financial instruments described can help the industries dealing also with environmental risks. In the management of their activities they must build up strategies to reduced environmental risks and to afford potential damage, as mentioned above. These instruments allow the settlement of industrial activities, accounting part of the budget to the environmental protection. Guarantees for environmental damage are requested mandatory in specific category of industries. At the same time, they could be a security instruments for the payment of future potential damage and an instrument to incentive better practice. They have an incentive function for environmental protection also giving premium reduction if

the industry has environmental certifications. These instruments help the environmental liability regulation, according to the polluter pays principle.

The ex-ante deposits are voluntary instruments that permit to the industry to store money to recover environmental damage. As the guarantees, they could be an incentive for the industry to achieve a safer management of the activities, in order to avoid potential environmental damage and lose the money stored.

Deposits, guarantees and funds can be used in combination to have a more complete economic security against damage, if it is regulated in the correct way. It is necessary a supervision or regulation for the fate and the future potential use of these reserves of money, to assure they will be used for the defined scope.

They are frequently used to bear the remediation and clean-up measures requested after the occurrence of environmental damage.

The use of these instruments in environmental field create some problems related to the high uncertainty of environmental risks. The difficult calculation of potential losses, the amount of potential damage, their frequency, the remediation costs prevent a correct calculation of the guarantee or deposit needed. These difficulties are connected to the lack of historical data of environmental damage.

Box 2.1 – Environmental Financial Instruments: some examples

Financial Guarantee

According to the ELD indications, the Spanish government implemented a mandatory financial guarantee system through the Law 26/2007. The Spanish Law listed the operators that require a mandatory financial guarantee to cover their environmental liability and recover the damage. The guarantee covers unlimited liability of operators for any damage to people, property and environment. There are three different options to establish a guarantee: insurance companies, bank bonds, and the constitution of technical reserve allocated in *ad hoc* fund, financed though financial investment backed by the public sector. The maximum amount of the guarantees is fixed between 300 thousand and 20 million Euros, depending on the potential damage. The guarantee is defined in each case by the authorities, considering the potential risks and their magnitude(Pedraza et al., 2004).

Guarantee Funds

The Mining Guarantee Fund was established in the Netherlands with the purpose to cover damage when the operator is insolvent or the activity is ceased and it cannot be compensated in any other way. The levies on the mineral production finance the fund. A similar fund exists also in Belgium, the Belgian Coal Mine Guarantee Fund. It is financed by levies as well, but it is divided in two parts. Part of the levies is deposited in the fund A, with separate accounts for each involved company. The collected levies from account A can be paid back to the company fifteen years after the cessation of the company's operations. The other part of levies is deposited in the fund B, which is essentially a collective fund that covers the remediation costs in case of insolvency (Bocken, 2002).

2.3.2 Risk transfer instruments

Risk transfer involves the shifting of risk to others and it is the base mechanism of insurance products. The **insurance** is a finance instrument that aims to manage the risk, transferring

it, or part of it, from one actor (the insured) to another (the insurer), who takes it in exchange for an amount of money (the premium), with the aim to not be exposed to uncertain future losses. The insurance can properly manage the risk when an actor's willing to pay to transfer the risk to someone else is higher than the value of the actual risk, that means the actor is risk averse. The insurance company, instead, has to be risk neutral to success in its work and have profitable solutions, therefore it has to collect and "pool together a rather large number of homogeneous but independent risks" (Monti, 2002), leading to the reduction of uncertainty through the law of large number. To manage the risk properly, the insurers need to assess the risk through statistical analysis, create a risk pool of different class of risk to distribute the losses of the insured among a wide group of them, set the right premium to bear the future losses.

It could happen that the magnitude of losses increases too much and the insurance company cannot bear the costs anymore. So, to avoid this situation, the insurer can address to coinsurance or reinsurance companies. These kinds of companies undertake part of the insurer risk in exchange for a premium as well, undertaking part of the risk.

The evaluation of risks and the prerequisite to be the risks insurable have the same basis in all insurance mechanisms. According with the Swiss Re report "Insuring environmental damage in European Union" (Busenhart et al., 2007) the four key criteria for the insurability are:

- Assessability: the insurer must have the possibility to quantify probability and severity of a possible damage, in order to calculate the appropriate amount of the premium.
- Randomness: accidental events and the time at which the damage occurs must be unpredictable.
- Mutually: the insurer has to collect and pool together to bear similar risks and hazards.
- Economic Viability: insurance company has to charge a premium proportionate with the risk accepted and it has to be profitable over the time.

The most important condition is the quantification of risk through probabilistic and statistical information on the occurrence of damage and the possible related losses in order to evaluate the premium for the insured and the feasibility for the insurance company. To conduct successful business the insurance company has to take into account different costs and different needs, looking at the authorities, the policyholders and the investors. So it has to manage with the uncertainty of the risk, because "the greater the uncertainty with regard to expected losses, the greater the capital requirements to cover this uncertainty" (Busenhart et al., 2007). The definition of the actual value of the risk is based on historical data related to the occurrence of such events and it is calculated "by discounting the magnitude of the loss by the probability of its occurrence" (R=PxL)(Monti, 2002).

The mechanism described until here is related to the so called third party liability, that is when the insured has to compensate a third party affected by the damage.

Other types of insurance exist and they are based on the same general insurance rules, but

they provide a different system of coverage for the insured party.

The **first-party insurance** is an alternative to the traditional insurance, it is a kind of insurance coverage where the insurer compensate the victim of a damage (Faure, 2001). The insured person has direct claims against the insurance company if he suffers for a damage covered by the policy (Bergkamp, 2001). The base principle of the first-party insurance is that the insurer pays the harmed party when the damage occurs, proving that the damage has been caused by the insured risk. Hence, under this policy, the insurer covers directly the victim.

The first-party insurance is financed by the victim itself, paying usually an amount of money lower than the full compensation sum (Faure and Grimeaud, 2000). It is a different type of insurance, but the basic procedures and the fundamental criteria defined above for the evaluation of risk and premiums, are still valid.

The insurance company can provide also other instruments like the **finite risk products**, based on the transfer of financial liabilities related to a damage from a legally responsible party to a professional risk carrier. They are a form of reinsurance that take into consideration the time value of money. An example of finite risks products is represented by the Loss Portfolio Transfer (LPT) agreements, that are used to convert future liabilities to a fixed price related to the present-day values[19]. In this last case, the insurer takes the responsibility directly for the payment of liability of a risk in the future (OECD, 2003). It is a retrospective form of re-insurance, for which the policyholder pays a premium calculate on the net present value of the claims, including a charge for the administrative expenses, risk capital and profits.

Industries can finance **funds** also in an insurance perspective. They can allocate a sum of money to these funds, established by national institutions or government for different kind of risks, in order to increase their capacity to compensate potential damage sharing the risk with other industries. These funds pay for the remediation of damage or part of it, according to the money invested by the single industries. Similar to these funds, governments or international institutions can establish **risk sharing agreements** to face with high uncertainty risks. They are based on a collective responsibility, which involves all the members to share the responsibility and cover the damage. These agreements need to be well-regulated and could be required to the members a preventive measure of security to be part of the group.

Another transferring risk option is represented by the **bonds**, that move the risk to the capital market. They can be a viable solution when the potential risks increase and the retention or the insurance of these risks become too expensive for the companies. Bonds work as an investment for the enterprises that bought them. The industries bet on the risk buying these bonds, that could give them extra yields, if the risk does not occur. They are debt security instruments, through that the issuer has a debt with the holder, who is obliged

[19] The present-day value corresponds to a financial formula that identify the potential investment income generate by the premium.

to pay him interests. The amount of money derived from the market of bonds are used as fund to recover the potential losses related to the risk or, in absence of damage, to pay the interests.

Risk transfer instruments are widely used also to deal with environmental damage.

To insure the environmental damage, according to ELD regime, the insurance industry must defined the coverage address and its scale (Busenhart et al., 2007). They have to identify and assess the damage, including its significance and severity. To do that is necessary evaluate the conditions prior the adverse event of the resources, the so called "baseline condition", establishing type, quality and ecological function of the resources. The ecological function is important for a better assessment of the damage and effects on that resource. The severity of damage is a fundamental prerequisite to determine the liability for the damage to the environment and it can be measured taking into account the characteristics of impacts (degree, extent and duration), the sensitivity and rarity of resources involved, environmental standards to define acceptable and unacceptable limits (Busenhart et al., 2007).

As aforementioned, also to insurer environmental liability the criteria of insurability are requested to make possible the quantification of the risk and the severity of damage, the possible causes and the types. But regarding the environmental risks some problems arises. The most important difficulty met in this field is the lack of data available about previously harmful events or losses and about the potential adverse effect on the natural resources.

To define risks and related premiums the traditional insurance uses statistical tools and approaches based on the probability of the occurrence of an accident, that cannot be used in the environmental insurance because there are not this kind of historical data. The insurance industry has to develop new methods to determine the elements necessary to the calculation of premiums. When frequency, severity and magnitude are unknown, an alternative is the generation of loss scenarios based on process analysis and models (process description, derivation of process hazard, identification of hazardous substances, development of incident scenarios, description of the effects, quantification of resulting costs), considering also geographical information and possible propagation patterns for dangerous substances (Busenhart et al., 2007).

Other difficulties present for the insurance companies about the environmental risks concerns its generalized uncertainty, which might undermine the insurer's ability to properly evaluate and assess the risk ex ante, and the informational asymmetries, that can generate distortions and agency problems. This can lead to adverse selection, that could occur in the setting of environmental insurance when the risk undertaken is not classified in the correct way by the insurer, and to moral hazard phenomena, that is a wrong perception of the insurance as a license to pollute by the industry owners. Regarding the uncertainty, the difficulties arise especially for the gradual pollution incidents and involve both factual and legal uncertainty. The first one refers to the knowledge about the event occurred, it includes difficulties to determine the beginning, the duration and the long-term effects of the pollution and it regards the damaging effects of new technologies and substances introduced, as well. The legal uncertainty, instead is linked to the generalized uncertainty

introduced by the legal system itself and depends on the way in which those rules are interpreted and applied by legal actors. The choices made by law and policy makers greatly affected the insurability of a risk (Monti, 2002).

To respond to the problematic features of environmental risk, the insurance industry tried to develop new techniques. According to the new environmental regime, the insurer should be more involved in the management of the risk, enhancing the knowledge and technical abilities to properly act on risk features. The modern environmental insurance mechanism has now a new phase, placed before the transfer of risk: the "risk remodeling" (Monti, 2002). The coverage for environmental damage is provided only a site-specific basis, therefore the transferring of the risk might be carefully evaluated and classified. This new procedure provides for an inspection of the industry plant by qualified engineers part of the insurance company and when the risk is assessed the insurer and the insured continue to cooperate for the reduction of risk and for the improvement of loss prevention strategies. The coverage is tailored on customer needs focused on specific types of environmental risks, that can have adverse effects both on-site and off-site, and it is set up on a long-term basis, after this new phase, even it has time limitation of claims made and manifestation or discovery formulas. A close relationship between the insurer and the insured is needed in this kind of coverage, because the insurer has to monitor the insured, during the contractual period, to evaluate possible incentives, rewarding investments in precautions and safety devices through annual premium amount reduction.

The operators of dangerous industrial activities are the key target of environmental insurance market under the new liability regime, in which they are liable of any damage caused and they have to bear all the clean-up, third-party compensation and litigation costs. There are other private parties interested in environmental insurance solutions, being involved in environmental liability scheme. They can be contractors engaged in construction, transportation, contaminated site cleanup, or consulting firms advising for industry, or professional environmental advisors (Demidova, 2004).

The different insurance instruments and policies mentioned above can be applied for the management of the environmental damage.

For the environmental sphere the first party insurance can be considered from two different point of view: as a pure first-party insurance where the operators or citizens stipulate a coverage for a damage it may harm themselves; or as direct insurance, where the potential polluter would cover himself and third parties suffering damage resulted from his site. In this latter case the potential policyholder is not the victim, but the injurer, and the coverage compensate the only existence of damage, not the liability (Faure, 2001).

The use of the first-party policy is increasing in the environmental insurance world and according to the Report "Environmental damage insurance in theory and practice"(Faure, 2001) the environmental risks could be better insurable on the first-party basis. In particular, this avoid problems of adverse selection and risk differentiation. It is "easier to control and assess ex ante the risk that a particular victim would suffer damage instead of assessing the risk that his insured potential injurer would cause harm to a third party and

would thus be found liable" (Faure, 2001). In this case, there are less uncertainties that lead to have an easier risk differentiation. Another advantage of this kind of policies is that the liability is no more a requirement to claim on the coverage, even it must be clearly described which kind of damage is covered.

At the same time arguments against the first-party insurance exist, because it can create misunderstanding among the insured, that can consider it as a "license to pollute", and it could contradict the "polluter-pays-principle" at the base of the ELD regime. The polluters could pay less attention to the protection of the environment and not invest in safer performance of their activities (Demidova, 2004).

The other insurance products presented might be useful in a contest of cleanup and remediation measures for contaminated sites.

The funds and the risk sharing agreements are based on the same principle of environmental insurance, but they involve more and bigger industries and deal with higher risks. For example, they are used to insure nuclear power plants and potential oil spill contamination.

Also, bonds can find a useful role in the management of the environmental damage. They are widely used as catastrophe bonds o performance bonds. Industry invest in these bonds and they can require the money to restore the environment when a damage occur, but if they are virtuous, improving their environmental strategies and security, they can earn form this investment.

Box 2.2 - Environmental risk transfer instruments: some examples

Insurance

The Dutch Milieuschadeverzekering is an environmental damage insurance which provides coverage for the clean-up costs on an insured site and adjacent areas, for a damage event originated on the insured site. It is a claim made policy, that means it cover damage occurred during the insured period, and it does not cover the civil liability of the insured. It pays for the clean-up operation and for the potential damage and restoration related to these operations. At the same time the policy covers also property damage resulting from a soil and water pollution on the insured site or from the cleanup operation on a third-party property (Bocken, 2002).

Direct Insurance/First Party Insurance

The Swedish Environmental Damages Insurances (EDI) is a compulsory insurance that compensate an unnamed third party when the liable party is insolvent or when the source of damage is unknown. It is not a liability insurance, it does not provide coverage for the insured himself. The scheme is divided in two parties: environmental insurance (EIL) which provides compensation of damage according to the environmental code, and Clean-up Insurance (CUL) which covers the clean-up measures of soils as requested by the authorities. A similar insurance coverage exists in Finland (Bocken, 2002).

Funds

The Klärschlamm-Entschädigungsfonds was established in Germany in 1999 to compensate damage associated with the use of sewage sludge in agriculture. The use of the sewage sludge is authorized by the German Act on Fertilizes. The Fund is managed by the Federal Office of Agriculture and Food (BLE) and is financed by a levy on the price of sludge for agricultural use (Bocken, 2002). The farmers who sustained damage (for example from residual polluters contained in the sludge) take legal action to receive a compensation.

Risk Sharing Agreements

The P&I Clubs (Protection and Indemnity Clubs) is an international risk sharing agreements involving tanker owner of 13 clubs. It works as a mutual insurance scheme with a no-profit basis for the coverage of marine oil pollution liability. Every year the members pay a contribution, which should cover claims and administrative costs. The members share the potential profits and losses, if the amount is insufficient to compensate the losses, an additional premium can be asked from the members (Bocken, 2002).

Bonds

The State of Queensland, Australia, adopted a performance bond system with the implementation of the Mineral Resources Act. The mining operators have to pay a sum of money to the competent authority at the beginning of the activity for the performance bonds, that provide economic incentives to consider potential environmental impacts occurring during the mining operation. With the payment of these performance bonds the government ensure the rehabilitation of the site, if the mining company fails, when the activity ceases. These bonds create incentives for the companies to promote environmental safeguards. The amount of money that each company has to pay as guarantee is estimated on the past history and experiences of the companies, if a company achieved successful environmental strategies, the required security deposit can be lower (EFTEC, 2004).

2.3.3 Fiscal instruments

Fiscal instruments such as taxes can incentivise risk prevention. A **tax** is compulsory, *unrequited* payments to general government. The meaning of an unrequited payment refers to transfers for which the government provides nothing in return, although fiscal revenues are used to finance goods or services to others or to the community as a whole (OECD, 2001). An environmental tax is a tax *whose base is a physical unit (or a proxy of a physical unit) of something that has a proven, specific negative impact on the environment* (Eurostat, 1997). There are various ways to categorize environmentally related taxes, depending on whether one focuses on the design of the tax or its purpose. When focusing on design, the taxes are often classified as (OECD, 2003): (i) emissions and effluent taxes; (ii) product taxes; and (iii) natural resource taxes. The distinction between the first and the second is that the first taxes the emissions directly, while the second taxes products that are likely to generate environmental damage in their manufacture or use. Product taxes attach a price to pollution while natural resource taxes place a price on the use of scarce natural resources.

Environmental tax reform (ETR) is a part of the Europe 2020 resource efficiency initiative (EC, 2011), aiming at among others limiting the environmental impacts of resource use while at the same time improving economic performance, hence decoupling environmental pressures from economic growth. The principle of ETR is a transformation of the tax burden away from where it may cause adverse impact on economic competitiveness such as labour and capital taxation to areas where such impact is lower and to activities with provable negative environmental impacts (Ekins, 2009). Environmental taxes help to internalize environmental impacts and risks, and serve as an incentive to develop safer strategies to protect environment and use natural resources more efficiently.

Another type of instruments are environmental **certifications**. They typically involve accreditation for the implementation of safer and better technologies in the activities to

achieve specific scopes. Unlike taxes, they are voluntary instruments. The certifications can lead to a better and more favourable company image, and can also lead to a reduction of taxes and other required payment, such guarantees. Environmental certifications play a similar role as tax incentives. They are based on a voluntary choice to carry on activities under specific environmental standards. They are a form of corporate social responsibility to minimise the potential harmful impacts to the environment. They incentive operators to follow environmental protection standards, and by doing so reduce potential risks. The green certification rewards industries, by directing consumer choice with tangible benefits for the certified companies. Among the most popular environmental certification we can find the EMAS (Eco-Management and Audit Scheme) and the ISO 14001, that reward the evaluation, the management and the improvement of the environmental performance of industries.

Box 2.3 – Environmental fiscal instruments: some examples

Taxes

The Danish Governments introduced a pesticides tax in order to reduce the pesticide application and to promote the use of less harmful pesticides. The tax was intended to protect the surface and groundwater bodies, the latter being source of drinking water provision usually without treatment. As a product tax, the pesticide tax is levied on the sales prices of different pesticides and differentiated according to the categories of use, rather than the toxicity levels. The collected revenues are reimbursed to farmers through lower land taxes and subsidies for organic and environmentally friendly farming (EFTEC, 2004).

Tax Incentives

The US EPA introduced a Brownfields tax incentives to encourage clean-up and reuse of brownfields. With this tax incentive, the costs of the clean-up operations are fully deductible in the year in which they incurred. In the 2006, the tax incentives have been extended to oil clean-up. These tax incentives can be applied to properties with specific land use and contamination prerequisites, such as the insertion of the property in the taxpayer's inventory and the supply of the potential hazardous substances present in the property. EPA designates the eligible properties for the tax incentives (EPA, 2008).

Certifications

ISO 14000 certifications, promoted by the International Organization for Standardization (ISO), involves management system standards. The ISO 14001 category issues to environmental management system and reward industries that improve their environmental performance in all operational activities[20]. In Italy, the government established some regulatory simplifications and monetary incentives for certificated industry operating in waste, energy, water and pollution reduction sectors. For example, the D.Lgs. 152/2006 (Environmental Code) established a reduction of the 40% in the payment of financial guarantee for the waste management industries with ISO 14001 certification.

[20] ISO 14000 regulations at http://www.iso.org/iso/iso14000.

3. ENVIRONMENTAL INSURANCE MARKET IN ITALY

3.1 Introduction and structure of the chapter

Insurance is one of the most widespread instruments to hedge against the risk of environmental damage even if not a mandatory in many countries. Italy is one of these, there is no requirement to underwrite insurance for the environmental liability. The only exception is the Veneto administrative region, where waste disposal and treatment plants are subject of mandatory financial protection.

To analyse the experts' views and opinions, I have conducted a survey on availability, distribution and efficiency of the insurance instruments for environmental liability in Italy. In section 3.2, I describe the existing insurance market, along with the main institutions, products and penetration. In sections 3.3 and 3.4, I summarise the survey and evidence collected, also about the experts' suggestions on possible future developments.

3.2 Environmental Insurance Market in Italy.

The environmental insurance market segment is dominated by a pool of insurers that involves a number of companies to offer solutions better capable to cover environmental liability risks. The so-called 'Pool RC Inquinamento' was created back in 1979, only a few years after the Seveso accident (see chapter 1). The Pool was born out the necessity to increase the insurance capacity to cover environmental damage and liability, and to improve insurers' ability to analyse environmental threats. The Pool involves 28 Italian (re)insurance companies operating in Italy; among them 23 direct insurers and 5 re-insurers. Few more insurers who are not members of the Pool offer financial product for environmental liability, among them three large international insurance groups.

The Pool pursues two complementary purposes: (i) it offers insurance products that can be tailor-made to specific clients' requirements (mainly by modifying inclusion and exclusion clauses), and (ii) it performs the role of re-insurer, by pooling the environmental liability risk underwritten by the participant companies, as well as the collected premiums.

Today, the Pool offers different insurance solutions for environmental damage, for both accidental and slow-onset, gradual pollution. The Pool's supply comprises specific environmental solutions, proper for pollution damage, and provides extensions for existing solutions, adapting them to include environmental damage.

Specific environmental solutions include both the third-party tort liability and the environmental liability. They cover damage to people and property, and damage caused by business interruption, and in addition, the costs of remediation measures to undo environmental harm when it occurs. The later includes remedy for water, soil and air pollution, and restoration of protected habitats and species.

The Pool has four main environmental policies, comprising a base policy and optional additional clauses. The principal and most comprehensive policy is the Environmental Liability Policy for Settlements. The base guarantee includes the coverage for accidental

damage caused by pollution to a third-party (personal injury, activity interruption, damage to property) and the coverage for the costs of the remediation measures inside and outside the plant's area, and the restoration measure of the site to the original conditions. The optional clauses provide special coverage extensions for damage caused by asbestos, property placed in the plant, loading and unloading dangerous goods and transport of dangerous goods. Other policies focus on specific activities and have the same base guarantee as for environmental and civil liability. These policies cover environmental liability of activities conducted on third-party sites, activities on loading and unloading with mechanical device, and transport of dangerous goods. Optional addition can be stipulated for policies covering activities by contractor's sites, as guarantees for compensation for damage caused during the insured activities but revealed only after the contract expiration, and to cover activities of subcontractors and the loading and unloading operations.

Looking at the whole environmental insurance sector, pool and extra-pool companies, the typologies of products offered are similar and they cover the same kind of liability and damage, remediation measure, third-party pollution damage and contractor's activities.

The general civil liability policies can have a pollution clause, but it offers a partial protection compared to pollution policies. These policies include third-party or property damage only for accidental cause of environmental damage; slow-onset, gradual pollution is excluded. Other exclusions refer to the remediation of environment inside the plant and the type of pollution and damage. This type insurance products have rather strict conditions and applies only to limited extent to environmental pollution damage.

The premiums are determined by on-site risk assessment of plant activities and a general questionnaire filled by the client. The policies are tailor-made to specific classes of risk at the plant facility. The clients can opt out or in specific clauses which is then reflected in the premium and maximum coverage. The cost of a policy includes the net cost of the risk pooling, the management cost and value-added taxes (VAT). The latter for insurance contracts amounts to 22,25% in Italy. The Association of Italian Insurers (ANIA) and the General Confederation of Italian Industry (Confindustria) signed an agreement in 2004 that reduces by 20% the premiums for businesses complying with environmental certification (UNI EN ISO 14001 and EMAS[21]).

According to the available data of the Pool Inquinamento[22], only about 1% of the business has bought a specific environmental policy, whereas some 70% of the companies chose an extension of other insurance products such as third-party liability (TPL) to cover environmental damage. Some 29% of companies have no insurance coverage for

[21] UNI EN ISO 14001 is an international certification for all organization following an environmental improvement, according to defined requirements, in their activities processes and management, and it is provided by the International Organization for Standardization (ISO). Last regulation review was in the 2015. EMAS (Eco-Management and Audit Scheme) is an European certification system to promote and improve the environmental efficiency of activities. It has been established in the 1993 and the last regulation revision was in the 2009 (Regulation 1221/2009). Both these certifications are based on voluntary request.

[22] Based on data form 2010, but experts indicated that the situation has not changed substantially ever since.

environmental damage (Figure 3.1). Almost 50% of pollution policies refer to waste treatment sector, followed by transport, and chemical and oil sectors (Figure 3.2). Exploring the geographical distribution (Figure 3.3), Veneto region has the highest penetration rate. The figure also shows a significant gap in insurance cover between the North and South of Italy.

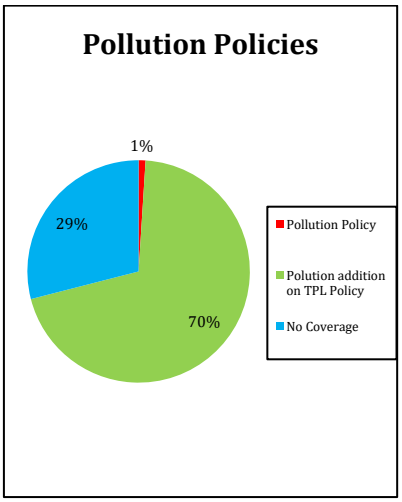


Figure 3.1 – Environmental insurance in Italy by type of policy[23].

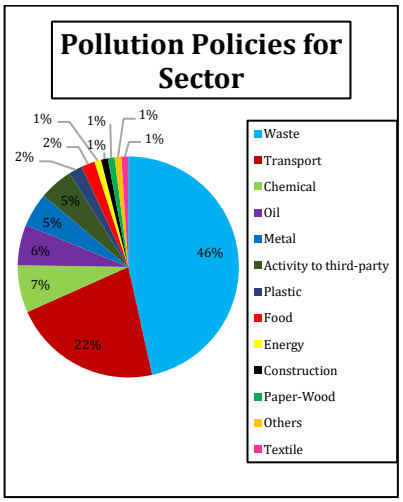


Figure 3.2 – Environmental insurance in Italy by industrial sector[24].

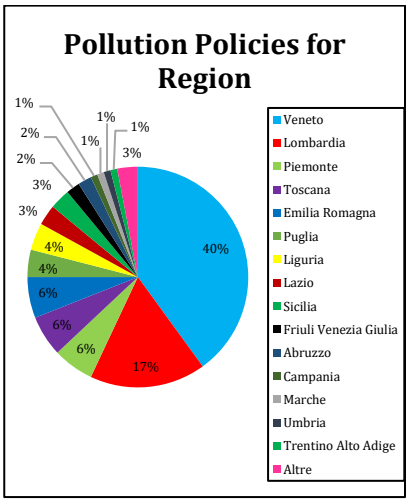


Figure 3.3 – Environmental insurance in Italy by administrative regions[25].

3.3 Survey and Interviews

To collect experts' views and opinions about the status of environmental insurance in Italy and possible future improvements, I have conducted a survey based on an online questionnaire and semi-structured phone interviews with representatives of insurance companies and other experts.

The survey aimed to shed light on the perceived efficiency of insurance as an instrument for environmental liability. The questions related to the availability, types, uptake and efficiency of insurance instruments, current weaknesses and strengths, and potential future development and regulatory changes needs to increase the penetration.

The questionnaire created with Google Form (Annex 1) allowed a wide distribution; at the same time the questionnaire facilitated collection and analysis of the responses. The questionnaire includes 18 questions divided in 5 sections: environmental damage and liability perception, current insurance market and instruments, insurance companies' experience (demand and supply), opportunities and treat, and structural information about respondents.

[23] Pool Inquinamento Data of 2010 (Faglia, 2010).

[24] Pool Inquinamento Data of 2010 (Faglia, 2010).

[25] Pool Inquinamento Data of 2010 (Faglia, 2010).

An invitation to respond to the survey was sent by email to a large number of insurers in Italy. The dissemination of the questionnaire was supported by selected experts who circulated the invitation though their personal and professional networks. Despite the major effort made to reach a large number of insurers, I was able to collect only few responses which were insufficient for statistically relevant tests.

By contrast, the phone interviews have been more successful. I interviewed experts and managers at the Italian Association of Insurers (ANIA), the Pool Inquinamento, several extra-pool insurers and re-insurers, as well as academic experts. I used the same questions as in the online questionnaire as a guide for the semi-structured interviews. On average, the phone interviews lasted for about an hour or more.

The answers to the online questionnaire and the results of the interviews convey similar general views. A minor disagreement was noted between the perceptions of the insurers and experts, mainly related to how public regulator could facilitate the insurance penetration.

3.4 Results

In the following paragraphs, I summarize the results of the survey, drawing a sketch of the perceived situation on environmental liability insurance market in Italy, and the possible solutions.

3.4.1 Awareness among the businesses held liable

Despite the growing consciousness of environmental issues and the attention paid to environmental protection by the business sector, the demand for insurance policies covering environmental damage in Italy is very low. The potentially liable operators are not sufficiently aware about the environmental liability regulations and the potential financial implications. Most operators are not familiar with the all aspects pertaining the existing European and national regulation.

The main problem is related to the lack of knowledge about the environmental risks associated with the business operation, generally perceived as low or not warranting a financial protection. For different reasons, including lack of risk-aware culture and the economic downturn since 2008, financial protection against environmental damage and harm is considered a priority. Where the financial protection is required (as in the Veneto region), taking action beyond the required level of protection is attributed a second-order importance. The operators see the potential environmental damage related to their activities as a very low probability risk, especially for the small- and medium-sized companies, but, according to the experts, they are no aware that over the time the risk increases and the probability of a pollution damage become higher.

The environmental damage has a very broad definition and in common view it is related only to the natural resources, the protected species and habitats or to certain ecosystems. Operators in industrial and commercial sectors believe environmental risks are connected only with hazardous activities, oil, waste and chemical industries for example, neglecting the fact that environmental damage can material also as a result of other activities. The academic

experts and the insurers agreed that risk characterisation and assessment capable of identifying possible environmental harm should be introduced as a standard management practice. It is perceived necessary to take further actions to improve the risk culture by the industries and contribute to a greater risk awareness.

Often, when industrial activities turn out to be insurable, following the risk assessment, the operators misunderstand the results. They have the wrong perception that this means there are not large risks and they reject to pay for environmental policies. This result to be a barrier to the insurance market development. The general opinion among the experts is that this paradox must be converted, the operators need to be substantially sensitized and aware of environmental risks.

3.4.2 Insurance market and supply

On the insurance companies' side, underwriting and management of risks associated with environmental damage is not perceived as a problem, neither for the capital requirements nor for the insurability. The insurance industry developed a range of tailor-made instruments responding to every need of the operators. Existing products are sufficient to cover and protect against many environmental risks, without excessive costs. According to the experts, for the most cases the premiums for environmental liability insurance does not exceed 5.000 Euro, which is affordable even by small industries. The prevailing view is that insurance industry offers sufficient rage of tailor-made and affordable financial products.

Despite this, the insurance penetration is limited. The number of pollution-related policies managed by the Pool Inquinamento does not exceed 5.000. A bulk of these refers to environmental liability policies for settlements and they are taken mostly by small- and medium-sized industries, with a higher concentration in the waste treatment sector. The insurers that are not members of the Pool Inquinamento address mainly the needs of larger industries but even in this case the number of environmental policies is still very small. This situation seems to be the same in the other European countries, also where there are insurance pools like in Spain and France. The only exception among the European countries is Germany which has a more developed market.

The insurance companies have more consciousness for the environmental problem and the necessity for an insurance coverage; their main difficulty is related insufficient risk awareness of the business operators.

The environmental liability policies can require special technical knowledge, and they could not be immediately comprehensible both for the industrial operators and for the insurance agents. Understanding these products necessitates advanced technical skills and training. Some insurers, notably the Pool Inquinamento, started providing special courses. Helping to improve awareness about the environmental damage and liability is an area where insurers play a role, eventually contributing to better prevention of environmental risks. Risk prevention conducted by insured businesses can we 'rewarded' by lower premiums, hence further incentivising reduction of risk, for the benefits of all. Currently, the environmental risk assessment for small business with limited potential environmental damage is

conducted based on an expert off-site evaluation. Insurers too can benefit from a better understanding of the causes and propagation of environmental hard. The risk assessment is not perceived as a critical and central issue for environmental insurance, but the experts believe that it could be an important instrument to develop, in order to increase their supply, even for the risk characterization and estimation, to find more suitable coverage costs and to improve their market penetration.

3.4.3 Possible solutions and implementations

At the current state, any improvement could be made in the insurance market. To successfully develop this sector a deep change is necessary, especially in the industrial approach to the environmental risk.

It is important to strengthen the prevention role of the insurance to improve safer action by the insurers. Discussing with the experts, some possible solutions have been highlighted.

A possible instrument could be an incentive on the policies, providing a cost reduction over the years for virtuous behaviours.

Given the increasing attention to green policies, industries could use the pollution insurance as a symbol of good policies, to increase their image on the market, as they do with environmental certification or other green practice. Insurance companies could promote this kind of advertisement also to make more attractive their solution on the market.

The most important aspect that must be enforced is the information to the businesses, it is extremely important to increase their awareness on the environmental liability and the damage they could cause. This require a large effort by the insurance companies and by the State. An information campaign on a large scale could be effective, but the support of the State is fundamental in this type of actions.

The common opinion is that the State should make more effort to promote these instruments. A legislative and authorisation reform is needed to develop the environmental insurance sector. Establishing a mandatory environmental insurance could be a solution, to lead to a change of mind in the business sector, the only volunteer actions are no sufficient.

According to the researchers, a mandatory insurance could arise some problems in the structure of the market. The authorizations to operate industrial and commercial activities follow a set of criteria that are usually different from those of insurability. With a mandatory insurance, some activities would result excluded by the market, because they do not reflect the insurability criteria. Hence, the insurance sector will define the whole industrial market structure.

Insurers do not completely agree with this view. The insurability criteria can include many different activities and the not-insurable business would be a limited number.

Establishing a mandatory insurance for environmental liability, even according to the insurers, should follow a gradual process, that takes into account some aspects. The compulsory pollution insurance should be required to specific sectors of the industry, following the Veneto example for the waste sector, but including other more hazardous

categories of businesses. Introducing a compulsory insurance, a reduction of the policies costs could be possible, but at the same time a reduction of the insurance taxes required is necessary as the introduction of incentives.

Another necessary effort to make these solutions more effective is required at European level. A more defined alignment of insurance taxes and guidelines in the European countries is important to create a competitive and stronger market, also at the international scale.

3.5 Conclusions

The experts' opinions revealed a need of development in the environmental insurance market. It is the base for an implementation of their knowledge and their capacity to support the risks in a more adequate way. A market development brings to the acquisition of skills and the collection of historical data to provide more efficient coverage.

The State should have a central role and collaborate with the insurance sector to boost the market. Important reforms in the culture and in the legislation about the environmental liability and damage are necessary to change the current situation and have a more aware market.

4. CASE STUDY: WASTE DISPOSAL AND TREATMENT IN VENICE PROVINCE

4.1 Introduction

To explore the practical challenges of designing financial guarantees schemes for the waste treatment sector, in this chapter I focus on the Veneto administrative region (Box 4.1). Veneto introduced a mandatory financial guarantee for waste disposal and recycling back in 1999. I chose this regional regulation as a case study, to evaluate the effectiveness of a mandatory insurance instruments and the other financial measures in force, as a possible solution to implement on a larger scale. My empirical analysis refers to one of the seven Veneto provinces, the Venice Metropolitan City.

In section 4.2 I introduce the normative framework currently in force for the waste financial guarantees regulation. As next, in section 4.3, I characterize the waste disposal and treatment plants (WTPs) located in the Venice Metropolitan City, for which I collected detailed data (see also Annex II). In section 4.4, I explain how I analyse the hazard exposure of the WTPs and a statistical analysis on the financial guarantee aspects. Finally, in the section 4.5, I summarise the results of my analysis.

Box 4.1 - Veneto region and provinces, an overview[26].

Veneto Region is one of twenty administrative regions in Italy. It is located in the north-east of the Italian peninsula. Veneto has a population of almost 5 million. With GDP per capita GDP around 30.800 Euro, Veneto counts to the most economically developed Italian regions. It extends over ca. 18.400 sq.km, of which 57% is occupied by plains, 29% by mountains and 14% by hills. Veneto has 200 km of coastline on the Adriatic Sea. The territory is divided in 7 provinces (Venezia, Treviso, Padova, Verona, Vicenza, Rovigo e Belluno) and the regional capital is Venice. The administrative definition of the Venice Province is Metropolitan City (MC) of Venice. It comprises 44 municipalities with some 860.000 habitants. It extents for 2.473 sq.km and around 600 sq.km of these are occupied by lagoons.

Location of Veneto in Italy

Subdivision of the region into provinces, with Venice Metropolitan City highlighted

Minicipalities of the Venice Metropolitan City

4.2 Regional Regulatory Framework for Waste disposal and treatment plants

Veneto adopted mandatory financial guarantees for all waste treatment and disposal plants, requiring both insurance pollution cover and surety policy. The Region's early action on

[26]Data extracted by the Istat, Regione Veneto and Città Metropolitana di Venezia websites.

environmental damage dates back to 1980's. The first legislation on financial guarantees in the waste treatment sector was adopted in the 1999 and embedded in the Decision of Regional Council (DGR) 2528/1999. This provision had been modified over the years through the regional government's decisions[27] 2229/2011, 1543/2012, 1489/2013, 346/2013, 14/2014 and 1347/2014. The regional regulation in force is the 2721/2014[28], which replaced the previous ones.

This latter decision defines who (which industrial activities) is obliged to seek financial protection as well as the ceilings of financial guarantees (Annex A of the Decision) for every activity. The Decision also includes standard form for stipulating financial guarantees (in Annex B), developed in collaboration with the insurers.

Guarantees are required for all new and renewed or modified WTP authorizations, for the entire time of the authorized activity, under penalty of temporal suspension of the authorisation. There are four different authorizations for the waste plants at the national level (see Box 4.2): simplified procedure, single environmental authorization (AUA, *autorizzazione unica ambientale*), ordinary procedure, and integrated environmental authorisation (AIA – *autorizzazione integrata ambientale*). In Veneto, all these authorisations follow the same financial guarantee provisions of the DGR 2721/2014.

According to the DGR 2721, the guarantees must be addressed to the competent provincial governments, to cover the costs of the waste management. The competent authority issues guarantee policies, in case of non-compliance, to bear the costs of necessary remediation measures.

The regulation requires insurance coverage for pollution damage and financial guarantee, that can be provided by financial organisations (banks or insurance companies).

The amounts of required protection are amount to:

- 3.000.000 Euro for the insurance coverage, only for waste produced by third-party;
- 0,5 Euro/kg of hazardous waste and 0,2 Euro/kg of not hazardous waste for the financial guarantee.

The definition of financial guarantee ceilings considers only the quantity of waste stored temporarily in the waste treatment plants, not the whole volume treated. The activities addresses include landfills (not hazardous urban waste, hazardous and not hazardous waste, inert waste), temporary storage plants, collection points, disposal plants and recycling plants.

For landfills stricter rules apply. They are compelled to possess two different financial guarantees, one for the duration of the activity and one covering a post-activity period of 30 years. Landfills for urban waste, over the financial guarantee, are obliged to open a bank

[27] Deliberazione della giunta regionale (DGR).

[28] Deliberazione della giunta regionale n. 2721 del 29 dicembre 2014 - Approvazione schema di "Garanzie finanziarie a copertura dell'attività di smaltimento e recupero di rifiuti". D.Lgs. n. 152/2006 e s.m.i. ed integrazione delle disposizioni regionali vigenti in materia

account bound for the provincial administration, according to each approved project. Looking at the insurance coverage, they have to submit a different insurance policy for each 200.000 m^3, in relation to their location (situated in or outside of aquifer recharge area), and the typology of waste (e.g. urban, hazardous or not hazardous waste) as in the Table 4.1.

		Urban not hazardous waste	Hazardous waste	Not hazardous waste
Aquifer recharge area	*in Euro*	2.200.000	3.400.000	2.800.000
Not aquifer recharge area		1.500.000	2.000.000	3.000.000

Table 4.1 – Insurance cover required for landfills in Veneto Region.

Box 4.2 - Authorization Regimes in Italy[29].

Simplified Procedure

The simplified procedure consists of notifying the competent authority 90 days before the launch of the activity. The latter verifies the necessary prerequisites of conformity and approves the commencing activity. According to the articles 214 and 216 of the DL 152/2006, this procedure is applicable only to specific disposal activities under defined hazardous and not hazardous waste category as specified in the Ministerial Decree (MD) of 5 February 1998 and following integrations, MD of 12 June 2002 and MD of 17 November 2005. The procedure must be renewed every 5 years or in any case of activity's alternation.

Single Environmental Authorization (AUA)

This authorization, regulated by the Decree of the President of the Republic (DPR) 59/2013, includes all environmental licenses an operator needs to start the activity. The licenses requiring the AUA are listed in the article 3 of the Decree. The authorization applies to small- and medium-sized enterprises as specified in the MD of 18 April 2005, and the water treatment plants are not subject to AIA. The competent authority is the provincial administration which releases the authorization typically for 15 years.

Ordinary Procedure

This is the ordinary authorization for the disposal and treatments waste plants regulated, after the project approval, in accordance to the article 208 of the LD 152/2006. The authorization includes all permitted operations and the category and quantity of waste. The competent authority issuing the authorization is the provincial administration, and the authorisation is renewed every 10 years.

Integrated Environmental Authorization (AIA)

This authorization replaces the ordinary procedures for some waste treatment plants, subject to through review, listed and regulated by the LD 152/2006, Title III-bis Part II and Annex VIII. This authorization can be issued by national, regional or province authorities after a compliance check of competent authorities (Conferenza dei Servizi). The AIA is the transposition of the European IPPC (Integrated Pollution Prevention and Control) and requires compliance with specified emission pollution limits and the application of the best available techniques (BAT) to reach the defined standards. The duration of the AIA is usually 10 years, but it could be longer if the plant obtained environmental certification (12 years with UNI ISO 14001 and 16 years with EMAS).

[29]Information collected according to the guidelines: 'Gestione Dei Rifiuti Aggiornamento 2014: Guida alla normativa e alla normativa applicativa ed integrativa della Regione Veneto' (Regione Veneto, 2014)

There are categories of activities and waste that have different provisions and reduced ceilings, as summarized in Tables 4.2.

Activity	Insurance cover	Financial guarantees
	in Euro	
Temporary storage of own production waste	1.500.000	
Collecting waste points[30]	1.000.000	
Disposal plants of own production waste	2.000.000	
Recycling Plants for inert waste par.7 with EWC[31] 17xxxx [32]	Not required	0,1/kg waste
Recycling Plants for inert waste[33]	Not required	0,2/kg waste

Table 4.2 – Insurance coverage and financial guarantees amount reduced for special provisions in Veneto Region.

WTP and businesses with environmental certification are entitled to reduced financial protection, for both insurance coverage and financial guarantee. Activities certified by EMAS have a reduction of 50% and those certified by UNI EN ISO 14001 have a reduction of 40%.

4.3 Data description

The data analysed in this section were obtained from the Environmental Department of the Metropolitan City (MC) Venice, which is the competent authority for the waste financial guarantees and receives all the waste authorizations and financial guarantee policies for the currently working waste plants.

Because no digital register exists, I extracted the data from the paper-form archive of authorisations[34]. I considered only the waste plants currently operating, with valid authorization and financial guarantee policies, using the available lists of plants provided by the MC and ARPAV (Agency for the Environmental Prevention and Protection of Veneto) with the help of the provincial technical officials. I have not included authorized plants for the storage of own production waste, but only the plants collecting and treating third-party

[30] According to the art. 29, Regional Law 3/2000 and to the Ministerial Decree 08/04/2008.

[31] EWC: European Waste Catalogue.

[32] As defined in the Annex I – Sub-annex I of Ministerial Decree 05/02/1998: "Technical provisions for the collection/recycling of not hazardous waste": inert waste with CER 17xxxx include waste derived from construction and demolition operations.

[33] As defined in the Annex I – Sub-annex I of Ministerial Decree 05/02/1998: "Technical provisions for the collection/recycling of not hazardous waste": par.7 other CER (inert waste), par. 1.1 (paper and cardboard), par. 2.1 (glass), par. 3.1 and 3.2 (metals), par. 6.1 and 6.2 (plastic), par. 9.1 and 9.2 (wood and cork), par. 10.1 (rubber), par. 13.1 and 13.2 (inorganic materials)

[34] The data extraction took place in the Environmental Department of MC offices in Venice. Due to the confidential character of the data included in the archive folder, I submitted a formal request to the Environmental Department Manager, but the majority of data used in the analysis are contained in the authorizations, that have public access.

production waste. The resulting table is attached in the Annex II.

The data collected refer to 191 waste disposal and treatment plants, located in 38 municipalities of the Province's territory. Their geographical distribution is shown in the Figure 4.1.

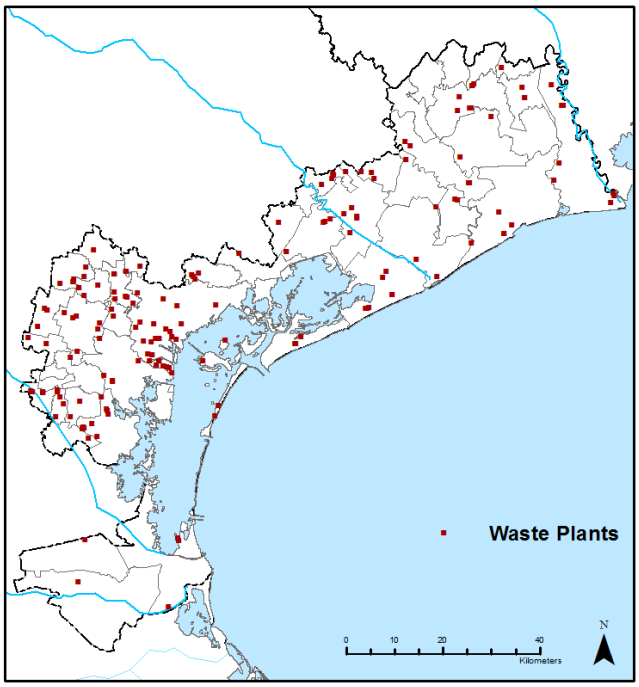


Figure 4.1 - Disposal and treatment plants distribution in the Venice Province.

The collected data include waste related activities authorized under the all different authorization's regimes in the area of the Venice Province (Table 4.3).

Authorization Regime	Number of Plants
Simplified Procedure	52
AUA	38
Ordinary Procedure	79
AIA	21

Table 4.3 - Number of waste plants for authorization regime.

The data of interest gathered refer to the numbers of waste disposal and treatment plants, their location, type of authorization, quantity and the typology of waste stored and treated, amount of the financial guarantees and insurance company involved, and environmental certification.

The total authorized amount of waste stored instantaneously in the Venice Province is around 340.000 tons, of which 221.000 are hazardous waste and 119.000 are not hazardous waste.

Over 40 insurance companies and banks provide guarantees and insurance policy in the study area, for a total coverage amount, considering only the financial surety policy, exceeding 35 million Euro, ranging from 40,00 Euro to 4.200.000,00 for single activities. The

insurance coverage is 3.000.000 in each plant.

In accordance with the exclusion and ceiling reduction criteria laid down in the regional regulation for certain waste storage, some 43 plants are exempted from mandatory insurance cover, and some 41 WTPs possess environmental certification (38 adhering to UNI EN ISO 14001 certification and 3 to EMAS certification).

I collected data also for the landfills for not hazardous waste placed in the area. There is only one operating landfill, located in Jesolo, and three landfills in post-mortem phase, this is when the activities are ceased, but they are still controlled and monitored to exclude any pollution damage. The active plant has a total financial guarantee coverage of 4.435.000, covering the operative and post-mortem phases for each tank. The coverage for the post-mortem phase of the other landfills are between 2.500.000 and 6.350.000. In the following analysis, I have not considered the landfills data.

For the subsequent spatial analysis, I georeferenced the waste plants' locations, using their postal addresses. To this purpose, I used specialised software developed in Python. Additional data for a spatial analysis on natural hazards was obtained from other sources. I considered seismic hazard, hydrogeological hazard, the aquifer vulnerability for the pollution and the recent pluvial flood.

For the seismic hazard map, I used the Civil Protection Department's (CPD) risk classification at municipal level[35]. This classification identifies four zones of risk (Table 4.4), based on the seismic event frequency occurrence over a certain magnitude in a defined period of time (generally 50 years).

Zone	Description
Zone 1	Highest risk. Major earthquakes may occur.
Zone 2	Quite strong earthquakes may occur.
Zone 3	Rare earthquakes may occur.
Zone 4	Lowest risk. Low probability earthquakes occurrence.

Table 4.4 – Seismic zones description.

For the analysis of flood hazard, I used the hazard prone areas identified by the competent river basin authorities for the scope of the Floods Directive (2007/60/EC), assembled by the Italian National Institute for Environmental Protection and Research (ISPRA)[36]. The EU Floods Directive was transposed into Italian legislative framework by the legislative decree (LD) 49/2010. In 2015, ISPRA compiled a single spatial layer with all flood hazard areas for the probability scenarios as in Table 4.5.

[35]Seismic zones data by Italian Civil Protection on the website http://www.protezionecivile.gov.it/jcms/en/classificazione.wp?request_locale=en. Data updated to March 2015.

[36] ISPRA Database on http://geoportale.isprambiente.it/tematiche_pt/iffi-2/?lang=en.

Probability	Description	Return Period
P1	Low probability of flood event	Over 200 years
P2	Medium probability of flood event	100-200 years
P3	High probability of flood event	20-50 years

Table 4.5 – Hydrological risk probability description for ISPRA classification.

I have also used the flood-prone areas identified in the flood protection plan (PAI, *piano di assetto idrogeologico*) developed in compliance with other flood risk legislation (ministerial decree of 29 September 1998). The latter distinguishes 3 levels of risk (Table 4.6)[37]. I obtained this data from the Geological Atlas of Venice Province (Vitturi, 2011), together with the pluvial flood and the aquifer vulnerability data.

Risk	Definition	Description
P1	Moderate	Return Period of 100 years. Included also all the remediation area with mechanical or mix draining.
P2	Medium	Return Period of 50 years and hydrometric height < 1m.
P3	High	Return Period of 50 years with hydrometric height > 1m.

Table 4.6 - Hydrological risk probability description for PAI classification.

The flood hazard risk as identified above considers pluvial flooding along the major river courses. Hazard arising along the minor rivers and artificial urban drainage network is not easy to determine for specified probabilities (return period). To consider these hazard-prone as well, I used the boundary of areas intense subject to recently flooded from intense precipitation events. This data refers to the period 2000-2009.

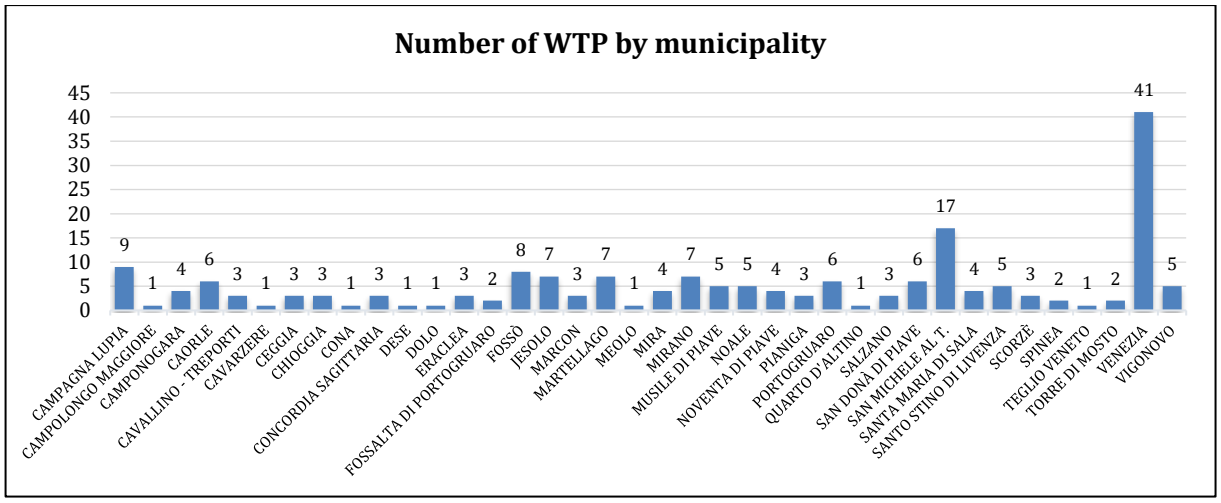
Finally, I have also used the data on aquifer vulnerability to pollution, that is the natural tendency of an aquifer to be polluted by anthropic activities. This data considers the first groundwater body located in a permeable and porous substrate, giving a value to different hydrological parameters (depth of groundwater, pluvial infiltration, self-purifying properties, superficial lithology, aquifer hydrogeological characteristics, permeability, acclivity of topography) converting them in vulnerability classes: very low, low, medium, high, very high, extremely high.

4.4 Data Analysis

4.4.1 Waste plants and financial guarantees

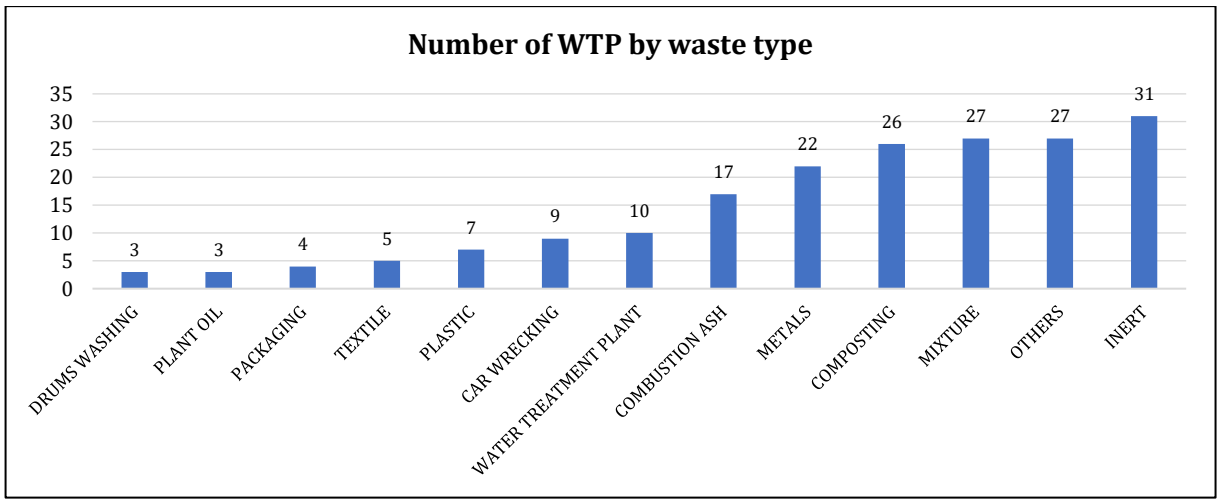
The number of plants for each municipality could be taken as an indicator of the hazard distribution. Graph 4.1 shows the numbers of plants by municipalities, highlighting those that are subjected to a higher potential hazard of waste pollution or contamination.

[37] For the Livenza, Tagliamento, Piave, Brenta-Baccgiglione River Basins the risk classification is different. It is based on 100-years scale and hydrometric height > 1m. They consider the historical flood sensitivity of different areas next to the rivers.



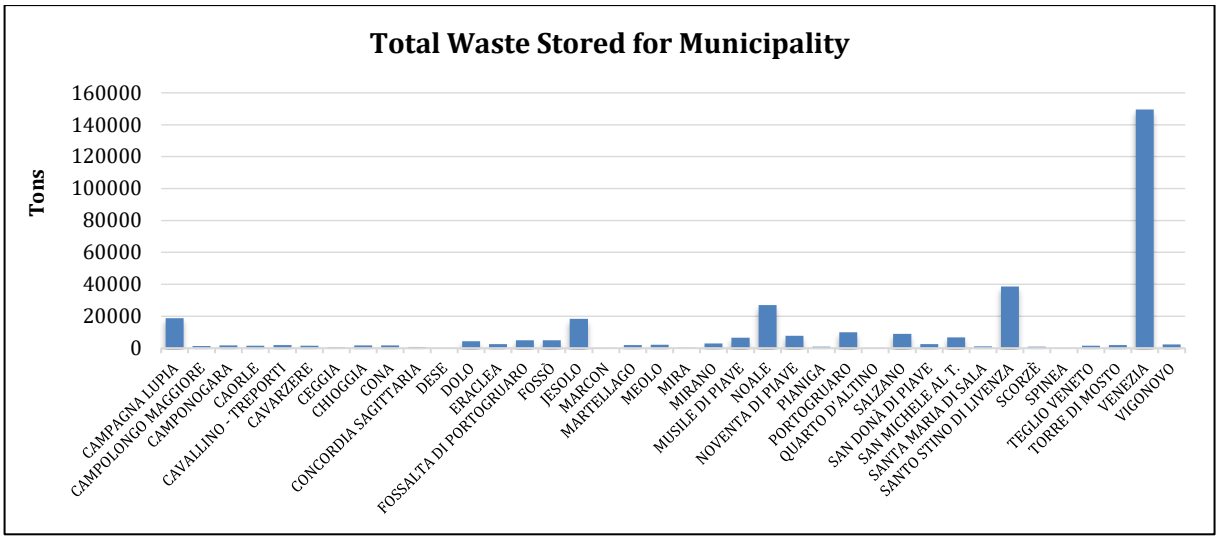
Graph 4.1 - Number of waste treatment plants by municipality in the province of Venice.

These WTP are further classified by type of waste stored, recycled or treated. Graph 4.2 represents the number of WTP for waste typology.

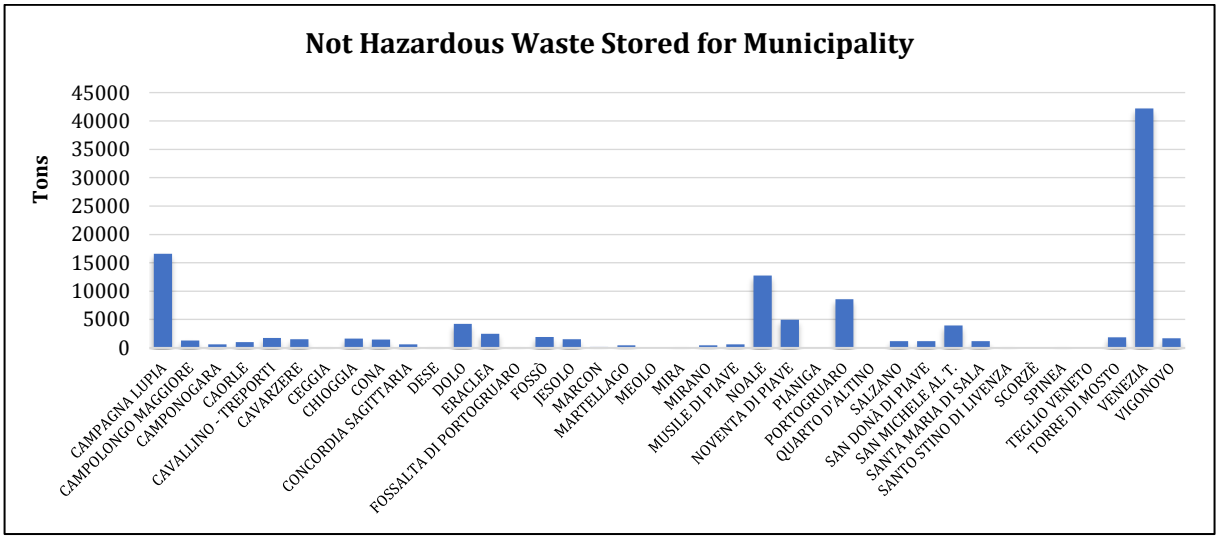


Graph 4.2 – Number of waste treatment plants by waste type in the province of Venice.

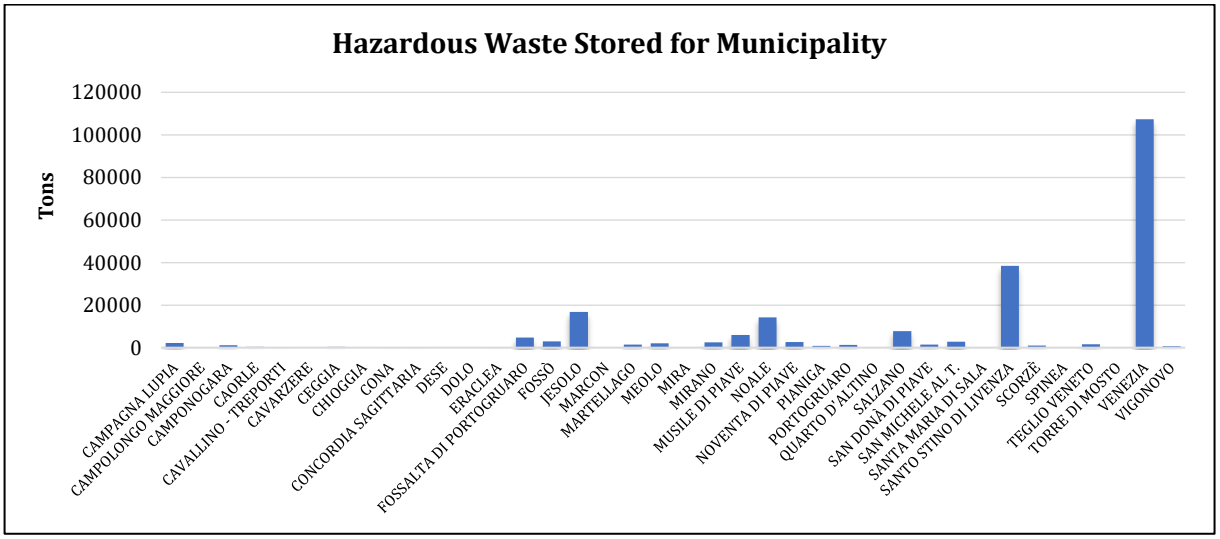
The WTP have different waste storage capacity and different dimensions, so a better indicator of the potential risk could be the amount of waste storage. The Graphs 4.3 – 4.5 shows that the municipalities with the higher amount of waste stored do not necessarily correspond to those with the higher numbers of plants.



Graph 4.3 - The total amount of waste stored for each municipality in the Venice Province.

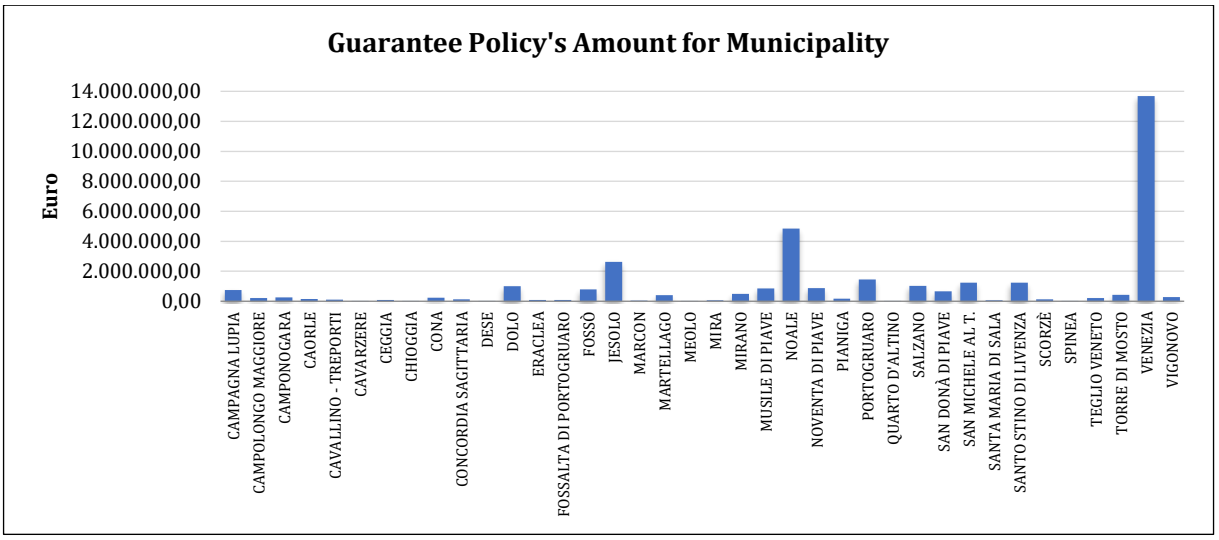


Graph 4.4 - The amount of not hazardous waste stored for each municipality in the Venice Province.



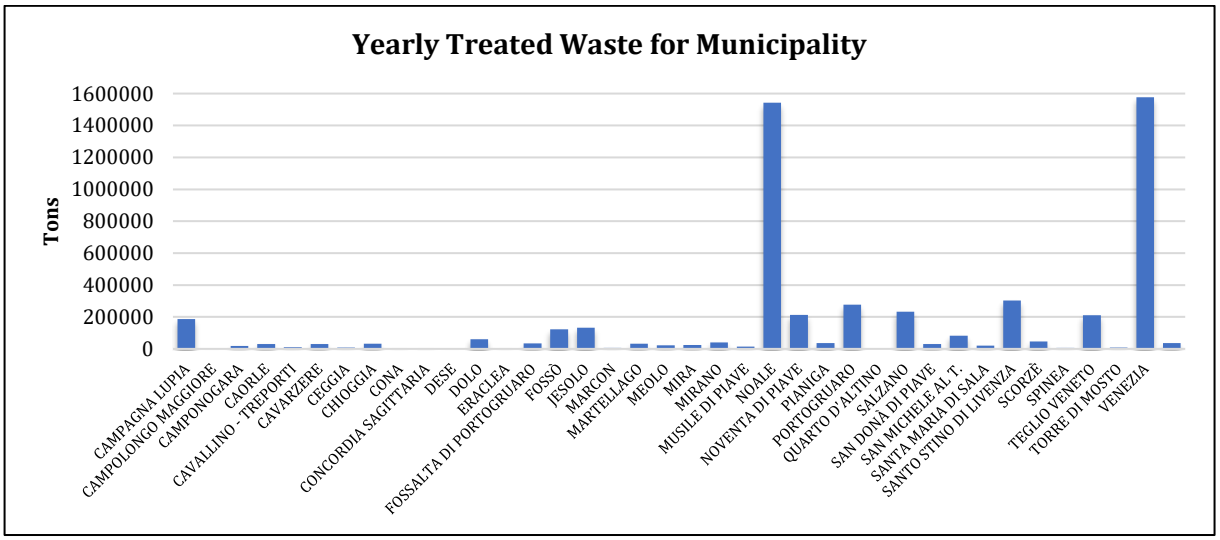
Graph 4.5 - The amount of hazardous waste stored for each municipality in the Venice Province.

Analysing the data, I compared the hazardous, not hazardous and total waste stored for each municipality with the sum of the guarantee policy's amounts granted for each municipality. The guarantee policy's amounts are calculated on the amount and the type of waste stored. In the graph below (Graph 4.6) is represented the sum of coverage caps of guarantee policy for each municipality. Comparing these data, their trend results to be similar, as expected. The higher coverage caps correspond to the higher amount of waste stored, even according to the guarantee's cost reduction incentives.



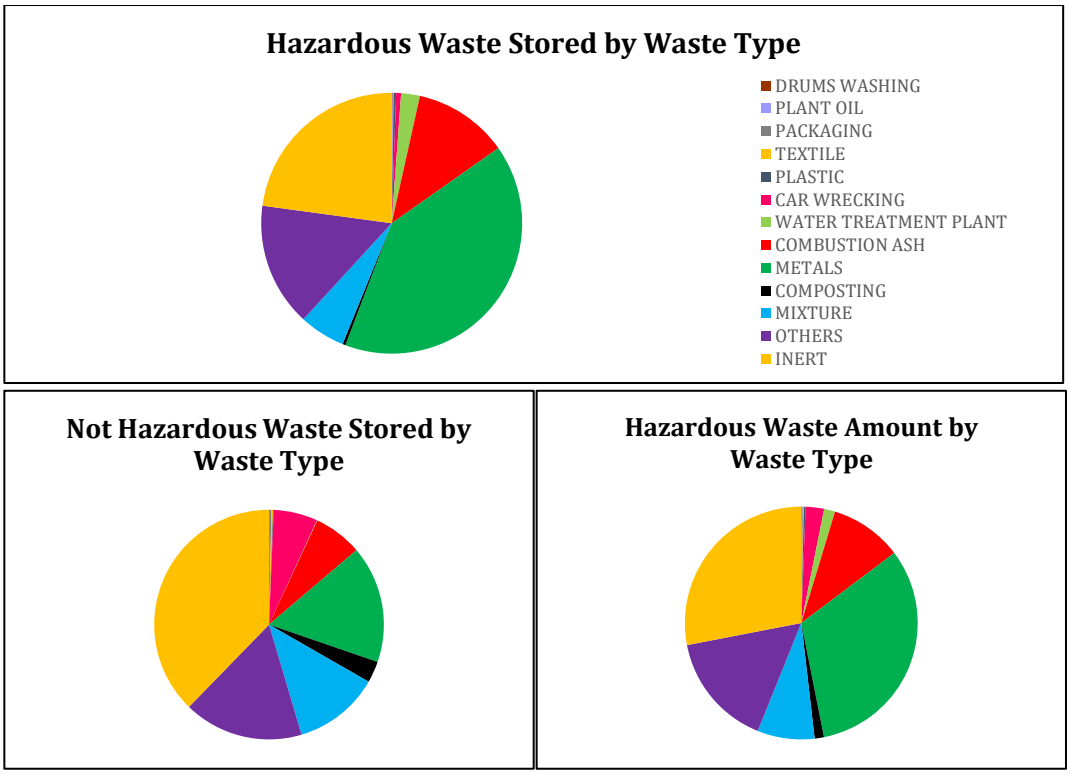
Graph 4.6 - Total amount of financial surety coverage cap for each municipality in the Venice Province.

The yearly treated amount of waste is mostly higher than the waste stored amount (Graph 4.7), and in some cases the difference is really pronounced (for example the Noale municipality). Comparing this latter graph with the coverage cap's ones, they seem to follow the same trend, even with some exception. Noale has a yearly treated amount of waste comparable to the amount treated in Venice, but the gap in the coverage cap amount is noticeable.

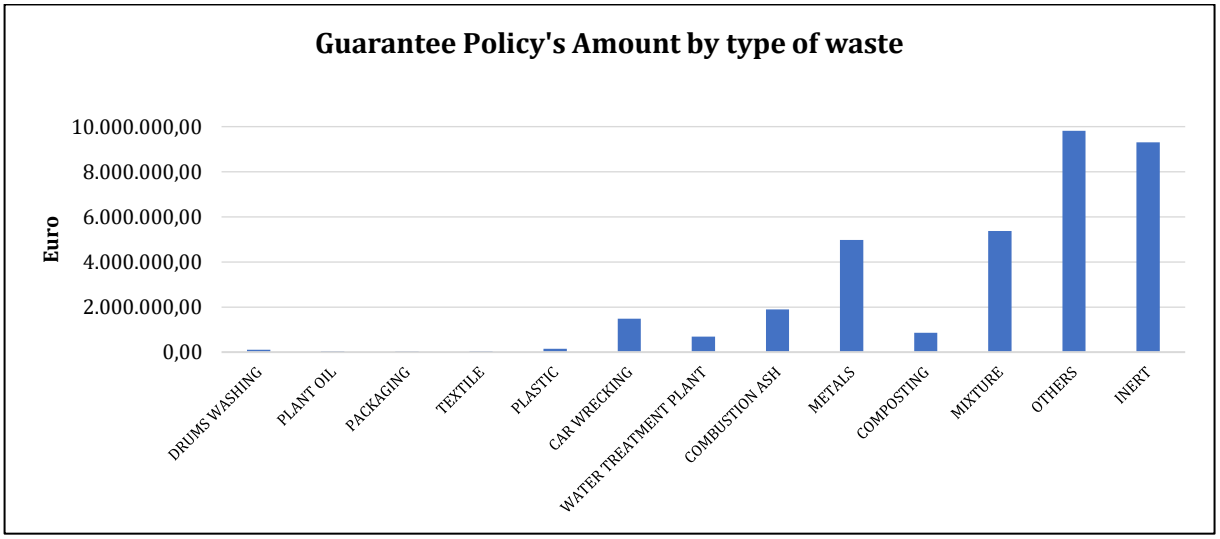


Graph 4.7 - The yearly amount of total waste for each municipality in the Venice Province.

Looking at the waste typology amount, metals have the highest impact on the territory, considering the amount of total and the hazardous waste stored. Inert waste have a relevance importance as well, especially in the not hazardous category. Metals have a low financial coverage compare to other waste typology stored, because part of them fall within the cost reduction incentive established by law.



Graph 8 - The amount of waste stored by type in the Venice Province.



Graph 9 - Total amount of financial surety coverage cap for each waste type in the Venice Province.

4.4.2 Waste plants and natural hazards

The environmental characteristics and the related natural hazards could affect the anthropic activities and lead to higher pollution events. I considered different natural hazards, comparing their distribution and magnitude with the waste plants location.

The Province of Venice rests on the two seismic zones with the lower risk of earthquakes (Figure 4.2): zone 3 and zone 4. The majority of the waste plants and the higher amount of waste stored considered are located in the seismic zone 4. This result to be not a risk of primary concern in this area.

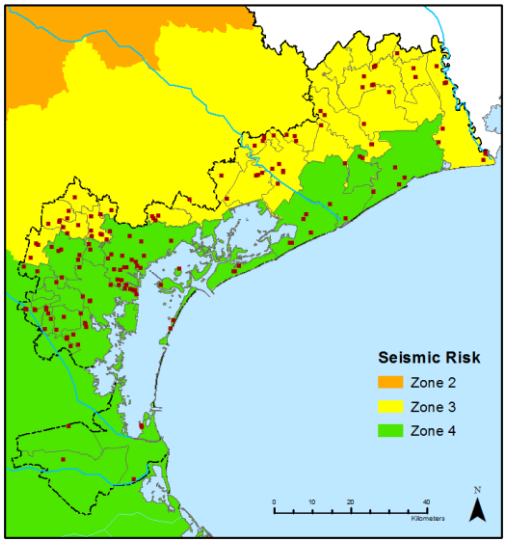


Figure 4.2 - Seismic zones of Venice Province.

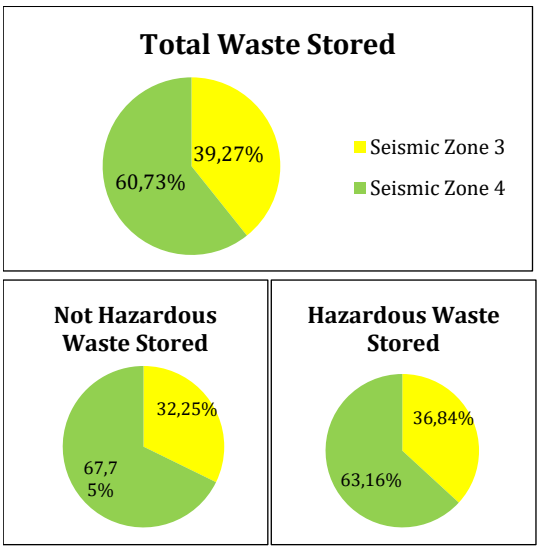


Figure 4.3 - Percentage of waste stored amount for seismic zone.

The fragility of Venice Province area is due to its hydrogeological conditions. There are many areas prone to flood hazard. Figures 4.4 – 4.6 show a clear evidence of the potential flood risk. There is a very high number of waste treatment plants in a P1 (88 plants) zone and a considerable number in the P2 and P3 zones (17 and 24 plants). A high amount of waste stored could be affected by flood events, eventually leading to contamination (Figure 4.7).

The above data refer to the hazard mapping conducted for the scope of EU Floods Directive. Comparing this data with one related to the PAI, the situation appears to be different. The flood-prone areas identified by PAI are smaller for each probability scenario. Figures 4.8 and 4.9 show the differences.

The PAI hazard classification is not up-to-date, the new hazard mapping conducted by competent river basin authorities is more recent. In the past, the incomplete flood hazard classification could have led to underestimation of risks and unwarranted authorization of waste treatment plants or other industrial activities in areas where these should not be located.

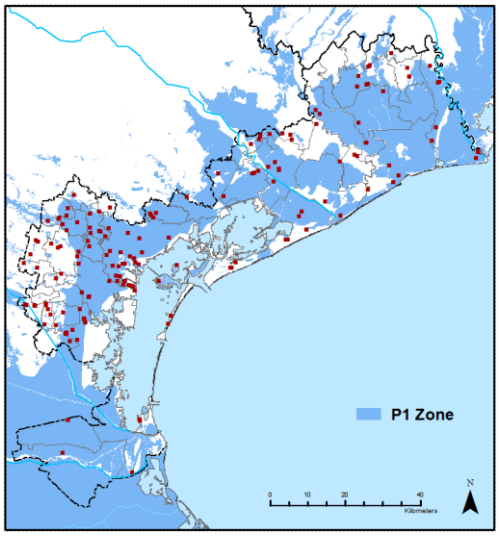


Figure 4.4 - Zone subjected to low probability of flood events

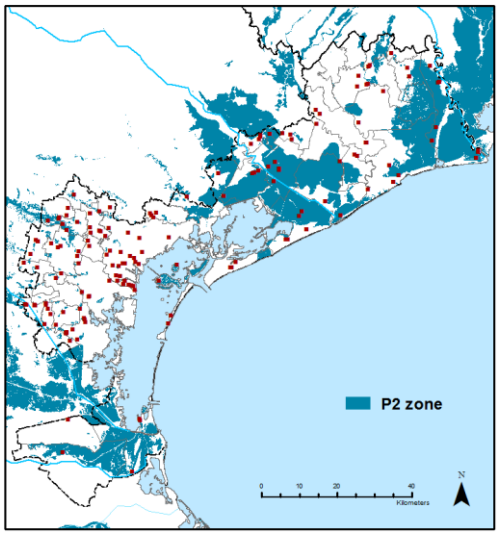


Figure 4.5 - Zone subjected to medium probability of flood events.

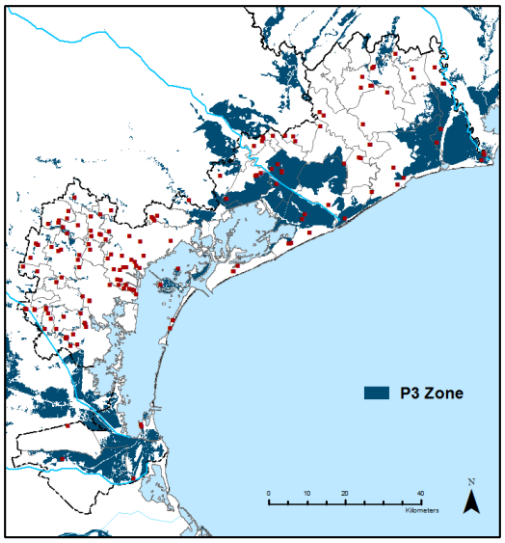


Figure 4.6 - zone subjected to high probability of flood events

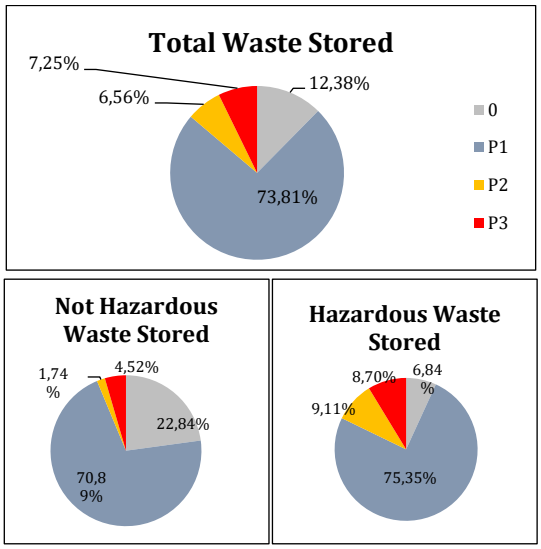


Figure 4.7 - Percentage of waste stored amount in zone with flood events probability.

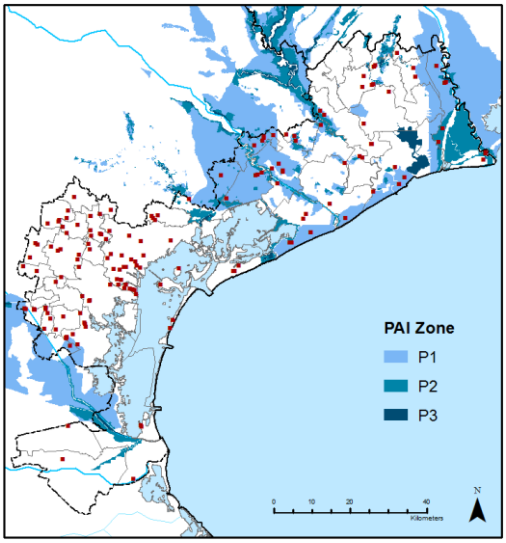


Figure 4.8 - Flooded areas by PAI probability.

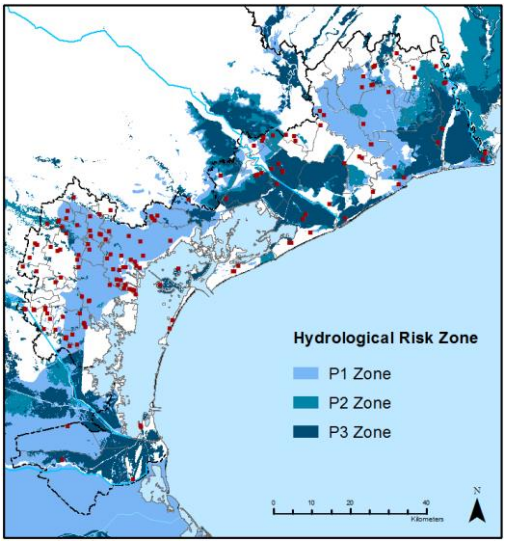


Figure 4.9 - Flooded areas by ISPRA probability.

Delineation of the recent floods from intense precipitation, and along minor hydrological and urban drainage networks is shown in Figure 4.10. A significant number of WTP (57 plants) is located in areas recently flooded. The WTP account for a minor capacity of about 30% of the total waste, of which hazardous waste comprise only a small (4%) fraction (Figure 4.11).

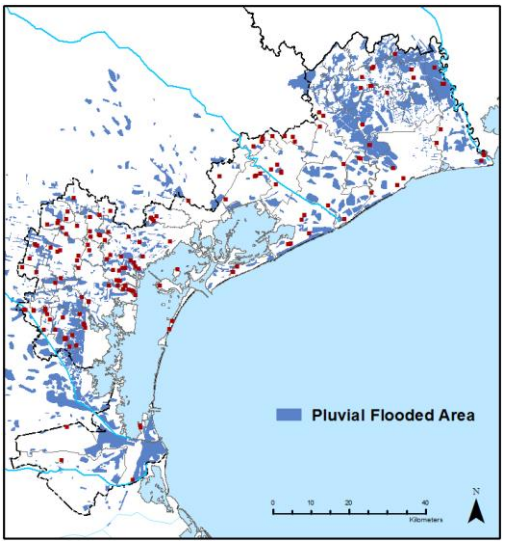


Figure 4.10 – Recently flooded areas by extreme precipitations.

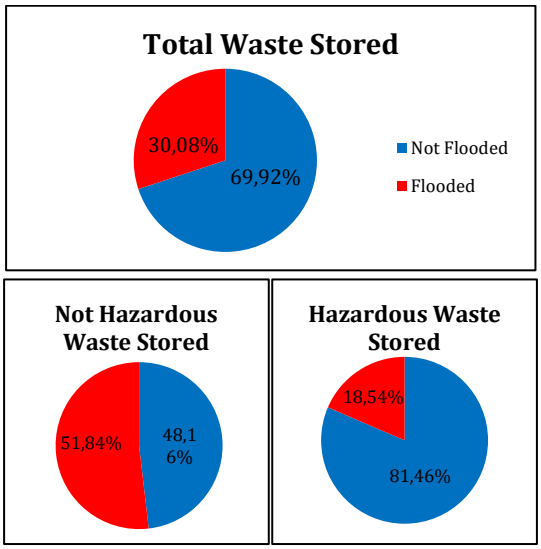


Figure 4.11 - Share of waste volume stored in recently flooded areas.

Concerning the hydrogeological characteristics of the Venice Province, another important factor to consider is the natural vulnerability of the aquifers to the pollution. Most plants are situated in area with low and medium vulnerability for aquifer pollution (73 and 71 plants) and the total amount of waste stored reflects the same situation.

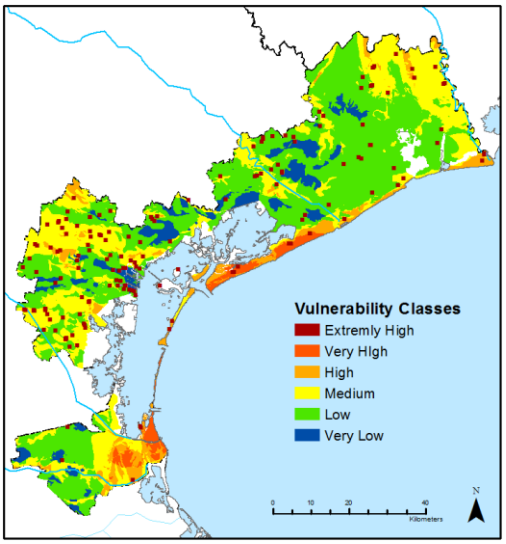


Figure 2.12 – Classes of aquifer vulnerability to pollution.

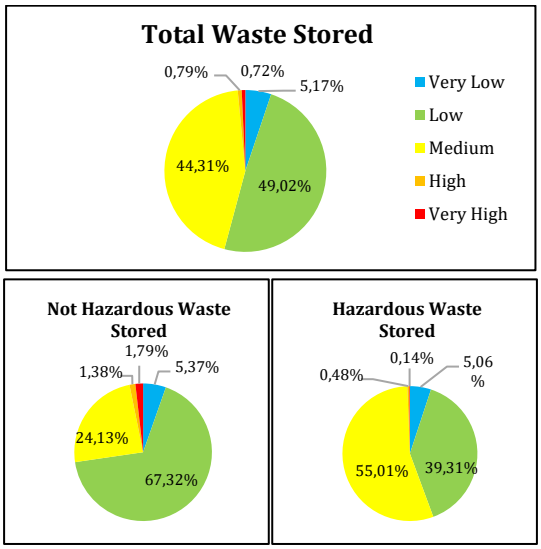


Figure 4.13 – Percentage of waste stored amount placed in each class of aquifer vulnerability.

4.5 Results and conclusions

The waste treatment plants are unequally distributed across the territory of the Venice Metropolitan Area. The analysed WTP are characterised by very different storage capacity and types of waste treated, disposed and recycled. The mandatory financial guarantees, in the form of surety and insurance policies, as required by the regional regulation, cover the hazard of accidental pollution by the WTP as well as the necessary remediation measures.

According to the insurance experts, the insurance cover amounting to 3.000.000 Euro is adequate for this kind of WTP, if the policy is stipulated for a specific pollution type. Instead, the financial guarantee ceilings as specified in the regulation seem to be too low for the full remedy of the potential environmental damage. The financial guarantees apply in cases of unlawful behaviour and when the competent authority must intervene to restore the polluted area. In that case, operators often disrespect the authorization rules, by storing higher volumes and different types of waste, and the financial guarantee is no longer sufficient. The estimation of the guarantee ceiling by volume of waste stored as defined by regulation can be adequate in ordinary conditions, but is not sufficient to ensure an adequate environmental remedy in all situations.

From my analysis, another critical point refers to the criteria that determined the ceilings of financial guarantees. Volumes of stored waste may not be a good proxy for the potential environmental damage associated with the authorised waste treatment activities. The annual volume of treated waste is better capable to trail the hazard of environmental pollution

The territory of the province is characterised by an uneven distribution of natural hazards, which can affect the potential environmental damage arising from the WTP. The hazardous and not hazardous waste stored could be dispersed in the environment and pollute different environmental compartments. A large number of waste plants are located in recently flooded areas or in zones with high flood probability. Partly, this can be a result of the incomplete classification of the flood hazard, before the recent flood hazard mapping and assessment compelled by the EU Floods Directive.

The entire province of Venice is characterised by fragile hydrogeological conditions. On-going human induced climate change could further aggravate the hydro-meteorological hazards. The aquifer vulnerability to pollution is mainly at a low-medium level, but there are also some aquifers with a high vulnerability. The presence of waste in these areas could lead to a severe pollution problems.

A legislative reform may reconsider the WTP authorisation procedure, placing higher emphasis on the environmental conditions of the potential sites, in particular the hazard exposure and vulnerability of the underlying aquifer. The ceiling of the mandatory financial guarantees could better reflect the hazard risk and the volume of treated waste. More comprehensive criteria could be specified for the compelled insurance cover and guarantee scheme, better tailored to the WTP processes.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 The environmental risk in Italy is neglected.

Italy is prone to many natural and man-made hazards, and experienced many instances of substantial environmental damage as a result. Over the past fifty years or so, Italy had been the stage of major and minor industrial accidents, with severe impacts on the environment (ecosystem integrity) and human health. An example of these accidents is the ill-famed case of accidental leakage of dioxin that prompted adoption of EU environmental legislation (the SEVESO Directive on the control of major-accident hazards involving dangerous substances), set to prevent, improve the response to, and reduce the impacts of similar accidents.

At the European level, the environmental liability has been regulated in 2004 with the Environmental Liability Directive, which was transposed in Italy in 2006 through the Environmental Code 152/2006. The Code defines the environmental damage and the related operators' liability, in compliance with the polluter-pays-principle. Despite a long history of environmental damage and environmental legislations in force for years, there is an insufficient awareness among the concerned businesses regarding the liability for harm caused on environment, and rather little knowledge about the current normative requirements.

The sensitivity towards protecting environmental from industrial pollution has arguably increased, as shown by recent investments in green technology and operations. But on the risk prevention side, and financial back-up for environmental restoration, the action level is rather low. Insurance penetration for environmental pollution damage is very low. This is because environmental harm that can be caused by industrial operations and processing potentially hazardous substances is attributed a low priority by the concerned companies. It is rather common that threats with a very low probability of occurrence are neglected and the costs of restoration are insufficiently hedged against.

It is important to change this and foster culture of conscientious environmental risk management across all kinds of industrial activities, even if not strictly associated with hazardous substances. The operators need to acquire better knowledge on the potential environmental harm, and improve their risk management practice. It is important to consider environmental liability among the threats compromising the financial viability of the business. Cost-effective investments in risk prevention and a full internalisation of environmental harms in pricing of the industrial products and services can foster innovation capable of improving business resilience and reducing the environmental footprint. It is important to promote a virtuous behaviour in the industrial management and encourage a financial back-up for the required remediation costs, and by doing so avoid insolvency. This should become an issue of primary importance in the industrial management and to do that a large information campaign should be conducted. A wider distribution of information is fundamental, each operator should be aware of the risks and the liability they bear with respect to the environment and the social welfare.

5.2 Veneto Region, a case of good practice

Veneto adopted legislation compelling financial guarantees for environmental liability. So far it is the only Italian administrative region that requires a mandatory environmental and pollution insurance for waste treatment activities, over the guarantee policies in favour of the competent authority. The DGR 2721/2014 defines a cover based on the type and volume of waste stored. The required amount of financial backup is lowered if the waste treatment plant is certified for certain categories of waste.

The mandatory insurance for the WTP appears to be a sound strategy because it brings about tangible benefits for risk management, makes easier environmental authorisation procedures, and boost insurance market. My survey has revealed that the majority of pollution policies were stipulated for waste treatment sector in Veneto. The example of Veneto could be followed in the rest of Italy, but with some modifications, according to my analysis and the opinions of experts whom I interviewed.

The first possible improvement refers to the criteria used to evaluate the insurance ceiling. Currently, this is based only on the type and amount of waste stored. The current practice may not offer an adequate financial back-up, especially in terms of at the financial guarantees. It may be important to differentiate the cover ceiling according to take into account, for example, the treatment processes, the substances treated and the location of waste treatment plants. The financial protection should be incremented also as a function of natural hazards by which the plants may be affected, considering also the effect of human induced climate change on the probability and magnitude of the hazards. In my view, the climate change impacts should be taken into account through the plant authorisation process.

Another recommendation is to extend pollution insurance coverage to other industrial categories that could cause sizeable impact on environment such as chemical, galvanic and oil industry. This should be accompanied by improved evaluation of economic risks associated with the environmental damage, both for the polluter and third parties.

Finally, the operators' compliance with the rules underlying the authorisation and a regular control of the WTP activities reduce the risk of environmental damage. Competent authorities should be better equipped to ensure compliance and conduct ex-ante hazard and risk assessment. Many problems related to the insufficient financial back-up arose from operators' unlawful behaviour. As a consequence, the competent authority had to bear the costs of environmental restoration which puts another pressure on the already strained public finances in Italy.

5.3 The roles of public and private partnerships

Both public and private sector play an important role for increasing the awareness about environmental liability and damage. The survey conducted for the purpose of this thesis has shown the need to improve knowledge of the individual industrial operators and to steer a step change in the perception and management of environmental risk. Insurers have

knowledge, skills and capacity to address these challenges. The insurance industry developed many tailor-made, cost-effective instruments to hedge against pollution damage and finance restoration measures. The experts confirmed that capacity exists to cover accidental risks leading to environmental damage. In Italy, the Pool Inquinamento involves many insurance and reinsurance companies with sizeable capacity to underwrite environmental risks. Yet even if there is a sufficient supply of insurance products, the market is very limited, mainly as a result of a low demand. The low awareness of the industrial sector about the environmental risks hampers insurance market.

Insurance is an accessible, affordable and mature instrument for ensuring a rapid and responsible remedy of environmental damage. But insurance can play a substantial role also in risk prevention. To this end, governments and insurers may enter mutually beneficial partnerships in terms of (capacity for) a better environmental risk assessment and enhanced financial protections against insolvency as a result of excessive costs of environmental restoration. A well-targeted information campaign on national scale may help to improve the low perception of environmental risks, these a central element of businesses' responsible management.

Insurers should further develop skills and knowledge about their clients' needs and processes that may harm environment. Insurers should know what products and processes applied by their clients, and the potential environmental harm these can cause, despite the very technical and specialised nature of the WTP operation. Insurance may be harnessed for the sake of risk prevention, although the insurers may not have a sufficient knowledge on how this could be achieved. Insurance sector has the potential to set-off a step change, offering a better suitable coverage for operators, and introducing financial incentive for risk reduction. Insurance policies could play a role in the portfolio of green financing instruments.

The government can help to animate insurance markets, for example by making the insurance cover mandatory for certain industrial sectors. A regulatory reform, based on the experiences gained in the Veneto region, may bring about positive results. In countries where a mandatory insurance was introduced, positive outcomes have been observed in terms of market size and financial protection. The introduction of compulsory insurance policy should be accompanied by a reform of the environmental authorization criteria, which are presently not aligned with criteria of risk insurability. It is important to prevent that authorised industrial activities become uninsurable. The costs of mandatory insurance could be compensated by, or bundled with environmental taxation. It seems beneficial to lower the value-added tax on environmental insurance, and compel disclosure of risks that can lead to substantial environmental harm.

A close cooperation between governments and insurance industry should be focused also on the identification of viable solutions and mutual support for the case of larger accidents, that insurers alone cannot master. A public-private partnership is a favourable solution to risk associated with very low probability of occurrence and very high costs. These risks are currently not regulated and the damage caused by 'a natural phenomenon of exceptional,

inevitable and irresistible character' (Article 4) are exempted from the scope of the ELD. A possible solution for these risks may be integration of different instruments, suitable for all environmental liability challenges. A single instrument will be not sufficient to cover all potential environmental risks, while a combination of insurance and a national or regional guarantee fund, or other financial guarantee instruments, could be a valid solution.

It is important that public and private sectors make a real effort to cooperate and implement suitable financial instruments and solutions that protect companies from insolvency and at the same time incentivise better risk prevention. On-going climate change may further amplify the risk and better solutions are urgently needed.

5.4 EU level implementation

Preservation of healthy natural environment and reduction of the negative impacts stemming from human activities, in particular industrial production, are among the central goals of the EU environmental policies. European environmental legislation European Union provides indications for the introduction of environmental issue in the national legislations, and the ELD is an example of this effort. The polluter-pays-principle is the base of the European directive that promotes and develops remediation and restoration measures for environmental disasters and that encourages the use of financial security instruments.

In 2017, the European Commission released a report summarising the outcomes of an in-depth review of European environmental legislation and its transposition by the EU member states (EC, 2017a). The review addressed different fields of environmental management, and highlighted best practices as well as outstanding challenges identified in each member state. The report made concrete suggestion for future improvement.

From among the common causes for delayed or incomplete implementation of Union's environmental law, which also pertains to ELD, those that should be highlighted include lack of coordination between various authorities on each level of administrative competence, insufficient resources, data and knowledge gaps, non-effective enforcement and integration across environmental policies. The main evidences underlined the necessity of: (i) a more structured dialogue with the MS to better understand every specific need, (ii) a tailored support for expert exchanges in the MS to improve a mutual learning and to share solutions, (iii) strategic discussion at the European and national level to improve the EU environmental rules.

Focussing on the Italian experience, analysed in the Italian report (EC, 2017b), the fragmentation of competencies at regional and local levels makes the implementation of environmental policies problematic. Environmental liability and financial security need a substantial improvement. The information to the businesses operators is incomplete, both for the insurance instruments and for the ELD provisions. The effectiveness of the ELD requires proactive initiative, as the establishment of a national register for environmental incidents and the provision of national guidance. An important effort should be taken in the financial security sector, to improve the widespread of environmental insurance and guarantees taken by the businesses. To do that, it could be important to have more

transparency on the structure of compliance assurance and on the methods used to address environmental significant risks.

In the 2013 Italian experience report on the ELD, required by the Directive itself (art. 18, ELD), Italy asked for more specific and standard provisions for the Directive implementation. Now, it is clear that Europe has a fundamental role to have a more successful result in the implementation of the directives, guiding the single Member States to find the more effective strategies, cooperating together. A closer cooperation within the Europe and the countries help in the identification of the different needs and of the specific and common solutions.

This is particularly important thinking about the climate change which requires an important effort to European Union to find solutions at international level, to train the single countries to face these new scenarios, to implement a common strategy at a wider level. There are different programmes and purposes working on these issues, especially to highlight the potential risks in industrial sector connected to the climate change, for example the "Climate Risk Disclosure Project". It is important to arise the industrial awareness about this topic, to change the management asset in term of environmental risk and to increase actions for financial security and remediation measures. A large effort is required to lead these initiatives, instruments and project to a wider public, including both major and small-medium businesses.

5.5 Further researches

There are many elements of good practice revealed and analysed in depth in my thesis. However, further research should be conducted to fill the data and knowledge gaps, and to better explore institutional preconditions and comparative advantages (and drawbacks) of the various financial and economic instruments discussed in the chapter 2.

It is important to gather experts, researches, authorities, industrial operators and stakeholders to make these solutions a reality. Improved, WTP-specific environmental risk assessments serve different goals; it should inform WTP authorisation, help to determine the financial requirements that ensure compliance with environmental liability; and chose cost-effective risk mitigation actions.

Further researches should help to develop a standard assessment model and methods to evaluate the environmental risks arising from the WTP operation. Assessment of risks should address all environmental components affected, and the possible propagation of harm through web of ecological interactions. This standard model should be adaptable to different types of WTP and substances stored. This is important to better categorize the risks before a damage occurs. A proper identification and characterisation of risks is important for this purpose, and essential for assessing the monetary value of environmental harm/restoration which is fundamental designing effective financial protection instruments.

The first step to achieve the above is an improved data collection with respect to industrial accidents, environmental remediation and restoration costs, environmental matrices, and sources of risk. The analysis done should be extended to the evaluation of the natural hazards coverage, the implementation and the efficiency of the financial instruments to underpin the

damage caused by natural extreme events. This should include the climate change issues and identify actions to reduce disaster risk, especially in the fragile Italian territory, avoiding large losses in term of economic, environmental, and social values.

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ANNEX I

Survey: Insurance for Environmental Damage

The following survey examines the insurance experts' opinion on the available insurance instruments for the environmental damage.

The survey is part of the research study for my Master's Thesis in Environmental Sciences at Ca' Foscari University of Venice, supervised by Prof. Antonio Marcomini and Jaroslav Mysiak.

The thesis studies the financial guarantee and insurance instruments for the environmental damage, aiming to analyse their availability, use and efficiency, to underline opportunities and threats in their application and the possible implementation for the development of this market.

To achieve a whole result, the insurance experts' opinions are a fundamental part of the thesis.

I would thank you for your collaboration and support.
I am available for any other clarification and discussion.

Andrea Staccione

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Section A: Environmental Damage

1. Are the business operators aware of their liability for the potential environmental damage caused by their activities, as defined in the Environmental Liability Directive (2004/35/CE) for the prevention and restoration of environmental damage, transposed in Italy with the Legislative Decree 152/2006 part VI?

   Not aware [1] [2] [3] [4] [5] Completed aware

2. Do the aware businesses protect themselves sufficiently from the potential risks involved?

   ☐ Yes, they have a complete insurance coverage

   ☐ In part, they have a partial insurance coverage

   ☐ No, they don't have any insurance coverage.

   Comments:

   _____
   _____
   _____

3. How much relevance is given by the businesses to the environmental damage themes?

   None [1] [2] [3] [4] [5] Very High

   Comments:

   _____
   _____
   _____

Section B: Current Market and Available Instruments

4. How much relevance is given by the insurance companies to the market related to the environmental damage?

   None [1] [2] [3] [4] [5] Very High

5. Do the specific insurance instruments available for the environmental damage take into account the peculiar needs of the businesses? (Such as risk characteristics, frequency, quantification and persistence of damage, environmental conditions and potential environmental comparts involved...)

   ☐ Yes, completely

   ☐ Partially

   ☐ No, there is any attention

   Comments:

   _____
   _____
   _____

6. To what extent could be strengthened the development of specific solutions for the environmental damage?

   None [1] [2] [3] [4] [5] Very High

   If the development could be strengthened, how?

   _____
   _____
   _____
   _____

7. What are the limitations of the currently available insurance instruments for the environmental damage, in term of efficacy and adequacy?

_____
_____
_____
_____

8. What are the insurance solutions available for the environmental damage with major relevance, considering the increasing risks related to the climate change and to the economic and social changing?

_____
_____
_____
_____

Section C: Company's Experience

9. What are the solutions offered by your company to insure environmental damage?

_____
_____
_____
_____

10. How extended is the demand of insurance solutions for environmental damage?

Absent [1] [2] [3] [4] [5] Very High

11. Have you ever been in a situation in which it was not possible to satisfy the customer insurance request?

☐ Yes

☐ No

Comments:

_____
_____
_____

12. Providing suitable a solution to the costumers, how difficult is to evaluate the environmental damage properly?

Any Difficulty [1] [2] [3] [4] [5] High Difficulty

Comments:

_____
_____
_____

Section D: Opportunities and Threats

13. Which are the toughest treats to the efficient insurance instruments development for the environment?

- ☐ Inadequate Italian legislation
- ☐ Absence of a compensation participation of the State for the damage caused by extraordinary events
- ☐ Inability to evaluate the damage
- ☐ Scarce interest by the businesses
- ☐ Scarce interest by the insurance company
- ☐ Coverage cap too high
- ☐ Others

14. How the government could encourage the development of the insurance market for the environmental damage?

_____
_____
_____
_____

Section E: Company Details

15. What insurance company do you work for?

_____

16. Which geographic area does the company work for?

_____

17. How many insurance policies have been stipulate by your company?

_____

18. What kind of policy to insure environmental damage does your company offer?

_____

ANNEX II

Venice MC Waste Disposal and Treatment Data.

Section A: Plants details

ID	Company Name	Address	Municipality	Prcedure
1	Baldan Recuperi E Trattamenti S.R.L.	Via Marzabotto 28	Campagna Lupia	AUA
2	Idea S.R.L.	Via Marzabotto 18	Campagna Lupia	AUA
3	Maniero Luigi S.R.L.	Via Dell'industria	Campagna Lupia	Ordinary
4	Menin & Busatto S.N.C.	Via 1° Maggio 110	Campagna Lupia	Simplified
5	Recycling Di Ferrara Daniel	Via Dell'artigianato 32	Campagna Lupia	Ordinary
6	Sd Laguna Pallet S.R.L.	Via Dell'industria 18	Campagna Lupia	Simplified
7	Servizi Ecologici Brenta S.R.L.	Via Colombo 1	Campagna Lupia	AUA
8	Superbeton S.P.A.	Via Marzabotto 176	Campagna Lupia	AUA
9	Veneta Fert-Cart S.N.C. Di Canton P.I. Marileno & C.	Via XXV Aprile 13	Campagna Lupia	Ordinary
10	Autodemolizioni Toniolo Ugo	Via Lova 147	Campolongo Maggiore	Ordinary
11	Autodemolizioni Gobbi S.N.C. Di Gobbi Giovanni & C.	Via Nuova 23	Camponogara	Ordinary
12	Metal S.N.C. Di Ditadi Moreno E Refellato Matteo	Via Dante Alighieri 24/E	Camponogara	Ordinary
13	Tav Rottami Di Tassetto Vanni	Via Dell'industria 55	Camponogara	Ordinary
14	Zara Franco	Via Dell'industria 29	Camponogara	Simplified
15	Azienda Servizi Integrati - A.S.I. S.P.A.	Via Traghete 101	Caorle	Ordinary
16	Giulia Metalli S.R.L.	Via Triangolo 8d	Caorle	Simplified
17	Impresa Manutenzioni Giro Luciano Guerrino S.R.L.	Via Trieste	Caorle	Ordinary
18	Marifer S.R.L.	Via Triangolo	Caorle	AUA
19	Rossi Mario Pietro & C. S.N.C.	Strada Sansonessa 71	Caorle	Simplified
20	Rossi Mario Pietro & C. S.N.C.	Strada Sansonessa 71	Caorle	Ordinary
21	Veneziana Energie Risorse Idiriche Territorio Ambiente Servizi - V.E.R.I.T.A.S. S.P.A.	Via Fausta 222	Cavallino - Treporti	Ordinary
22	Verde Ambiente S.R.L.	Via Fausta - Fg. 40 Mapp. 354	Cavallino - Treporti	Simplified

ID	Company Name	Address	Municipality	Prcedure
23	Verde Ambiente S.R.L.	Via Sette Casoni 14	Cavallino - Treporti	AUA
24	Tommasin Angelo	Via Dell'artigianato 11	Cavarzere	AUA
25	Mambretti Metalli S.R.L.	Via 1° Maggio 440/A	Ceggia	AUA
26	Pasquon Stefano	Via Formighè 621	Ceggia	Ordinary
27	Tras-Eco S.R.L.	Via Tagliamento 377/A	Ceggia	Ordinary
28	Doria Servizi Ecologici Srl	Via Maestri Del Lavoro	Chioggia	Simplified
29	Eco-Stile S.R.L.	S.S. Romea 39	Chioggia	Ordinary
30	Scavi E Trasporti Meo Di Boscolo Marino Meo & C. Snc	Via Val Da Rio	Chioggia	AUA
31	Veneta Ecorecuperi Sas Di Miotto Leopoldo Fernando & C.	Via Valletta	Cona	Ordinary
32	Adriatica Fertilizzanti Di Fuin Andrea E Fabio & C. S.N.C.	Via Della Torba 50	Concordia Sagittaria	AUA
33	Azienda Agricola Inti Di Zarpellon Cesar	Via Levasa 481	Concordia Sagittaria	AUA
34	Officina 3m S.N.C.	Via Aquileia 171	Concordia Sagittaria	Ordinary
35	In Log Service S.R.L.	Via Istituto Santa Maria Della Pietà 6	Dese	Simplified
36	Ecosider S.R.L.	Via Del Lavoro 2	Dolo	Simplified
37	Azienda Servizi Integrati - A.S.I. S.P.A.	Via Dei Pioppi 1	Eraclea	Ordinary
38	Edilizia Doretto E Buoso S.R.L.	Via Turati 57	Eraclea	AUA
39	General Beton Triveneta S.P.A.	Via Delle Industrie 9/A	Eraclea	AUA
40	General Beton Triveneta S.P.A.	Via M. L. King 5	Fossalta Di Portogruaro	Simplified
41	Mb Servizi S.R.L.	Via M.L. King 9/L	Fossalta Di Portogruaro	Ordinary
42	Compagno Emilio	Via IV Novembre 24	Fossò	Ordinary
43	Ecodreaming S.R.L.	Via IX Strada 26	Fossò	Ordinary
44	Ecolando S.R.L.	Via IX Strada 109	Fossò	AIA
45	Edilizia Bert Di Berto Giovanni & Orlando S.N.C.	Via Callesette 58	Fossò	Ordinary
45	Edilizia Bert Di Berto Giovanni & Orlando S.N.C.	Via Callesette 58	Fossò	Ordinary
46	Invemet S.R.L.	Via VIII Strada 15	Fossò	Ordinary
47	Maniero Gianni	Via Alessandro Volta 7	Fossò	AUA
48	Nec New Ecology S.R.L.	Via IX Strada 115	Fossò	AIA
49	Nuova Ecologica 2000 S.R.L.	Via VII Strada 9	Fossò	Ordinary
50	Azienda Servizi Integrati - A.S.I. S.P.A.	Via Aleardo Aleardi 46	Jesolo	Ordinary
51	C.I.M.P.S. Consorzio Inerti Materie Prime Secondarie S.R.L.	Via Ettore Bugatti 61	Jesolo	Ordinary

ID	Company Name	Address	Municipality	Prcedure
52	Eco Flumen Srl	Via Bartolomeo Cristofori 10	Jesolo	AIA
53	Rizzetto Livio	Via Meucci 17	Jesolo	AUA
54	Sari Gianni S.R.L.	Via Correr 72	Jesolo	Ordinary
55	Sari Gianni S.R.L.	Via Correr 72	Jesolo	Ordinary
56	Superbeton S.P.A.	Via B. Cristofori	Jesolo	Simplified
57	Biasuzzi Cave S.P.A	Via Piailoi 21	Marcon	Simplified
58	Ecoservizi S.R.L.	Via Delle Industrie 59	Marcon	Simplified
59	Rein S.R.L.	Via Alta 3/A	Marcon	Simplified
60	Fassina Diego & C. S.N.C.	Via Olmo 93	Martellago	Ordinary
61	Le Sac Di Tavella Luciana	Via F. Baracca 28/A	Martellago	AUA
62	Ni.Ce Sas Di Ceolin Nico & C.	Via 1° Maggio 5	Martellago	Simplified
63	Pellizzon Agriservice S.N.C.	Via Boschi 10 - Fg. 2 Mapp. 314	Martellago	Simplified
64	Pellizzon Agriservice S.N.C.	Via Boschi 10 - Fg. 2 Mapp. 318-319	Martellago	Simplified
65	Pellizzon Agriservice S.N.C.	Via Boschi 10 - Fg. 2 Mapp.360-364	Martellago	Simplified
66	Pellizzon Giampaolo, Gianluca E Pierantonio S.S.	Via Roviego Snc	Martellago	Simplified
67	Lazzarato Gianluca & Stefano & C. S.A.S.	Via Roma 220	Meolo	Ordinary
68	Euroveneta Fusti S.R.L.	Via Maestri Del Lavoro 25	Mira	Ordinary
69	Nalon S.R.L.	Via Romea 14	Mira	AUA
70	Nalon S.R.L.	Via Sambruson 14	Mira	AUA
71	Plastic-One S.R.L.	Via Maestri Del Lavoro 10	Mira	Simplified
72	Ballarin S.N.C.	Via Taglio Sinistro 63/A	Mirano	AUA
73	Centro Plastica S.R.L.	Via Galilei 10	Mirano	Ordinary
74	Epiu' S.R.L.	Via Chiesa 7	Mirano	AUA
75	Marchesin Giovanni	Via G. Saragat 13	Mirano	Simplified
76	Veneziana Energie Risorse Idiriche Territorio Ambiente Servizi - V.E.R.I.T.A.S. S.P.A.	Viale Venezia 3	Mirano	AIA
77	Vivian S.R.L.	Via Taglio Sx 159/A	Mirano	Ordinary
78	Zanetti Narciso	Via Don Orione 10	Mirano	AUA
79	Agro T&C Di Trevisan E Casagrande S.N.C.	Via Mutilati 5	Musile Di Piave	Ordinary
80	Ecopate' S.R.L.	Via Dell’artigianato 41	Musile Di Piave	Ordinary

ID	Company Name	Address	Municipality	Prcedure
81	Re.Te S.R.L.	Via Dell'artigianato 21	Musile Di Piave	Ordinary
82	Societa' Agricola Agrotec 2 Sarl	Mutilati 5	Musile Di Piave	Simplified
83	Venetafusti Di Maritan Walter & C. S.N.C.	Via Emilia 8	Musile Di Piave	Ordinary
84	Betonrossi S.P.A.	Via Pacinotti 12	Noale	AUA
85	Cosmo Ambiente S.R.L.	Via Feltrin 125	Noale	Ordinary
86	Cosmo Ambiente S.R.L.	Via Mestrina 46x	Noale	AIA
87	Scatamburlo Pietro	Via Brugnole 94	Noale	AUA
88	Trevisan S.P.A.	Via Meucci 15	Noale	Ordinary
89	I.F.A.F. - Impresa Facchetti Adolfo E Figli S.P.A.	Via Clanova 105	Noventa Di Piave	AUA
90	Nekta Ambiente S.R.L.	Via Majorana 5	Noventa Di Piave	AIA
91	Poletto Aldo S.R.L.	Via Pacinotti 6	Noventa Di Piave	AIA
92	Superbeton S.P.A.	Via Copernico	Noventa Di Piave	AUA
93	Co.Ma.Tess Dei F.Lli Lazzarin Adriano Andrea & Giulio S.N.C.	Via Dell’industria 25	Pianiga	Simplified
94	Commerciale Rottami S.R.L.	Via Cavin Maggiore 213/A	Pianiga	Ordinary
95	Eurekambiente S.R.L.	Via Marinoni 80	Pianiga	Ordinary
96	F.Lli Demo Costruzioni S.R.L.	Via Casai Del Taù 54	Portogruaro	Simplified
97	Infanti & De Faveri S.N.C.	Via Bassie 44	Portogruaro	Ordinary
98	Pivetta Roberto	Viale Pordenone 75	Portogruaro	Simplified
99	Superbeton S.P.A.	Via S. Isidoro	Portogruaro	Simplified
100	Trevisan Carlo & C. S.N.C.	Via Fossalta 48	Portogruaro	AUA
101	Zai S.R.L.	Via E. Mattei 14	Portogruaro	AIA
102	Azienda Servizi Pubblici Sile - Piave S.P.A.	Via Guglielmo Marconi	Quarto D'altino	Ordinary
103	Depuracque Servizi S.R.L.	Via Roma 145	Salzano	AIA
104	Eco-Metal S.R.L.	Via Dell’artigianato 26	Salzano	Ordinary
105	Pigozzo Scavi Di Pigozzo Lino & C. S.N.C.	Via Villatenga 167	Salzano	Ordinary
106	Azienda Servizi Integrati - A.S.I. S.P.A.	Via Tronco 4	San Donà Di Piave	Ordinary
107	Eco Service S.R.L.	Via Revine 8	San Donà Di Piave	Ordinary
108	I.S.E. Italiana Servizi Ecologici S.R.L:	Via Della Francesca 56	San Donà Di Piave	Ordinary
109	Ilsa Pacifici Remo S.P.A	Via Trezza 19	San Donà Di Piave	Simplified
110	Maritan Zefferino	Via Grassaga 37	San Donà Di Piave	Ordinary

ID	Company Name	Address	Municipality	Prcedure
111	Se.Fi. Ambiente S.R.L.	Via Argine Di Mezzo 25	San Donà Di Piave	AIA
112	Autodemolizioni San Michele Di Gandolfi Luca & C. S.N.C.	Via Dell'industria 17	San Michele Al Tagliamento	Ordinary
113	Calcestruzzi Zillo S.P.A.	Via Della Pianca	San Michele Al Tagliamento	Simplified
114	Canevarolo Vittorio	Via Prati Nuovi - Fg. 56 Mapp. 86	San Michele Al Tagliamento	Simplified
118	Canevarolo Vittorio	Via Del Faro - Fg. 50 Mpp. 478	San Michele Al Tagliamento	Simplified
120	Canevarolo Vittorio	Via Prati Nuovi - Fg. 56 Mapp. 58	San Michele Al Tagliamento	Simplified
124	Canevarolo Vittorio	Via Capodistria - Fg. 50 Mapp.496	San Michele Al Tagliamento	Simplified
127	Gesteco Spa	Via Molinovo 4	San Michele Al Tagliamento	AIA
128	Livenza Tagliamento Acque S.P.A.	Via Parenzo	San Michele Al Tagliamento	Ordinary
129	F.Lli Livieri Snc Di Livieri Bruno E C.	Via Ferraris 1	Santa Maria Di Sala	Simplified
130	Rexpol S.R.L.	Via E. Fermi 14-16	Santa Maria Di Sala	AUA
131	Riviera Rottami Di Giampiero Livieri & C. S.N.C.	Via Ferraris 1	Santa Maria Di Sala	Aua
132	Stocco & Tognon Fonderie S.R.L.	Via Grandi 11	Santa Maria Di Sala	Simplified
133	Co.Met.Fer S.R.L.	Via Interporto 5	Santo Stino Di Livenza	Ordinary
134	Ecolfer S.R.L.	Via Lino Zanchetto 29/31	Santo Stino Di Livenza	Ordinary
135	Ecolfer S.R.L.	Via Lino Zanchetto 8	Santo Stino Di Livenza	Ordinary
136	Kada S.R.L.	Via Lino Zanchetto 6	Santo Stino Di Livenza	Ordinary
137	Unic Di Bogus Dorina	Via L. Grassi 6	Santo Stino Di Livenza	Aua
138	Acqua Minerale San Benedetto	Viale Kennedy 65	Scorzè	Aia
139	Guerra Renato Azienda Agricola	Via San Paolo 35	Scorzè	Ordinary
140	Tronchin S.R.L.	Via Canaletto 18	Scorzè	Ordinary
141	Femio Luca & C. S.N.C.	Via Negrelli 38	Spinea	Simplified

ID	Company Name	Address	Municipality	Prcedure
142	Xpo Supply Chain Consumer Goods Italy S.P.A.	Via Delle Industrie 10/D	Spinea	Aua
143	Re Aldo & C. S.A.S.	Via Dell’artigianato 14	Teglio Veneto	Ordinary
144	Giglio S.R.L.	Via Triestina	Torre Di Mosto	Ordinary
145	Superbeton S.P.A.	Via Boccafossa 49	Torre Di Mosto	Simplified
146	Aim Vicenza S.P.A.	Via Righi 10 - Porto Marghera	Venezia	Aia
147	Alles - Azienda Lavori Lagunari Escao Smaltimenti S.P.A.	Via Dell’elettronica 5	Venezia	Aia
148	Biasuzzi Cave S.P.A	Via Della Tecnica 6	Venezia	Simplified
149	Boscolo Bielo Ivano S.R.L.	Canale Della Scomenzera 1	Venezia	Ordinary
150	Busolin S.R.L.	Strada Della Motorizzazioni Civile 4	Venezia	Aua
151	Calcestruzzi Zillo S.P.A.	Via Paganello 9	Venezia	Aua
152	Cementi Candeo S.P.A.	Via Dell’elettricità 21	Venezia	Aua
153	Colombara S.R.L.	Via Malcontenta 28	Venezia	Ordinary
154	Ecoprogetto Venezia S.R.L.	Via Della Geologia 31	Venezia	Aia
155	Ecoprogetto Venezia S.R.L.	Via Della Geologia 31	Venezia	Aia
156	Ecoricicli Veritas S.R.L.	Via Della Geologia	Venezia	Ordinary
157	Ecoricicli Veritas S.R.L.	Via Della Geologia	Venezia	Ordinary
158	Enel Produzione S.P.A.	Via Dei Cantieri 5 - Loc. Fusina	Venezia	Aia
159	Enel Produzione Spa	Via Dell’elettronica 9	Venezia	Ordinary
160	Epiu' S.R.L.	Via Giustizia 18	Venezia	Simplified
161	F.Lli Artuso Group S.R.L.	Via Martiri Della Libertà 373	Venezia	Ordinary
162	Ferrarese S.R.L.	Via Bottenigo 84	Venezia	Simplified
163	Guardie Ai Fuochi Del Porto Di Venezia - Societa' Cooperativa	Via F.Lli Bandiera 55	Venezia	Aia
164	Il Grillo Societa' Cooperativa Sociale	Via Castellana 177/B	Venezia	Ordinary
165	Ironstone S.R.L.	Via Della Chimica 5	Venezia	Simplified
166	Ma.Ba S.N.C. Di Marchiori Franco & Manca Maurizio	Via Santa Barbara 13	Venezia	Aua
167	Ma.Ce.	Via Dell’Avena 10	Venezia	Ordinary
168	Metalrcycling Venice S.R.L.	Via Dell'Elettronica	Venezia	Aua
169	Old Beton S.P.A.	Via Della Tecnica 6	Venezia	Ordinary
170	Prevato Leonida	Via Martiri Della Libertà 155	Venezia	Aua
171	S.G.S S.R.L, Societa' Gestione Sacche	Sacca San Mattia	Venezia	Ordinary

ID	Company Name	Address	Municipality	Prcedure
172	Sifagest S.C.A.R.L.	Via Della Chimica 5	Venezia	Aia
173	Simar - Societa' Metalli Marghera S.P.A.	Via Delle Industrie 22	Venezia	Aia
174	Superbeton S.P.A.	Via Triestina 163	Venezia	Simplified
175	Superbeton S.P.A.	Via Della Tecnica 6	Venezia	Simplified
176	Tecnoecology Srl	Via Della Geologia 33	Venezia	Ordinary
177	Terminal Intermodale Adriatico Srl - Rottami Ferrosi	Via Dell'elettricità 21	Venezia	Ordinary
178	Terminal Intermodale Adriatico Srl - Silos 28-33	Via Dell'elettricità 21	Venezia	Ordinary
179	Terminal Intermodale Adriatico Srl - Silos 5	Via Dell'elettricità 21	Venezia	Ordinary
180	Terminal Rinfuse Venezia S.P.A.	Molo B	Venezia	Ordinary
181	Tiso Alfredi E Figli S.R.L.	Via Malamocco 84/A	Venezia	AUA
182	Veneziana Energie Risorse Idiriche Territorio Ambiente Servizi - V.E.R.I.T.A.S. S.P.A.	Via Galba 10	Venezia	Ordinary
183	Veneziana Energie Risorse Idiriche Territorio Ambiente Servizi - V.E.R.I.T.A.S. S.P.A.	Via Dei Cantieri 9	Venezia	Ordinary
184	Veneziana Energie Risorse Idiriche Territorio Ambiente Servizi - V.E.R.I.T.A.S. S.P.A.	Via Dei Cantieri 9 - Loc. Fusina	Venezia	AIA
185	Volpato S.R.L.	Via Della Tecnica 9	Venezia	Ordinary
186	Zac S.R.L.	Via Degli Abeti 17	Venezia	Ordinary
187	Imball Nord S.R.L.	Via Dell'artigianato 12	Vigonovo	Simplified
188	Imball Nord S.R.L.	Via Del Lavoro	Vigonovo	AUA
189	L.M. Livieri Migliorini Servizi Ecologici S.R.L.	Via II Strada 25	Vigonovo	Ordinary
190	Maniero Valentino Di Maniero Andrea E Gaetano S.N.C.	Via 1° Strada 17	Vigonovo	Simplified
191	Maniero Valentino S.N.C. Di Maniero Andrea E Gaetano	Via I Strada 28/30	Vigonovo	Ordinary

Section B: Waste Stored and Treated

ID	Waste Typology	Total Stored Waste (Tons)	Hazardous Stored Waste (Tons)	Not Hazardous Stored Waste (Tons)	Yearly Waste Treated (Tons/Years)
1	Inert	1370	0	1370	25000
2	Inert	13640	0	13640	60000
3	Metals	1680	1557	123	52000
4	Inert	1300	0	1300	14999
5	Plastic	8	8	0	2700
6	Wood	100	0	100	2571
7	Plant Oil	9	0	9	2000
8	Combustion Ash	50	0	50	2500
9	Mixture	650	650	0	25000
10	Car Wrecking	1400	100	1300	2400
11	Car Wrecking	426	56	370	
12	Metals	925	900	25	11250
13	Metals	110	110	0	2200
14	Metals	209	0	209	5500
15	Water Treatment Plant	85	85	0	
16	Metals	409	0	409	2960
17	Mixture	29	29	0	500
18	Metals	409	0	409	2980
19	Inert	200	0	200	6000
20	Inert	325	325	0	18120
21	Water Treatment Plant	80	80	0	
22	Composting	160	0	160	999
23	Mixture	1602	0	1602	8999
24	Inert	1500	0	1500	30000
25	Metals	96	0	96	2600
26	Composting	117	117	0	2700
27	Plant Oil	261	261	0	2520

ID	Waste Typology	Total Stored Waste (Tons)	Hazardous Stored Waste (Tons)	Not Hazardous Stored Waste (Tons)	Yearly Waste Treated (Tons/Years)
28	Mixture	500	0	500	4800
29	Soil	0	0	0	0
30	Inert	1130	0	1130	28500
31	Car Wrecking	1680	230	1450	5000
32	Composting	300	0	300	2990
33	Textile	3	0	3	90
34	Car Wrecking	339	11	328	1965
35	Packaging	96	0	96	2990
36	Metals	4252	0	4252	59820
37	Water Treatment Plant	55	55	0	
38	Inert	1990	0	1990	2990
39	Combustion Ash	480	0	480	2100
40	Combustion Ash	120	0	120	2900
41	Inert	4800	4800	0	31300
42	Inert	850	850	0	25000
43	Raee (Electrical)	800	500	300	28500
44	Mixture	840	120	720	
45	Inert	520	520	0	25000
46	Catalyst	106	66	40	5950
47	Metals	155	0	155	4500
48	Raee (Electrical)	1200	500	700	
49	Mixture	400	400	0	33750
50	Water Treatment Plant	130	130	0	
51	Inert	14050	14050	0	90000
52	Plant Oil	480	240	240	
53	Mixture	100	0	100	2900
54	Car Wrecking	275	50	225	7800
55	Mixture	2292	2292	0	25000

ID	Waste Typology	Total Stored Waste (Tons)	Hazardous Stored Waste (Tons)	Not Hazardous Stored Waste (Tons)	Yearly Waste Treated (Tons/Years)
56	Combustion Ash	980	0	980	6500
57	Combustion Ash	100	0	100	2600
58	Plant Oil	8	0	8	720
59	Plastic	45	0	45	3000
60	Inert	1410	1410	0	25000
61	Plastic	6	0	6	2990
62	Mixture	50	0	50	150
63	Composting	110	0	110	999
64	Composting	100	0	100	999
65	Composting	100	0	100	999
66	Composting	100	0	100	999
67	Inert	2050	2050	0	22500
68	Drums Washing	120	120	0	
69	Inert	30	0	30	9025
70	Inert	30	0	30	9025
71	Plastic	65	0	65	6400
72	Mixture	85	0	85	2990
73	Plastic	450	450	0	4500
74	Inert	60	0	60	2999
75	Metals	30	0	30	2100
76	Water Treatment Plant	1414	1345	69	
77	Car Wrecking	728	640	88	25000
78	Composting	100	0	100	2500
79	Composting	400	0	400	10943
80	Glass	5845	5845	0	
81	Cartridges	38	19	20	1352
82	Composting	200	0	200	999
83	Drums Washing	33	18	15	375

ID	Waste Typology	Total Stored Waste (Tons)	Hazardous Stored Waste (Tons)	Not Hazardous Stored Waste (Tons)	Yearly Waste Treated (Tons/Years)
84	Combustion Ash	200	0	200	3500
85	Inert	2130	2130	0	
86	Inert	21500	9000	12500	1252400
87	Composting	50	0	50	999
88	Paper	3080	3076	4	285000
89	Inert	4760	0	4760	10000
90	Mixture	2300	2300	0	200000
91	Chemicals	503	385	118	
92	Combustion Ash	90	0	90	2500
93	Textile	12	0	12	1600
94	Metals	625	623	2	25000
95	Mixture	250	245	5	10000
96	Inert	4500	0	4500	68000
97	Battery	560	350	210	25000
98	Mixture	1240	0	1240	22329
99	Combustion Ash	35	0	35	2500
100	Inert	620	0	620	11720
101	Mixture	3000	1000	2000	147500
102	Water Treatment Plant	105	105	0	
103	Physico-Chemical Treatment	3400	2200	1200	180000
104	Metals	560	560	0	27456
105	Inert	5050	5050	0	25000
106	Water Treatment Plant	85	85	0	
107	Medical	7	3	4	
108	Medical	7	0	7	
109	Inert	250	0	250	5990
110	Drums Washing	120	120	0	25000
111	Oil	2100	1200	900	
112	Car Wrecking	544	43	500	2500

ID	Waste Typology	Total Stored Waste (Tons)	Hazardous Stored Waste (Tons)	Not Hazardous Stored Waste (Tons)	Yearly Waste Treated (Tons/Years)
113	Combustion Ash	1150	0	1150	2000
114	Composting	150	0	150	999
118	Composting	150	0	150	999
120	Composting	150	0	150	1000
124	Composting	150	0	150	999
127	Mixture	330	0	330	65000
128	Water Treatment Plant	2750	2750	0	
129	Mixture	200	0	200	4500
130	Plastic	4	0	4	2900
131	Metals	970	0	970	12000
132	Metals	37	7	30	1430
133	Metals	35000	35000	0	200000
134	Mixture	1140	1100	40	25000
135	Mixture	1850	1800	50	37500
136	Mixture	610	610	0	40000
137	Textile	5	0	5	1274
138	Plastic	202	202	0	26800
139	Composting	300	300	0	9000
140	Composting	400	400	0	10500
141	Mixture	50	0	50	2999
142	Packaging	56	0	56	2500
143	Inert	1555	1555	0	211200
144	Catalyst	85	85	0	825
145	Combustion Ash	1890	0	1890	6500
146	Mixture	300	300	0	
147	Mixture	6000	0	6000	181500
148	Combustion Ash	1770	0	1770	6575
149	Mixture	437	437	0	81650
150	Mixture	260	0	260	13215

ID	Waste Typology	Total Stored Waste (Tons)	Hazardous Stored Waste (Tons)	Not Hazardous Stored Waste (Tons)	Yearly Waste Treated (Tons/Years)
151	Combustion Ash	120	0	120	2000
152	Combustion Ash	75	0	75	3000
153	Metals	1100	1100	0	30000
154	Waste-To-Energy Plant	0	0	0	
155	Secondary Solid Fluel (Css)	12174	24	12150	197000
156	Glass-Plastic-Metals	12000	12000	0	117504
157	Bulky Waste	695	695	0	28000
158	Own Production	3230	93	3138	
159	Own Production	1500	1500	0	45000
160	Inert	190	0	190	2999
161	Car Wrecking	1868	68	1800	
162	Metals	110	0	110	3150
163	Bilge Water	1040	1040	0	
164	Textile	240	0	240	7300
165	Metals	6800	0	6800	6800
166	Cartridges	0	0	0	1
167	Textile	24	24	0	1500
168	Metals	4215	0	4215	56340
169	Inert	750	750	0	
170	Inert	40	0	40	1680
171	Inert	550	550	0	
172	Sludge	3389	2854	535	
173	Metals	6570	4820	1750	41800
174	Combustion Ash	1010	0	1010	5990
175	Combustion Ash	65	0	65	3000
176	Inert	7500	7500	0	29000
177	Metals	15000	15000	0	400000
178	Combustion Ash	20000	20000	0	150000
179	Combustion Ash	6000	6000	0	100000

ID	Waste Typology	Total Stored Waste (Tons)	Hazardous Stored Waste (Tons)	Not Hazardous Stored Waste (Tons)	Yearly Waste Treated (Tons/Years)
180	Metals	30000	30000	0	
181	Inert	651	0	651	2000
182	Water Treatment Plant	50	50	0	
183	Water Treatment Plant	450	450	0	
184	Inert	1200	1200	0	30000
185	Car Wrecking	1460	160	1300	15000
186	Mixture	650	650	0	15000
187	Packaging	187	0	187	3495
188	Packaging	30	0	30	2800
189	Battery	330	0	330	
190	Mixture	1168	0	1168	5950
191	Mixture	640	640	0	25000

Section C: Financial Guarantees

ID	Insurance Company or Bank (Financial Guarantee)	Coverage Cap (€)	Insurance Coverage	Insurence Company (Insurance Policy)	Environmental Certification
1	Elba Assicurazioni Spa	41.100,00	No	-	No
2	Itas Mutua	76.760,00	No	-	No
3	Hdi Assicurazioni Spa	351.700,00	Yes	Hdi Assicurazioni Spa	No
4	Carige Assicurazioni Spa	90.000,00	No	-	No
5	Hdi Assicurazioni Spa	10.703,00	Yes	Hdi Assicurazioni Spa	No
6	Elba Assicurazioni Spa	22.000,00	No	-	No
7	Hdi Assicurazioni Spa	1.080,00	Yes	Hdi Assicurazioni Spa	ISO 14001
8	Axa Assicurazioni Spa	10.000,00	No	-	No
9	Unipolsai Assicurazioni Spa	143.000,00	Yes	Ras - Sun Insurance Office Ltd.	No
10	Coface S.A.	204.600,00	Yes	Hdi Assicurazioni Spa	ISO 14001
11	Unipolsai Assicurazioni Spa	103.000,00	Yes	Liguria Assicurazioni Spa	No
12	Banca Di Credito Cooperativo Del Veneziano Soc. Coop.	113.685,00	Yes	Generali Italia Spa	No
13	Liguria Assicurazioni Spa	24.200,00	Yes	Groupama	No
14	Italiana Assicurazioni Spa	8.580,00	Yes	Italiana Assicurazioni Spa	No
15	Unipolsai Assicurazioni Spa	17.000,00	Yes	Allianz Spa	No
16	Tua Assicurazioni Spa	90.002,00	Yes	Hdi Assicurazioni Spa	No
17	-	0,00	Yes	Reale Mutua Di Assicurazioni	No
18	Coface S.A.	11.928,00	Yes	Hdi Assicurazioni Spa	No
19	Elba Assicurazioni Spa	2.000,00	No	-	No
20	Elba Assicurazioni Spa	27.090,00	Yes	Unipol Assicurazioni Spa	No
21	Banca Intesa San Paolo Spa	16.000,00	Yes	Generali Italia Spa	No
22	Generali Italia Spa	32.000,00	Yes	Generali Italia Spa	No
23	Generali Italia Spa	66.340,00	Yes	Generali Italia Spa	No
24	Coface S.A.	25.000,00	No	-	No
25	Unicredit Spa	7.980,00	Yes	Reale Mutua Assicurazioni	No
26	Reale Mutua Di Assicurazioni	23.400,00	Yes	Reale Mutua Di Assicurazioni	No
27	Hdi Assicurazioni Spa	52.000,00	Yes	Hdi Assicurazioni Spa	No

ID	Insurance Company or Bank (Financial Guarantee)	Coverage Cap (€)	Insurance Coverage	Insurence Company (Insurance Policy)	Environmental Certification
28	Groupama Assicurazioni Spa	8.200,00	No	-	No
29	-	0,00	Yes	Hdi Assicurazioni Spa	ISO 14001
30	Elba Assicurazioni Spa	22.600,00	No	-	No
31	Gable Insurance A.G.	243.000,00	Yes	Liguria Assicurazioni Spa	ISO 14001
32	Coface S.A.	60.000,00	Yes	Generali Italia Spa	No
33	Banca Popolare Friuladria Spa	600,00	Yes	Allianz Spa	No
34	Reale Mutua Di Assicurazioni	71.065,00	Yes	Reale Mutua Di Assicurazioni	No
35	Vittoria Assicurazioni Spa	1.920,00	No	-	No
36	Italiana Assicurazioni Spa	995.500,00	Yes	Italiana Assicurazioni Spa	No
37	Unipolsai Assicurazioni Spa	11.000,00	Yes	Allianz Spa	No
38	Elba Assicurazioni Spa	64.845,00	No	-	No
39	Coface S.A.	9.600,00	No	-	No
40	Generali Italia Spa	26.400,00	No	-	No
41	Generali Italia Spa	49.300,00	Yes	Generali Italia Spa	No
42	Unipolsai Assicurazioni Spa	44.000,00	Yes	Fondiaria Sai Spa	No
43	Carige Assicurazioni Spa	150.000,00	Yes	Hdi Assicurazioni Spa	ISO 14001
44	Carige Assicurazioni Spa	200.884,71	Yes	-	ISO 14001
45	Milano Assicurazioni Spa	61.756,00	Yes	Milano Assicurazioni Spa	No
46	Reale Mutua Di Assicurazioni	9.300,00	Yes	Reale Mutua Di Assicurazioni	No
47	Amissima Assicurazioni	9.940,00	Yes	Hdi Assicurazioni Spa	No
48	Carige Assicurazioni Spa	234.000,00	Yes	Generali Italia Spa	ISO 14001
49	Amissima Assicurazioni Spa	88.000,00	Yes	Aig Europe S.A.	No
50	Unipolsai Assicurazioni Spa	26.000,00	Yes	Allianz Spa	No
51	Coface S.A.	1.668.000,00	Yes	Allianz Spa	No
52	Milano Assicurazioni Spa	168.000,00	Yes	Unipolsai	No
53	Coface S.A.	6.320,00	Yes	Generali Italia Spa	No
54	Alleanza Toro Spa	77.000,00	Yes	Hdi Assicurazioni Spa	No
55	Unipolsai Assicurazioni Spa	458.400,00	Yes	Hdi Assicurazioni Spa	No

ID	Insurance Company or Bank (Financial Guarantee)	Coverage Cap (€)	Insurance Coverage	Insurence Company (Insurance Policy)	Environmental Certification
56	Axa Assicurazioni Spa	215.600,00	No	-	No
57	Generali Italia Spa	22.000,00	No	-	No
58	Cassa Di Risparmio Di Venezia S.P.A.	1.760,00	Yes	Allianz Spa	No
59	Milano Assicurazioni Spa	9.900,00	No	-	No
60	Milano Assicurazioni Spa	310.200,00	Yes	Chartis Europe S.A.	No
61	Veneto Banca S.C.P.A.	112,00	No	-	No
62	Allianz Spa	11.000,00	No	-	No
63	Banca Santo Stefano - Credito Cooperativo	22.000,00	Yes	Fata Assicurazioni	No
64	Banca Santo Stefano - Credito Cooperativo	22.000,00	Yes	Fata Assicurazioni	No
65	Banca Santo Stefano - Credito Cooperativo	20.000,00	Yes	Fata Assicurazioni	No
66	Banca Santo Stefano - Credito Cooperativo	20.000,00	Yes	Fata Assicurazioni	No
67	Fata Assicurazioni Spa	30.000,00	Yes	Allianz Spa	No
68	Coface S.A.	60.717,00	Yes	Allianz Spa	ISO 14001
69	Intesa San Paolo Spa	301,00	No	-	No
70	Intesa San Paolo Spa	301,00	No	-	No
71	Hdi Assicurazioni Spa	5.260,00	Yes	Hdi Assicurazioni Spa	No
72	Elba Assicurazioni Spa	6.800,00	Yes	-	No
73	Generali Italia Spa	94.598,20	Yes	Generali Italia Spa	No
74	Unipolsai Assicurazioni Spa	600,00	No	-	No
75	Banca Popolare Friuladria Spa	600,00	No	-	No
76	Coface Sa	187.170,00	Yes	Generali Italia Spa	ISO 14001
77	Liguria Assicurazioni Spa	188.952,00	Yes	Allianz Spa	No
78	Fata Assicurazioni Danni Spa	20.000,00	Yes	Fata Assicurazioni	No
79	Generali Italia Spa	88.000,00	Yes	Generali Italia Spa	No
80	Coface S.A.	701.400,00	Yes	Hdi Assicurazioni Spa	ISO 14001
81	Carige Assicurazioni Spa	7.620,00	Yes	Allianz Spa	No
82	Generali Italia Spa	44.000,00	Yes	Generali Italia Spa	No
83	Milano Assicurazioni Spa	12.827,80	Yes	Aig Europe S.A.	No

ID	Insurance Company or Bank (Financial Guarantee)	Coverage Cap (€)	Insurance Coverage	Insurence Company (Insurance Policy)	Environmental Certification
84	Reale Mutua Assicurazioni	4.000,00	No	-	No
85	Generali Italia Spa	281.160,00	Yes	Generali Italia Spa	No
86	Generali Italia Spa	4.200.000,00	Yes	Generali Italia Spa	ISO 14001
87	Hdi Assicurazioni Spa	10.000,00	Yes	Fata Assicurazioni	No
88	Unipolsai Assicurazioni Spa + Banco Santo Stefano Credito Cooperativo	347.351,97	Yes	Allianz Spa	ISO 14001
89	Coface S.A.	47.600,00	No	-	No
90	Hdi Assicurazioni	690.000,00	Yes	-	ISO 14001
91	Generali Italia Spa	129.660,00	Yes	Unipolsai Assicurazioni	ISO 14001
92	Axa Assicurazioni Spa	1.800,00	No	-	No
93	Carige Assicurazioni Spa	2.640,00	Yes	Vittoria Assicurazioni Spa	No
94	Reale Mutua Di Assicurazioni	125.600,00	Yes	Reale Mutua Di Assicurazioni	No
95	Amissima Assicurazioni Spa	51.500,00	Yes	Hdi Assicurazioni Spa	No
96	Hdi Assicurazioni Spa	594.000,00	No	-	ISO 14001
97	Amissima Assicurazioni Spa	105.000,00	Yes	Unipol Assicurazioni Spa	ISO 14001
98	Alleanza Toro Spa	169.488,00	Yes	Alleanza Toro Spa	ISO 14001
99	Axa Assicurazioni Spa	7.700,00	No	-	No
100	Axa Assicurazioni Spa	30.406,00	No	-	No
101	Itas Mutua	540.000,00	Yes	Generali Italia Spa	ISO 14001
102	Banca Di Monastier E Del Sile Credito Cooperativo Societa' Cooperativa	14.984,27	Yes	Allianz Spa	No
103	Coface Sa	884.400,00	Yes	Generali Italia Spa	ISO 14001
104	Elba Assicurazioni Spa	26.220,00	Yes	Groupama	No
105	Amissima Assicurazioni Spa	110.000,00	Yes	Aig Europe S.A.	No
106	Unipolsai Assicurazioni Spa	17.000,00	Yes	Allianz Spa	No
107	Amissima Assicurazioni Spa	2.600,00	Yes	Zurich	No
108	Carige Assicurazioni Spa	5.549,44	Yes	Reale Mutua Di Assicurazioni	No
109	Carige Assicurazioni Spa	55.000,00	No	-	No

ID	Insurance Company or Bank (Financial Guarantee)	Coverage Cap (€)	Insurance Coverage	Insurence Company (Insurance Policy)	Environmental Certification
110	Allianz Spa	26.400,00	Yes	Aig Europe S.A.	No
111	Banca Popolare Friuladria Spa	564.988,25	Yes	Fondiaria Sai	EMAS
112	Liguria Assicurazioni Spa	121.800,00	Yes	Groupama	No
113	Milano Assicurazioni Spa	253.000,00	No	-	No
114	Generali Italia Spa	30.000,00	Yes	Generali Italia Spa	No
118	Generali Italia Spa	30.000,00	Yes	Generali Italia Spa	No
120	Generali Italia Spa	30.000,00	Yes	Generali Italia Spa	No
124	Generali Italia Spa	30.000,00	Yes	Generali Italia Spa	No
127	Reale Mutua Assicurazioni	165.000,00	Yes	Hdi	No
128	Banca San Biagio Del Veneto Orientale S.C.	302.500,00	Yes	Generali Italia Spa	EMAS
129	Hdi Assicurazioni Spa	7.600,00	Yes	Unipolsai Assicurazioni Spa	No
130	Milano Assicurazioni Spa	880,00	Yes	Marsh - Hdi Gerling	No
131	Tua Assicurazioni Spa	41.000,00	Yes	Aig	No
132	Elba Assicurazioni Spa	14.080,00	Yes	Amissima Assicurazioni Spa	No
133	Milano Assicurazioni Spa	757.800,00	Yes	Milano Assicurazioni Spa	ISO 14001
134	Allianz Spa	144.000,00	Yes	Aig Europe S.A.	ISO 14001
135	Coface S.A.	297.000,00	Yes	Aig Europe S.A.	ISO 14001
136	Elba Assicurazioni Spa	38.000,00	Yes	Aig Europe S.A.	No
137	Elba Assicurazioni Spa	980,00	Yes	Groupama Assicurazioni Spa	No
138	Unicredit Spa	22.000,00	Yes	Hdi	No
139	Elba Assicurazioni Spa	60.000,00	Yes	Itas Mutua	No
140	Hdi Assicurazioni Spa	42.812,00	Yes	Generali Italia Spa - Fata Assicurazioni	No
141	Unipolsai Assicurazioni Spa	1.360,00	Yes	Unipolsai Assicurazioni Spa	No
142	Axa Assicurazioni Spa	1.120,00	No	-	No
143	Allianz Spa	221.909,96	Yes	Allianz Spa	No
144	Amissima Assicurazioni Spa	15.200,00	Yes	Amissima Assicurazioni Spa	No
145	Axa Assicurazioni Spa	415.000,00	No	-	No

ID	Insurance Company or Bank (Financial Guarantee)	Coverage Cap (€)	Insurance Coverage	Insurence Company (Insurance Policy)	Environmental Certification
146	Banca Popolare Di Vicenza	165.000,00	Yes	Generali Italia Spa	No
147	Generali Italia Spa	1.807.692,40	Yes	Generali Italia Spa	ISO 14001
148	Generali Italia Spa	383.790,00	No	-	No
149	Generali Italia Spa	4.013,10	Yes	Generali Italia Spa	ISO 14001
150	Coface S.A.	5.940,00	Yes	-	No
151	Banca Popolare Di Bergamo Soa	2.400,00	No	-	No
152	Elba Assicurazioni Spa	1.500,00	No	-	No
153	Milano Assicurazioni Spa	242.000,00	Yes	Allianz Spa	No
154	Coface Sa	197.397,13	Yes	Generali Italia Spa	ISO 14001
155	Allianz Spa	1.652.904,00	Yes	Generali Italia Spa	ISO 14001
156	Coface S.A.	1.584.000,00	Yes	Generali Italia Spa	ISO 14001
157	Coface S.A.	331.000,00	Yes	Generali Italia Spa	No
158	Intesa Sanpaolo Spa	259.653,71	Yes	Axa Assicurazioni	EMAS
159	Intesa Sanpaolo Spa	300.000,00	No	-	No
160	Coface S.A.	1.900,00	No	-	No
161	Coface S.A.	246.635,40	Yes	Unipol Assicurazioni Spa	ISO 14001
162	Elba Assicurazioni Spa	24.200,00	Yes	Allianz Spa	No
163	Coface Sa	526.213,89	Yes	Allianz Spa	No
164	Banca Santo Stefano Credito Cooperativo	37.590,00	Yes	-	Si
165	-		Yes	Generali Italia Spa	No
166	Banca Di Credito Cooperativo Di Marcon	40,00	Yes	Hdi Assicurazioni Spa	No
167	Generali Italia Spa	4.800,00	Yes	Allianz Spa	No
168	Milano Assicurazioni Spa	253.165,00	Yes	-	No
169	Coface S.A.	104.627,45	Yes	Ugf Assicurazioni	No
170	Itas Mutua	550,00	No	-	No
171	Cassa Di Risparmio Di Venezia	76.726,80	Yes	Toro Assicurazioni	No
172	Generali Ina Assitalia	920.400,00	Yes	??	ISO 14001
173	Amissima Assicurazioni	1.103.400,00	Yes	Hdi	ISO 14001

ID	Insurance Company or Bank (Financial Guarantee)	Coverage Cap (€)	Insurance Coverage	Insurence Company (Insurance Policy)	Environmental Certification
174	Milano Assicurazioni Spa	220.200,00	No	-	No
175	Axa Assicurazioni Spa	13.400,00	No	-	No
176	Milano Assicurazioni Spa	1.054.114,35	Yes	Sasa Assicurazioni Riassicurazioni Spa	No
177	Generali Italia Spa	180.000,00	Yes	Aig Europe S.A.	ISO 14001
178	Generali Italia Spa	240.000,00	Yes	Aig Europe S.A.	ISO 14001
179	Unipolsai Assicurazioni Spa	72.000,00	Yes	Aig Europe S.A.	ISO 14001
180	Axa Assicurazioni Spa	594.000,00	No	-	ISO 14001
181	Reale Mutua Assicurazioni	9.570,00	Yes	Axa Assicurazioni Spa	No
182	Banca Intesa San Paolo Spa	10.000,00	Yes	Generali Italia Spa	No
183	Coface S.A.	90.000,00	Yes	Unipol Assicurazioni Spa	No
184	Coface Sa	600.000,00	Yes	Unipol Igf Assicurazioni	No
185	Carige Assicurazioni Spa	224.400,00	Yes	Hdi Assicurazioni Spa	ISO 14001
186	Banca Mediolanum Spa	143.000,00	Yes	Generali Italia Spa	No
187	Liguria Societa' Di Assicurazioni Spa	24.684,00	No	-	ISO 14001
188	Elba Assicurazioni Spa	600,00	No	-	No
189	Unipolsai Assicurazioni Spa	99.000,00	Yes	Masiero Assicurazioni	ISO 14001
190	Liguria Societa' Di Assicurazioni Spa	59.906,00	Yes	-	No
191	Reale Mutua Di Assicurazioni	89.282,09	Yes	Liguria Assicurazioni Spa	No

Section D: Natural Hazards

ID	Flood Risk Probability Zone	Seismic Risk Zone	Class of Aquifer Vulnerability	Recently Flooded
1	1	4	2	Yes
2	1	4	2	Yes
3	1	4	2	No
4	1	4	3	No
5	1	4	3	No
6	1	4	2	No
7	1	4	3	No
8	1	4	2	No
9	1	4	3	No
10	1	4	2	No
11	1	4	3	Yes
12	0	4	2	Yes
13	1	4	2	No
14	1	4	2	No
15	3	4	3	No
16	0	4	2	No
17	1	4	2	Yes
18	0	4	2	Yes
19	1	4	2	No
20	1	4	2	No
21	0	4	5	No
22	0	4	5	No
23	0	4	5	No
24	3	4	1	No
25	0	3	2	No
26	0	3	1	No
27	0	4	4	No
28	3	4	4	Yes
29	0	4	4	No
30	1	4	2	No
31	1	3	2	Yes
32	1	3	3	No
33	1	4	1	Yes
34	0	4	2	Yes
35	3	4	3	No
36	0	4	2	No
37	0	4	2	No
38	2	3	3	No
39	2	3	3	No
40	0	4	3	No
41	0	4	3	No
42	0	4	3	No
43	0	4	3	No
44	0	4	3	Yes

ID	Flood Risk Probability Zone	Seismic Risk Zone	Class of Aquifer Vulnerability	Recently Flooded
45	3	4	3	No
46	0	4	3	No
47	0	4	3	No
48	0	4	4	No
49	3	4	2	No
50	0	4	4	No
51	3	4	2	No
52	0	4	5	No
53	0	4	5	No
54	0	4	4	No
55	1	3	1	No
56	1	3	3	No
57	1	3	3	No
58	1	4	3	No
59	1	3	3	No
60	1	3	2	No
61	1	3	2	No
62	1	3	2	No
63	1	3	3	No
64	0	3	2	No
65	1	4	3	No
66	1	4	2	No
67	1	4	3	No
68	1	4	3	No
69	1	4	1	No
70	0	4	4	No
71	0	4	4	No
72	1	3	3	No
73	1	4	1	No
74	1	4	2	No
75	0	4	4	No
76	3	3	1	No
77	2	3	2	No
78	2	3	2	Yes
79	3	3	1	No
80	3	3	3	No
81	2	3	3	Yes
82	1	3	2	No
83	1	3	3	No
84	2	3	3	No
85	2	3	3	No
86	0	3	3	No
87	1	3	2	No
88	1	3	2	No
89	0	3	2	No
90	0	4	1	No

ID	Flood Risk Probability Zone	Seismic Risk Zone	Class of Aquifer Vulnerability	Recently Flooded
91	0	4	2	No
92	0	4	2	Yes
93	1	3	2	No
94	1	3	3	Yes
95	0	3	3	No
96	1	3	2	No
97	0	3	3	Yes
98	1	3	2	No
99	1	3	4	Yes
100	2	3	3	No
101	3	3	2	No
102	3	3	2	No
103	3	3	2	No
104	3	3	2	No
105	2	3	2	No
106	3	3	3	No
107	2	3	3	Yes
108	2	3	3	Yes
109	0	3	3	Yes
110	3	3	4	Yes
111	3	3	3	Yes
112	0	3	3	Yes
113	3	3	3	Yes
114	0	3	2	No
118	1	3	2	No
120	1	3	2	Yes
124	1	3	2	Yes
127	1	3	2	Yes
128	1	3	3	No
129	2	3	3	Yes
130	2	3	2	No
131	0	3	2	Yes
132	1	4	3	No
133	1	4	2	No
134	0	3	3	Yes
135	0	3	2	No
136	1	4	2	No
137	1	4	2	Yes
138	1	4	1	Yes
139	0	3	3	No
140	3	4	0	No
141	1	4	2	No
142	1	4	3	No
143	1	4	1	Yes
144	1	4	2	Yes
145	1	4	2	Yes

ID	Flood Risk Probability Zone	Seismic Risk Zone	Class of Aquifer Vulnerability	Recently Flooded
146	1	4	2	Yes
147	1	4	2	Yes
148	1	4	2	Yes
149	1	4	1	Yes
150	1	4	3	No
151	1	4	3	No
152	1	4	1	Yes
153	1	4	1	Yes
154	1	4	3	Yes
155	1	4	2	Yes
156	1	4	2	No
157	2	4	1	No
158	1	4	2	No
159	0	3	3	No
160	1	4	2	Yes
161	1	4	2	Yes
162	1	4	3	No
163	1	4	2	No
164	0	3	3	No
165	1	4	2	Yes
166	1	4	1	Yes
167	1	4	1	Yes
168	1	4	1	Yes
169	1	4	3	Yes
170	0	4	3	No
171	1	4	2	Yes
172	0	4	2	No
173	0	3	3	No
174	1	4	3	Yes
175	1	4	3	No
176	1	4	3	No
177	0	4	3	No
178	0	4	3	No
179	0	4	3	No
180	2	3	3	Yes
181	2	3	3	Yes
182	3	3	3	No
183	3	3	3	Yes
184	3	3	3	No
185	3	3	2	No
186	1	4	1	Yes
187	3	4	0	No
188	0	4	4	No
189	1	3	2	Yes
190	2	3	2	No
191	1	3	3	No