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**Comparative Analysis of Phase I Environmental Due Diligence Findings
Across Industrial, Biogas, and Brownfield Sectors**

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Contents

Figures	5
Tables	6
Abstract	7
Chapter 1 – Due Diligence	8
1.1 - Introduction to Due Diligence.....	8
1.2 - Applications	9
1.3 - Key Elements.....	11
1.4 - Stages	13
1.5 - Possibilities	15
Chapter 2 – Environmental Due Diligence	16
2.1 – Introduction to Environmental Due Diligence	16
2.2 – EDD topics and Regulatory Framework.....	17
2.3 – EDD activity and Phase I & Phase II	22
2.4 – Ramboll Group	25
2.4.1. – Ramboll in Italy.....	27
Chapter 3 – Sectors Analysis	28
3.1 – Biogas Production and Europe situation	28
3.1.1 – Biogas plants assessed by Ramboll Italy	29
3.1.2 – Biogas Findings’ Analysis.....	30
3.1.3 – Ramboll’s Recommendations	35
3.1.4 – Estimated Cost Analysis.....	36
3.2 – Industrial sector and Europe situation.....	40
3.2.1 – Industrial sites assessed by Ramboll Italy	41
3.2.2 – Industrial Findings’ Analysis.....	43
3.2.3 – Ramboll’s Recommendations.....	48
3.2.4 – Estimated Cost Analysis	50
3.3 – Brownfield and Europe situation	54
3.3.1 – Brownfield assessed by Ramboll Italy	55
3.3.2 – Brownfield Findings’ Analysis	56
3.3.3 – Ramboll’s Recommendations.....	62
3.3.4 – Estimated Cost Analysis	64
Chapter 4 – Conclusions.....	65
Bibliography.....	67
Appendix 1	69

Appendix 2	70
Appendix 3	71

Figures

Figure 1 - Ramboll's office around the World.....	25
Figure 2 - Ramboll Group Strategy 2022 - 2026.....	26
Figure 3. Combined biomethane and biogas production per year in Europe (bcm).....	28
Figure 4 - Categories and number of findings in Biogas sector.....	32
Figure 5 - Percentage division of the risk level of the findings in Biogas sector	32
Figure 6 - Number of findings each Biogas reviewed report	33
Figure 7 - Focus on Categories with highest number of findings in Biogas sector.....	34
Figure 8 - Percentage division of the risk level of the findings in Industrial sector.....	45
Figure 9 - Categories and number of findings in Industrial sector	45
Figure 10 - Number of findings each Industrial reviewed report.....	46
Figure 11 - Focus on Categories with highest number of findings in Industrial sector	47
Figure 12 - Categories and number of findings in Brownfield sector.....	59
Figure 13 - Percentage division of the risk level of the findings in Brownfield sector	59
Figure 14 - Number of findings each Brownfield reviewed report	60
Figure 15 - Focus on Categories with highest number of findings in Brownfield sector.....	61

Tables

Table 1 - Categories established with number of findings for each risk level in Biogas sector	31
Table 2 - Average number of findings for each risk level in Biogas sector	33
Table 3 – Focus on categories with highest number of findings in Biogas sector.....	34
Table 4 - Average values for focused categories in Biogas sector	34
Table 5 – Numerical cost estimates of categories across risk levels in Biogas sector	37
Table 6 – Average cost scenario from Biogas reports.....	38
Table 7 – Non numerical cost estimates from Biogas reports	38
Table 8 – Count of non-numerical cost estimates related to categories and risk level from Biogas reports	39
Table 9 - Categories established with number of findings for each risk level in Industrial sector.....	44
Table 10 - Average number of findings for each risk level in Industrial sector	46
Table 11 - Focus on categories with highest number of findings in Industrial sector	47
Table 12 - Average values for focused categories in Industrial sector	47
Table 13 - Numerical cost estimates of categories across risk levels in Industrial sector	51
Table 14 - Average cost scenario from Industrial reports.....	52
Table 15 – Count of non-numerical cost estimates from Industrial reports	52
Table 16 - Count of non-numerical cost estimates related to categories and risk level from Industrial reports.....	53
Table 17 - Environmental conditions and risks identified within Brownfield reports.....	57
Table 18 - Categories established with number of findings for each associated risk level in Brownfield sector.....	57
Table 19 - Average number of findings for each risk level in Brownfield sector	61
Table 20 - Focus on categories with highest number of findings in Industrial sector	61
Table 21 - Average values for focused categories in Industrial sector	61

Abstract

In the context of a multitude of due diligence procedures, Environmental Due Diligence (EDD) is a technical investigation and assessment process designed to support commercial transactions involving “assets”. It aims to identify, analyse and quantify potential liabilities, risks and environmental costs associated with the target's current and past activities, which may have or may have had a potential impact on the environment, and its compliance with current environmental legislation, in order to obtain a comprehensive and impartial overview summarising all environmentally relevant information associated with the target, facilitating the definition of priorities for action and investments necessary to ensure regulatory compliance and improve environmental performance.

This thesis, carried out in collaboration with Ramboll Italy S.r.l., focuses on the comparative analysis of three different commercial sectors (Industrial, Biogas Plants, Brownfield) in which, but not only, Ramboll carries out its consulting activities, through the analysis of ten Phase I EDD cases for each sector. The topics for which points of attention (findings) were identified, the relative risk levels (Low, Medium, High), and the cost scenarios (Most Likely Case and Reasonable Worst Case) are discussed and reported, with particular focus on the topics with the highest number of findings, for which the main recommendations in relation to the issues identified are reported.

Fifteen categories of issues were identified in the biogas sector, fourteen in the industrial sector, and ten in brownfield sites. The main topics found included Environmental Permits, Water and Chemical Management, Waste and Asbestos Management, Atmospheric Emissions for active industrial sites only, represented by similar and different issues within the sectors analysed. The issue of Potential Soil and Aquifer Contamination, as well as the lack of analysable documentation during due diligence processes, was common to all sectors. On average, there are approximately 8,5 findings per site relating to the industrial sector, approximately 10,6 findings relating to biogas plants and approximately 5,2 findings for brownfield sites. The estimated average cost per site to address the issues identified for biogas sites is approximately €13,000 for MLC and approximately €23,100 for RWC, while for industrial sites it is approximately €381,700 for MLC and approximately €616,400 for RWC. As regards brownfields, the Phase I analysis does not allow a comprehensive estimate of the possible costs of resolving the issues identified without more detailed investigations (Phase II) into the various issues/problems (e.g. depth of contaminated soil, characterisation of contamination to be remediated, type of waste to be disposed of or sent for recovery, etc.).

It is evident that the findings are derived from the analysis of a limited number of cases and, consequently, they are not representative of the entire sectors. Nevertheless, they provide an useful insight, albeit partial, into the potential issues identified with EDD Phase I investigations of the various sectors covered by the thesis.

Chapter 1 – Due Diligence

In any trade or bargaining scenario, both parties invariably seek to secure the most advantageous arrangement for themselves. Indeed, during the Roman era, the Latin phrase “caveat emptor”, which can be translated as “let the buyer beware”, was in general use.

In the context of commercial transactions, the term “due diligence” originated in the USA in the aftermath of the 1929 stock market crash and during the Great Depression. These events revealed massive fraud, misleading statements, speculative abuses and unregulated securities offerings. In 1933, the Securities Act was enacted to restore investor confidence by imposing federal standards of truth in securities offerings. This required the disclosure of material information in registration statements and prospectuses, enabling investors to make informed decisions. Section 11 (codified at 15 U.S.C. § 77k) of ‘33 Act imposes liability on certain defined parties (issuers, directors, underwriters, experts, etc.) for false or misleading statements or omissions of material facts in a registration statement used in an offering. In addition to establishing strict liability for many parties, Section 11 contains affirmative defenses for certain defendants (other than the issuer). One of them is the *due diligence defense*, found in part in § 11(b)(3) (i.e. 15 U.S.C. § 77k(b)(3)) which states at the point (B):

*“(...) as regards any part of the registration statement¹ purporting to be made upon his authority as an expert or purporting to be a copy of or extract from a report or valuation of himself as an expert, (i) he had, **after reasonable investigation**, reasonable ground to believe and did believe, at the time such part of the registration statement became effective, that the statements therein were true and that there was no omission to state a material fact required to be stated therein or necessary to make the statements therein not misleading (...).”*

This section provided a defence of due diligence to those who had made reasonable investigation into matters contained in a prospectus for the issue of securities. Over time, court decisions developed the standards for what counts as a “reasonable investigation”, what “reasonable ground to believe” entails, how much inquiry is sufficient, how much reliance on experts or management is permitted, and so on. These judicial interpretations fleshed out what due diligence requires in practice and this process of evaluation in the USA has been named ‘**due diligence**’ since then. Moreover, the concept has evolved internationally to extend beyond verifying the accuracy of prospectuses, encompassing investigations related to corporate or asset acquisitions in commercial transactions, assessments of financing risks and broader pre-contractual inquiries.

1.1 - Introduction to Due Diligence

If we simply define ‘due diligence’ as a reasonable investigation process, it is evident that is performed by all individuals when making a purchase, where the buying decision is based on our value judgements, verifying the expiration date of a food product, its ingredients and dimension, assessing the potential for acquiring it at a more economical price elsewhere. In circumstances involving rarely significant purchase and elevated risk, we may consult with a knowledgeable friend for guidance. In the case of more substantial acquisitions, most individuals typically seek professional counsel on a less frequent basis. The purpose of such counsel is to ensure that transactions are not conducted in a manner that may result in financial loss, and to verify the legitimacy of the vendor's claim to the property or service in question.

Large corporation and other potential investors such as private equity firms that make significant investment purchases by buying other businesses are no different. They go through the process of Due Diligence, an audit of the potential investment, to confirm all significant facts and assumptions, conducted before entering into a contractual agreement with the other party. The process followed is usually formal as it forms the basis of any subsequent contracts or agreements.

¹ The term “registration statement” means the statement provided for in section 77f of this title, and includes any amendment thereto and any report, document, or memorandum filed as part of such statement or incorporated therein by reference.

With an increasing litigious society, the process of due diligence has become more formal and legal/financial based, leading historically to a protracted process, since it necessarily involved the physical examination of a voluminous amount of documentation on site. Technological advances have facilitated the execution of the analysis in a substantially more expeditious and efficient manner, involving both Internet and Intranet functionality.

Given that any search of a law dictionary reveals the meaning of “due” as payable or immediately enforceable and “diligence” involves care, attention and application, in consideration of the objective of due diligence and the evolution of the term, it is unsurprising that the legal process has become progressively comprehensive, as regulatory frameworks and associated business structures have evolved.

In the contemporary era, **Due Diligence (DD)** is a widely employed practice that involves a formal audit or investigation process through the compilation and evaluation of available information regarding a transaction by a party directly involved in the transaction (i.e. the buyer or seller) or by their advisor, and verification of relevant facts. These facts may relate to legal, business, financial or even environmental and safety issues, connected to various sub-aspects within the framework of a DD that are evaluated during a transaction, treated as independent process: environmental, health and safety (EHS Due Diligence), legal (Legal DD), and other areas (Technical DD, Financial DD, Commercial DD, Tax DD, ESG DD, Real Estate DD, etc.). The aim is to capture the current target company’s conditions by identifying strengths, weaknesses, risks, liabilities, costs, and to give the appropriately value to the transaction. It may impact the willingness to do the deal at all.

The assessment process can be initiated typically by potential buyer or bidder (in the case of an acquisition) or vendor or seller (in the case of a divestiture) of a business, including strategic investor (another business in the sector – a trade buyer), investment house (private equity), lender providing finance to the deal (debt provider) or other entities. Commissioning to possible external auditors may be direct or via an adviser, e.g. a lawyer or an investment bank/corporate finance house.

As with all areas, the initial step in due diligence activities is essential and needed. In the event of discussions concerning a potential investment operation, it is imperative that all parties involved demonstrate a willingness to engage in due diligence activities. However, it is at this point that the definition of the activity of due diligence can become blurred: in a merger situation, for example, prior to any informal or formal conversation, there would be a significant number of hours spent on due diligence to determine whether there is enough information that can lead to conversations about a possible merger. Thus, the starting point for any due diligence activity is never one single step with a single starting point. The actions surrounding due diligence must be adaptable within a framework that places the organisation and its owners, employees and advisers in a constant state of data collection and data organisation that can support whatever process is being started.

It is evident that all companies will undertake due diligence in some form – whether informal or formal – to ensure the integrity of the process. It is evident that larger organisations require a more structured formal approach, nonetheless within each company, it is essential to comprehend the role of due diligence in promoting the common good. In accordance with classical business principles, the responsibility for establishing the policies, procedures and culture of the company, as well as the approach in which it conducts its activities, lies with the management team.

1.2 - Applications

The nature of the due diligence depends on whether is required by the seller or the purchaser. Assuming the buyer, there are two main setting that may be displayed:

- A. The buyer’s intention to consolidate the business into its own operations with a view to achieving business benefits and synergies. Sometimes referred to as “the Borg”, this model may lead to fully assimilate the business, which lose its own identity, although sometimes brands may be kept for marketing advantage.
- B. The acquired business is kept as a separate entity with the view to sell it or seeking stock market listing, in the medium to long term period. Branded venture capital organisations or private equity houses/venture capital trusts typically use this model.

The post-merger activities and objectives are driven by the purchaser's intentions and determines the style of due diligence review to follow.

As might be anticipated, due diligence has become the norm in decision-making as regards, among others:

- Joint ventures;
- Mergers and Acquisitions (M&A);
- Initial Public Offering (IPO);
- Divestiture as Carve-out, Spin-off and Split-off;
- Choosing the fitting jurisdiction or location.

The term "Joint Venture" is an increasingly common one in both economic and legal languages, employed to summarise a wide range of agreements established between disparate parties, typically in the context of business collaboration, though in certain sectors, it may also extend to partnerships between private and public entities. These agreements entail a mutual undertaking to engage in activities of shared interest, accompanied by the allocation of proportionate obligations and responsibilities, the distribution of risks, and the leveraging of each party's distinct expertise. Due diligence investigation is not only about checking the assets or liabilities being contributed, but also about evaluating the partners themselves, their strategic fit, and the governance framework, making it more relationship-oriented than in a traditional M&A deal (Ufficio Contratti e Partnership - Consiglio Nazionale delle Ricerche, 2024).

Mergers and Acquisition (M&A) is a term used to describe the purchase (acquisition) and sale (divestiture) of businesses. However, it is also a broad term used to describe the strategic changes to an organisation, not just registered companies, and its ownership, covering the buying, selling, dividing and combining of different entities. The distinction between a merger or acquisition can be a matter of some confusion, particularly in cases where the brand or name of the company being acquired is subsequently employed as the name for the new organisation. Mergers and acquisitions are frequently referred to as corporate transactions and are typically structured as share or asset deals. The deal types can be:

- Asset deal: the buyer exchange cash for specific assets and liabilities of the target company (e.g., real estate, machinery, contracts, intellectual property, inventory).
- Share deal: the buyer exchange cash for shares (equity) in the target company from its shareholders.
- Merger: buyer and target merge into one single company; in the case of a forward merger, the buyer company becomes the surviving entity, with all shareholders being incorporated into it. On the other hand, in a reverse merger, the target company maintains its operational status following the completion of the merger. Horizontal mergers refer to transactions pursued to achieve a larger market share acquiring target companies with analogous products or service portfolio. Vertical mergers focused on the improvement of the control over the end-to-end process of the business combining entities in the same business sector, but a different level of the supply chain.

From the vendor point of view, the due diligence examination may help to identify and address risks about critical issues, liabilities, possible deal breakers with relative solutions, collect factual, objective, useful elements to give an understandable and complete picture of the target and associated risks and trying to maximise selling price, limit guarantees and compensation caps. The purchaser can protect its interests with a due diligence review identifying actual and potential risks and possible deal breakers or data gaps, trying to minimize costs considering liabilities and to obtain guarantees and compensation caps. To protect themselves from any future problems arising from past issues, they may also take out ad hoc insurance, escrow or similar arrangements.

An Initial Public Offering (IPO) is defined as the process by which a private company offers its shares to the public for the first time on a stock exchange, to raise capital to finance growth, the

repayment of debt, or invest in new projects. The provision of liquidity to early investors and founders (who can sell a proportion of their shares) is advantageous and helps to enhance the company's visibility and credibility. The choice of stock exchange (e.g., NYSE, NASDAQ, London Stock Exchange, Frankfurt Stock Exchange, Hong Kong Stock Exchange) impacts the style and content of the due diligence review, because each have their own listing rules and disclosure standards, requiring additional preparation and auditing of the company. The key output for an IPO due diligence is usually a prospectus and accompanying documents such as long-form and short-form reports, which are used to sell the shares. These are characterised by a high degree of structuring, with the specific information depending on the specific stock exchange where the listing occurs.

The Divestiture methods are processes used by companies that want to divest themselves of certain assets, divisions, or subsidiaries. These methods include the spin-off, split-off, and carve-out. The selection of a specific method by the parent company is contingent on a multitude of factors, yet the overarching objective remains the enhancement of shareholder value. The carve-out operation is employed when the parent company sells some or all the shares in its subsidiary to the public through an IPO, resulting in the establishment of a new set of shareholders in the subsidiary. In a spin-off, the parent company, despite receiving no cash consideration from the operation, distributes shares of the subsidiary that is being spun off to its existing shareholders on a pro-rata basis², in the form of a special dividend. In a split-off, the shareholders of the parent company are offered shares in a subsidiary; however, they must choose between holding shares of the subsidiary or the parent company, retaining their holdings, or alternatively, they may opt to exchange a proportion or all of their shares in the parent company for shares in the subsidiary. In these contexts, the due diligence review will focus heavily on separation issues (assets, contracts, employees, shared services, liabilities) and both buyer and seller must plan how the divested business will operate independently after the transaction.

So, it can be noticed that the concept of due diligence can be interpreted in a variety of ways, depending on the specific circumstances of the situation in question. Essentially in all such situations there will be the transfer of assets from one party to another or the creation of obligations, the existence of risks that may affect the future value of such assets or obligations and the needs to apportion the risks between the parties.

1.3 - Key Elements

As suggested by Wriht and Altimas (2015), it is possible to identify, among others, some key characteristic elements of due diligence reviews and reviewers:

- **Cost** – The cost of the investigation needs to be considered alongside the cost of the deal, the probability of its implementation and the potential economic consequences if the expected benefits are not achieved finalising the deal.
- **Confidentiality** – The release of information regarding the deal, or even the mere consideration or discussion of the deal, could potentially impact the share price of the involved companies and cause possible unrest among staff, as such transactions are often followed by staff cuts. Consequentially, due diligence assignments are often addressed using project names, non-disclosure agreements and have specific protocols around data rooms and use of data. To this end, it is possible to reach an agreement with the relevant parties, providing a valid justification under the guise of a "cover story" to facilitate the inspection of the target by the designated experts, effectively preventing the disclosure of the ongoing transaction to the personnel.
- **Facts** – Based on their experience, due diligence specialists can ask the proper questions and request specific information. Accordingly, the presentation of the review may be facilitated outlining the facts and their sources in a clear format. The information reported must be

² Pro rata is a Latin term that translates to "in proportion." Put simply, it is used to describe a proportionate allocation. It's a process in which an allocated asset is distributed in equal portions. An amount is assigned to one person according to their share of the whole if something is distributed to several people on a pro rata basis.

objectively accurate, with the possibility of replicating the same results regardless of the conditions under which the investigation was carried out (e.g. time, audit firm, etc.).

- **Business knowledge** – Due diligence investigators are employed for their independence, business knowledge of the sector and specific specialisms required by the task. Although most clients may possess a comprehensive understanding of the business's operating environment, they may not necessarily have the broader context of risks that could potentially impact the entity. To ensure that the review is focused on agreed business risks, it must be established effective communication between the client and the advisors.
- **Liability of investigators** – Although contracts for due diligence assignments typically include numerous caveats and disclaimers that limit the liability of external investigators, the process nevertheless remains inherently high risk. These contractual protections often specify that findings are based on information made available and cannot guarantee absolute completeness. However, if material issues are overlooked - such as hidden liabilities, regulatory breaches, or reputational concerns - the consequences for the investing or acquiring party can be severe, underscoring the critical importance of thorough and carefully managed due diligence.
- **Clarity of reporting** – The information acquired from the investigation must be transmitted and reported as clearly as possible, with clear recommendations and advice, both on the deal itself and on any post-deal issue(s).

Rational information and advice gathered through due diligence process enable to ensure decisions regarding a transaction. By being aware of risks and issues before the deal is made, the parties can ensure contracts are based on a realistic understanding of the deal. In some cases, for strategic reasons, the deal may go ahead regardless of the due diligence review, which is more focused on gathering information and making plans for integration post-deal. Adequate due diligence work encompasses elements beyond the domains of risk analysis and compliance; the focus is about basing decisions and post-deal predictions on sound information and judgement considering:

- Commercial risks – cyber security, business continuity and compliance.
- Finances – The comprehension of the business's past and actual performance enable to underlying the financial health (income and expenditure, profitability, assets, tax, other liabilities and cash flows) and assess its sustainability in the post-deal period.
- Business/commercial issues – Acknowledge the business position in the market with its products and services, strategic and business plan assumptions and predictions.
- Legality – Understand the legal foundation of the deal to properly address the future success of the entity that could be impacted by what is being transacted, such as assets and intellectual property, contracts, loans and pending litigation. Legislation may also impact the nature of the deal itself, e.g. special anti-money laundering or anti-trust considerations.

In consideration of the previous clarified elements and information, the multiple objectives for a due diligence review can be pictured as:

- Capture and describe all the confirmed data and information required to assess the financial, legal & regulatory and commercial information required to make decisions about the deal.
- Offer a comprehensive overview of the target's business proposition, including strategic direction, product portfolio, customer base, supply chain structure, operational model, culture & style, human resources, as well as the supportive tools and processes.
- Form an opinion on the progression of the deal should proceed, identifying any potential impediments and confirming the appropriate price to be paid (in accordance with the initial offer, also referred to as the "heads of terms"). This is based on the business and the buyer's own medium to long-term objectives.
- Offer foundation upon which the post-deal integration of people, processes and tools can be meticulously planned.

1.4 - Stages

Following the acceptance of the offer for the due diligence work, among the many methods and tools that can be used to conduct proper due diligence, there are a few possible steps that are generally followed by professionals called upon to perform this type of analysis. Basically, these steps can be the following:

1 - Preparation Step, understanding the business and the deal

The due diligence exercise, like every tight deadline and/or budget-restricted project, needs to be properly planned and coordinated. This phase is preceded by obtaining a high-level understanding of the business to identify potential risks and all benefits of the deal, including any that may not be evident from the information and documentation provided. At this point, a first warning signal can be encountered: if the target cannot provide all the required information, of any level, a full due diligence exercise may not be pursued, underlining the possibility that they could be not in full control of their business and indicating a very high inherent risk. In this initial phase, the following actions are undertaken:

- Overview of the deal and of the review process - Receive a briefing from the client and its advisors and comprehending the objectives of the deal, from both buyer and seller angles, the nature of the target and the high-level financial and legal information.
- Conflict check procedure - Check of clients' list, current and past, and make sure there's no reason that the firm cannot undertake work for the client. The check determines whether there are any previous contacts with a potential client or matter that could lead to a conflict of interest (LOCKTON).
- Non-Disclosure Agreements (NDA) - The sensitive nature of a due diligence assignment and the relative highly confidential material that is required, rise the necessity of a formal confidentiality agreement. To avoid the supply of incomplete or inaccurate information and to ensure consistency of reporting, the use of Virtual Data Rooms (VDR - web-based data rooms) and communications plans are pre-established.
- Form and prepare the review team - The team may consist of skilled project management & administration, financial, business and legal professionals, together with other specialists depending on the deal. Team members must have a clear understanding of their responsibilities, including strict compliance with the rules of engagement and adhere to established reporting deadlines.
- Identify areas for review and required information - This approach facilitates a comprehensive understanding of team members' roles, responsibilities and expected deliverables, Due diligence plans, checklist and data requests support the process.

Further consideration may be given to critical factors with the potential to jeopardise the due diligence analysis and the outcome of the transaction, directly linked with all the kind of costs:

- Accessibility of staff at the target, particularly considering any potential labour relations issues that may arise concerning the entity's future.
- Availability and reliability of information provided.
- Team working and co-operation of the review team.
- Temporal framework and associated limitations.
- External factors which may influencing the review.
- Failure to comply with confidentiality agreements, contractual obligations or specific regulatory requirements.

2 - Review Step

Performing the review has the main purpose to collect and assess data, using skills which most specialists learnt from other audits and reviews. The representations made by the target, their valuations, assessments and any legal, regulatory or compliance concern must be validated and double-checked. Typically, the review phase may unfold as follows:

- Desktop study: review of public data relating to the area where the target is located with the aim of defining a general framework;
- Dataroom: collection and evaluation of provided information or preparation of desktop studies (risk assessment based on documents, followed by a preliminary Q&A session to request missing key documents);
- Site Visit and Interview: the review of “on the ground” conditions is conducted by accessing and touring the site and interviewing the key responsible personnel. As an alternative option, a Phone Interview may be scheduled to contact the target’s representatives;
- Expert and Management call: questions and answers call with key responsible personnel, management and/or their consultants.

The success of the transaction and any possible price negotiations is contingent upon the accuracy and completeness of the information provided, such as the financial strength and related forecasts of the target company, the impact of the transaction on the profitability of the target company or the acquirer, the exposures to wider financial regulatory or liability risks and so on. Surely additional information may be required to complete the preceding and specialists needs to be aware of the full implications and impact of their findings and keep managers informed through a set of regular meeting, to ensure these issues are identified and assessed properly.

3 - Report findings Step

The typology of the assignment is subject to variation in accordance with the nature of the due diligence, pursuing different kind of results. The DD results or findings are highlighted issues which may be related to contracts, customers, employees, facilities, plant and equipment, environmental topics, financial conditions, taxes, and so on. The investigation may also eventually lead to corroborate the veracity of the documented fact, unrelated with any form of discrepancy. The employment of a “Materiality Threshold”, denoting the excess of a stipulated cost necessary to resolve a critical issue, facilitates the differentiation between varying levels of issues' severity. This approach also facilitates the identification of potential deal-breakers that could result in the abandonment of the transaction. In addition to the final report, which provides to the commissioner a comprehensive overview of all aspects identified by the due diligence process, a 'Red Flag' report is frequently requested. This report provides a preliminary summary of the main critical issues, along with related cost cases, prior to the set final delivery date of the final report. Based on obtained findings, further investigations may be suggested to provide a more detailed analysis of the relevant aspects (e.g. Phase II for Environmental Due Diligence).

In the event of an undertaking in-house review, the report is likely to be presented in a relatively informal manner, consisting of a presentation of key facts, while the assessment of an external firm required the report to be more structured and detailed, longer, and may follow a prescribed format (e.g. for an IPO). Despite all the circumstances, the report needs to communicate clear conclusions and recommendations, providing sufficient evidence to support them, which may suggest a revised priced or specific warranties and indemnities that should be required.

In many cases, the various advisors contracted for the purpose of conducting different types of due diligence will eventually engage in a discussion about the results from the various investigations, with a view to exchanging their respective opinions, expertise and alignment on the matter.

4 - Post-DD review Step

Frequently, post-review process is not accorded the necessary attention, but significant integration activity may be done assisted by the information gained during the due diligence review. In accordance with the conclusions drawn in the due diligence report, the auditing firm, having the appropriate expertise, may propose to provide assistance to the involved companies in the transaction and/or the post-acquisition phase. In the first instance, the support may concern the evaluation of disclosure schedules and proposed contract language, the negotiation of indemnities, the allocation of liabilities, the interaction and briefing of lenders, the coordination with insurance underwriters. With the signing

closing, the support may be provided to maximize asset value and minimize liabilities, with social and environmental management systems implementation, with site remediation, energy management, compliance assistance, permitting, closure/reclamation.

The debriefing process within the DD expertise team is also of significant importance, as it provides a forum for reflection and discussion on how to improve the quality of subsequent reviews.

1.5 - Possibilities

While most reviews may be conducted satisfactorily and reach a decision, the possibilities of encountering difficulties that may potentially harm the opportunity remain present. Adequate planning and scoping can prevent most of the issues. It is imperative that dealing with significant assumptions or lack of crucial information must be stated as clearly as possible in the final report delivered to the client and stakeholders who place considerable reliance on the outcome of a due diligence review.

The due diligence phase demonstrates a level of commitment between the parties, planning and discovery, with binding commitment and trust in case of business mergers. It is always advisable to walk away from a potentially unfavourable deal following due diligence, rather than facing the consequences later. With that in mind, it is important to note that due diligence should not be viewed as a straightforward “Go/No-Go” decision, more often it is a “Go but”. There appears to be a high degree of commitment from both parties to ensure that the deal is successfully concluded. Consequently, they are likely to work collaboratively to identify suitable ways to achieve this objective – perhaps through financial considerations (e.g. change to price), legal (e.g. contractual clauses) or commercial (e.g. agreements to work together jointly post-deal). The process of due diligence, when carried out in accordance with best practice, can provide the following benefits to the involved parties:

- Clearly definition of the transaction’s subject – reduce risk that valuations are ineffective or inaccurate and based on wrong assumptions.
- Questions posed have been sufficiently profound – investigators delve into difficult topic domains with complex issues and refrain from accepting the first answers received.
- Understand the deal breakers or changes required to ensure the deal viability – the deal is only viable up to a certain price.
- Considered the cultural and “fit” issues.
- Ready to begin integration based on findings.
- Not being obsessed with completing the deal and ignoring warning signs.

Chapter 2 – Environmental Due Diligence

2.1 – Introduction to Environmental Due Diligence

In the context of a multitude of due diligence procedures, the **Environmental Due Diligence** (hereinafter referred to as “**EDD**”) is a technical investigation process and assessment designed to support commercial transactions of “asset” or “target” (e.g. acquisition of real estate, concessions for the use of industrial areas, business expansions or corporate mergers), sharing all the main elements and key characteristics of due diligence listed in the previous chapter. In particular, the EDD aims to identify, analyse and quantify the potential environmental liabilities, risks and costs associated with the target’s current and past activities, which may have or may have had a potential impact on the environment, and its compliance with the current environmental legislation, to obtain a comprehensive, objective and impartial view that summarises all environmentally relevant information associated with the target. This instrument facilitates the delineation of the priority of action and the investments necessary to ensure regulatory compliance and enhance environmental performance.

EDD is performed to support the buyer and/or seller; specifically, reducing the uncertainty of costs and risks associated with potential environmental liabilities, facilitates a property transaction or company acquisition. In most cases, EDD is requested by the buyer, who will become responsible for managing the asset, or by investors, such as banks and credit institutions, to guarantee the economic investment transaction. In other cases, EDD is requested by the seller in order to verify that their business does not have or has not incurred environmental liabilities, such as subsoil contamination, and to ensure that there are no potential administrative and/or criminal proceedings following the sale of the asset. The presence of EDD provides an element of asset enhancement, allowing it to attract a greater number of investors (Capponi Brancone & Macerata, 2022).

As stated by Capponi Brancone & Macerata (2022), the first step in performing an EDD is to define the subject of the investigation, defining whether the transaction includes ownership of the area or only management of the facilities. Regarding the asset, it is crucial to assess the property’s territorial extent and during the acquisition of a company, it’s important to check if it has previously occupied or managed other sites, as these may carry liability concerns related to contamination, even if they are not part of the transaction.

The main objectives of environmental due diligence can be summarised as follows:

- a) Reconstruction of the site’s history, i.e. assessment of the site’s previous use and activities that have been carried out;
- b) Verification of compliance with applicable environmental legislation requirements and identification of legislative non-compliance;
- c) Identification of potential environmental liabilities associated with contamination of soil, subsoil and groundwater;
- d) Identification of any corrective actions to prevent or mitigate non-compliances, potential risks and potential environmental liabilities;
- e) Identification of the responsibilities and of related responsible parties for addressing or mitigating non-compliance or potential critical issues identified and the related costs and timeline, including those for further investigation.

These objectives may be pursued through the analysis of provided documentation and an evaluation of the present condition of the site, its direct inspection and, where deemed necessary, sampling and analysis of environmental matrices. The level of detail of the analysis and the objectives of the EDD may vary depending on the client’s needs, the type of object to be assessed and the time available.

The environmental due diligence investigation is composed of two main phases named “**Phase I**” and “**Phase II**”, typically consequential and related, which will be discussed in more detail below (see the paragraph II.3).

Besides the environmental focus of the EDD, this procedure may also include the analysis of additional aspects related to the target's inspection:

- *Structural, plant and energy due diligence*, applied during real estate transactions involving buildings, to assess the building's value and condition in relation to plant aspects and from an energy efficiency perspective.
- *Health and Safety due diligence*, together with environmental analysis, is recommended for industrial activities, due to the criminal liability of the employer and the incidence of costs associated with occupational diseases or legal disputes in the field of health and safety, thus assessing legislative compliance.
- *ESG (Environmental, Social and Governance) due diligence* is associated with new trends in sustainable finance and the inclusion of non-financial information in the reporting of large companies (European Directive No. 2014/95/EU). The main ESG criteria refer to issues such as climate-changing emissions, energy and production efficiency, waste management, biodiversity protection, worker health and safety, promotion of diversity, equal opportunities and inclusion, respect for privacy, human rights and community relations, regulatory compliance, stakeholder engagement, anti-corruption and transparency.

2.2 – EDD topics and Regulatory Framework

The legislative compliance is verified through EDD by assessing the following aspects (as indicative and not exhaustive):

- A. Soil, subsoil and groundwater:
 - natural or anthropogenic presence of abnormal values in soil or groundwater;
 - presence of contamination source on-site;
 - presence of contaminated sites in the vicinity of the asset;
 - presence of potential targets of naturalistic relevance or protection;
 - in case of known contamination, compliance with permissible concentration limits for soil, subsoil and groundwater and the definition of characterisation and risk analysis, remediation requirements, and related recommended techniques;
- B. Hazardous and/or restricted substances:
 - presence and management of such substances in underground/above-ground structures and systems (such as asbestos, man-made vitreous fibres, hydrocarbons, PCBs, PFAS, refrigerant gases, lead paint, etc.);
 - appropriate remediation and removal methods, where necessary.
- C. Regulatory compliance with permits and authorisations:
 - operating licences;
 - water supply;
 - management of raw materials and chemicals;
 - waste management and disposal;
 - wastewater treatment and discharges;
 - air emissions;
 - ozone-depleting substances and greenhouse gases;
 - noise and odour emissions.
- D. Additional regulatory requirements or constraints associated with the territorial framework:
 - seismic risk;
 - hydraulic and hydrogeological risk;
 - landscape protection areas;

These main aspects subject to EDD verification are discussed in detail below.

Soil, subsoil and groundwater

The primary environmental regulatory framework in Italy is Legislative Decree No. 152/2006, formally designated as the Environmental Code (*Testo Unico Ambientale*), which establishes legislation pertaining to a wide range of environmental aspects. A primary rationale for conducting

an environmental due diligence assessment in conjunction with an economic transaction is to establish a framework for assigning responsibility in the event of soil, subsoil and groundwater contamination.

In Italy, the "polluter pays" principle is enshrined in Legislative Decree No. 152/2006. Consequently, prior to any transaction, it is necessary to determine whether there has been any contamination of the soil, subsoil and groundwater prior to the transfer of ownership and management.

In order to verify the quality of the soil, subsoil and groundwater, it is necessary to identify current and past activities that may have led to the release of contaminants into the environment. The process entails an evaluation of the condition of the facilities (storage tanks, sewage systems, production facilities), a verification of production processes and current chemical and waste management procedures. So, it is pertinent to contextualise this information within the specific parameters of the site's geological and hydrogeological characteristics, which may increase or mitigate the repercussions of an impact that could be costly from an economic point of view in terms of safety measures and/or remediation, or cause delays in the construction of new buildings. Depending on the level of detail required, the activity may include investigations such as core sampling, sampling and analysis of soil, subsoil and groundwater, as well as monitoring of the latter and/or interstitial gases.

Hazardous and/or restricted substances

The presence of hazardous and/or restricted materials in the structural components of buildings and/or technological systems entails costs related to their management, maintenance and disposal, and may result in restrictions or prohibitions on the use of such buildings or systems. The following sections detail the characteristics of the main substances to be addressed within EDD's context and the specific regulations governing their management.

- *Asbestos Containing Materials (ACMs)* - Asbestos is a fibrous material consisting of natural mineral fibres belonging to the silicate and mineralogical series of serpentine and amphiboles. Asbestos, in both compact and friable matrices, has been extensively utilised as insulation and, secondarily, as a reinforcing and supporting material for other synthetic products (protective equipment and heat-resistant suits), as well as in window putty. The material is classified as a carcinogen and in Italy the Law 275 issued in 1992 established a ban on the extraction, import, export, marketing and production of asbestos. In Italy, the management of materials containing asbestos is governed by the Ministerial Decree of 6 September 1994. However, it is also important to check at local level (region, relevant local health authority) for any specific regulations and guidelines for the management of materials containing asbestos. Given its historical use in various sectors, asbestos has the potential to be a primary environmental hazard associated with buildings and industrial facilities. The presence of such materials does not necessitate their removal: they can be retained if they are in good condition and there is no risk of fibre release. This can be achieved by implementing a control and maintenance programme to monitor their condition and prevent any deterioration. Yet, ACM presence constitutes a financial liability associated with the property, a fact which must be considered when ownership of the property is transferred.
- *Man-made vitreous fibres (MMVFs)* – Known also as artificial glass fibres, including mineral wool and ceramic fibres, are widely used as insulation material in buildings and plants due to their acoustic and thermal insulation properties. Their use has increased since asbestos was banned but they are sometimes associated (e.g., pipe cladding). Directive 97/69/EC of December 5, 1997, defined a classification of the hazards of these materials based on fibre size and chemical composition. To date, there is no obligation to remove artificial glass fibres; however, in the event of removal, reference must be made to the "Guidelines for the application of regulations concerning exposure risks and preventive measures for health protection" approved by the State/Regions Conference, on the proposal of the Ministry of Health, at its meeting on March 25, 2015, and updated on

November 10, 2016. These guidelines suggest the behavioural guidelines to be followed in the installation and removal of artificial glass fibres according to their characteristics and hazards. The costs involved in removing MMVFs are, in general, comparable to the costs involved in removing asbestos. Legislative Decree No. 44 of June 1, 2020, established a new limit value for occupational exposure to refractory ceramic fibres, which are classified as carcinogens. For this category of artificial glass fibres, it is therefore essential to implement a monitoring programme to verify compliance with the exposure limit values established by legislation.

- *Polychlorinated biphenyls (PCBs)* - Widely used as dielectric fluids in electrical transformers and capacitors, thanks to their excellent insulating properties, non-flammability and chemical stability. In addition to these uses, PCBs have also been used as hydraulic fluids, synergistic diluents for pesticides, plasticisers, flame retardants, fungicides and paint components and they can also be found in building materials, such as treated wood beams, gaskets, fireproof coatings and joint sealants in building structures, constituting contaminants during the decommissioning of plants or buildings. Presidential Decree (D.P.R.) No. 216/1988 and Law No. 62/2005 introduced a ban on the marketing of equipment or substances containing PCBs and the obligation to inventory and manage equipment containing such substances.
- *Ozone-Depleting Substances (ODS) and Greenhouse Gases (GHG)* – The utilization of refrigerant gases containing substances harmful to the ozone layer, commonly used in air conditioning systems and air compressors, is banned by the EC Regulation No 1005/2009 of the European Parliament and of the Council of September 16, 2009. In the event of the presence of such substances, it is therefore mandatory to verify the possibility of replacing refrigerants subject to restrictions and, if this is not possible, to assess the costs of replacing the systems, which may therefore involve significant expenses. The environmental offences covered by Legislative Decree No. 231 of June 8, 2001, include the “production, consumption, import/export, possession and marketing of ozone-depleting substances”. Regarding refrigerant gases not classified as ozone-depleting substances, periodic checks are carried out to verify the absence of greenhouse gas leaks, as required by EU Regulation No. 573/2024 of the European Parliament and of the Council of 7 February 2024. The methods for monitoring and managing equipment containing greenhouse refrigerant gases are regulated by Presidential Decree No. 146 of October 16, 2018. EU Regulation No. 573/2024 gradually bans fluorinated gases (F-gases), a category of artificial greenhouse gases containing fluorine, used in various industrial and commercial applications, known for their high global warming potential (GWP) and chemical stability, which makes them particularly persistent in the atmosphere, contributing significantly to global warming when released.

As demonstrated by the previous information, the relevant legislation plays a crucial role in the context of EDD analysis, ensuring legal compliance and effectively managing the environmental risks associated with industrial, commercial and development activities. In addition to avoiding possible penalties, compliance with the legislation also contributes to ensuring the protection of the environment and public health, with a view to preventing, reducing and, when necessary, remedying environmental damage, with particular attention to the management of contamination, emissions, waste and natural resources. The environmental regulatory framework includes EU legislation, the national laws of the countries in which the EDD is carried out, and regional and local laws and resolutions.

In Italy, since 2022 “environmental protection” has been included among the fundamental principles of the Constitution in Articles 9 and 41, but the relevant environmental legislation is the Environmental Code (Legislative Decree No. 152/2006), issued by the Italian Government to reorganise the main environmental regulations and to implement certain EU directives, coming into force on 29 April 2006. It is divided into six parts, comprising a total of 318 articles, with 45 annexes, and defines the criminal/administrative penalties for non-compliance with the provisions. It sets out the main requirements for the management of water, waste and emissions and contains a series of provisions

that comprehensively regulate environmental protection and form the basis for all environmental due diligence activities carried out within the national territory. The six parts cover:

- 1) Common dispositions;
- 2) Procedures for Strategic Environmental Assessment “SEA” (VAS), Environmental Impact Assessment “EIA” (VIA) and Integrated Environmental Authorisation “IEA” (AIA);
- 3) Regulations on soil protection and combating desertification, water pollution prevention and water resource management;
- 4) Regulations on waste management and contaminated site remediation;
- 5) Regulations on air protection and reduction of atmospheric emissions;
- 6) Regulations on compensation for environmental damage;

The regulatory and permitting framework for the commissioning and management of industrial plants is complex and varied. Environmental authorizations must be required by all activities to obtain the necessary permits to implement new projects or make changes to existing and/or operating facilities in compliance with the requirements of Italian legislation and in line with international standards. According to Part II, the main environmental permits are:

- EIA identifies, describes and evaluates the direct/indirect effects of a project on various factors including humans, flora/fauna, soil, water, air, climate, landscape, material assets, cultural heritage, before their construction. The EIA Screening is the process of determining whether the procedure is required for a particular project. The legislation also provides for SEA, which allows for the analysis of the listed impacts when generated by plans and programmes.
- IEA, related to Industrial Emissions Directive (IED, Directive 2010/75/EU), aim to prevent and control of pollution from industrial activities using a comprehensive/integrated approach, that must consider the whole environmental performance of the installation (emissions to air, water and soil, prevent waste generation, use of raw materials, energy efficiency, noise, etc.), through the application of the Best Available Techniques (BATs).
- The DPR 59/2013 also introduced the Environmental Unique Permit (EUP or AUA) to streamline environmental administrative requirements. This permit allows SMEs and plants not subject to IEA to consolidate various environmental permits that were previously required and obtained separately, including those for wastewater discharge, atmospheric emissions, waste communication, agronomic use of livestock manure and wastewater, acoustic pollution, and the use of sludge derived from agricultural depuration.

Part III of the Environmental Code establishes rules for the protection and sustainable use of water resources, with particular emphasis on the prevention of water pollution. This is achieved through the implementation of environmental quality objectives, compliance with discharge limits and their gradual reduction, adjustments to sewerage and purification systems, identification of vulnerable areas, and measures aimed at saving and reusing water resources.

Part IV of the Code regulates waste management by establishing criteria for its classification, disposal and recovery as well as the management of contaminated sites, by establishing procedures for the remediation of contaminated sites, including the obligation to secure polluted areas, as well as contamination threshold concentrations (CSC) ascertain the extent of contamination in the environmental matrix (soil and water) is contaminated.

Part V of the D.Lgs. 152/06 establishes rules on air protection and the reduction of atmospheric emissions, setting criteria for their prevention, authorisation limits, collection and monitoring methods. Rather than the AUA, for specific plants and activities, a General Authorisation (AVG) may be required to authorise atmospheric emissions.

The Environmental Code does not address noise pollution, electromagnetic pollution, ionizing substances, water supply, the risk of major accidents (Seveso III), ozone-depleting substances, greenhouse gases, the Emissions Trading Scheme, and PCBs, for which specific regulatory references exist, some previously mentioned.

The Law 447 of 1995, titled "Framework Law on Noise Pollution," along with the amendments introduced by Legislative Decree 42 of 2017, outlines the fundamental principles for protecting both

external and living environments from noise pollution. The law analyses all issues relating to noise, the entities responsible for analysing them and the responsibilities of the State, Regions, Provinces and Municipalities. Article 8 establishes the requirement for the undertaking of noise impact and acoustic climate assessments for specific categories of construction projects; the D.P.C.M. of November 14th, 1997, sets the limit values and the definition of acoustic zonation classes. Royal Decree No. 1775 of 11 December 1933 is the 'Consolidated Law on Water and Electrical Installations'. This decree, with subsequent additions, consolidated and organised the laws relating to the use of public waters and the transmission and distribution of electricity, and established procedures for litigation and general provisions. The purpose of the framework is to provide a comprehensive and centralised regulatory framework for the management of water resources and electrical infrastructure. Titles 1 and 2 of the Decree establish rules on the diversion and use of public waters, including authorisations and concessions, and special provisions on groundwater, with specific rules for its use and management.

The European Union has developed a complex regulatory framework for environmental protection, based on directives, regulations and decisions, designed to promote the sustainable management of natural resources, pollution prevention and biodiversity protection. The main regulations that directly influence environmental due diligence include:

- Directive 1996/59/EC on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT).
- Water Framework Directive 2000/60/EC establishes a framework for the protection of surface water, groundwater, coastal and transitional waters in the EU, promoting the sustainable use and protection of aquatic ecosystems.
- Directive 2002/49/EC on the assessment and management of environmental noise.
- Directive 2004/35/EC known as the Environmental Liability Directive, it establishes the “polluter pays” principle and introduces obligations to prevent and remedy environmental damage, requiring economic operators to be liable for repairing damage caused to the environment (soil, water, biodiversity).
- Directive 2006/118/EC on the protection of groundwater against pollution and deterioration, last updated by Directive 2014/80/EU.
- EC Regulation No. 2006/1907, last updated with EU Commission Regulation 2025/1731 concerning the registration, evaluation, authorisation and restriction of chemicals (REACH).
- Directive 2018/851/EU represents the recent amendment to Directive 2008/98/EC, the Waste Framework Directive, which establishes the regulatory framework for waste management, provides a clear definition of what constitutes waste and the concepts of “by-product” and “end of waste” (when a material is no longer considered waste), setting targets for the recycling of materials such as paper, glass, metals and plastics.
- Directive 2010/75/EU on industrial emissions (IED), as mentioned above, concerns the integrated prevention and reduction of pollution caused by industrial activities, setting strict limits and requiring companies to obtain an environmental permit with relevant requirements.
- Directive 2012/18/EU (Seveso III) regulates the control of major accident hazards involving dangerous substances. It imposes strict requirements for the prevention of major accidents and for limiting the consequences for human health and the environment. Companies that handle such substances must implement emergency plans and notify the competent authorities.

These European directives, transposed into national law, form part of the regulatory framework within which companies operate in the EU, and compliance with them is an essential element of EDD activities.

Failure to comply with international, European and national environmental regulations can result in severe legal and financial consequences for economic operators. The main penalties include:

- Monetary sanctions: significant financial penalties may be imposed for regulatory violations, particularly in cases of failure to manage or dispose of waste properly, unauthorised emissions or failure to comply with remediation procedures.

- Compensation obligations: operators may be held liable for damage caused to the environment, covering the costs of remediation and restoration of contaminated sites.
- Remediation obligations: the companies responsible for the eventual contamination may be required to undertake remediation operations to restore the contaminated area to a safe condition.

Ensuring compliance with these regulations during environmental due diligence is essential to prevent unexpected expenses and damage to reputation, as well as to ensure the long-term sustainability of business operations.

2.3 – EDD activity and Phase I & Phase II

There are no European or national standards or guidelines for conducting an EDD. In the context of the preliminary assessment of any liabilities associated with soil, subsoil and groundwater at the international level, reference is typically made to the standard defined by ASTM (American Society for Testing and Materials) International, the US technical standardisation body, equivalent to the Italian National Unification Body (UNI EN standards). For the execution of EDD Phase I (see the following paragraph for further information), the ASTM has issued specific protocols, ASTM E1527-21 and ASTM 1528-22. These protocols are only partially implemented in Europe and are applied within the available limits. The objectives of this practice are twofold: firstly, to collect and document good practices in the field of environmental assessments for commercial properties, and secondly, to promote high-quality, standardised assessments. The practice provides a practical, uniform method for conducting appropriate investigations, establishing a clear standard to aid in the legal interpretation of Limited Environmental Liability. This technical protocol introduces a series of concepts that must be applied during the process of environmental assessment, including:

- *Recognized Environmental Conditions (REC)* – (1) the presence of hazardous substances or petroleum products in, on, or at the subject property due to a release to the environment; (2) the likely presence of hazardous substances or petroleum products in, on, or at the subject property due to a release or likely release to the environment; or (3) the presence of hazardous substances or petroleum products in, on, or at the subject property under conditions that pose a material threat of a future release to the environment.
- *Historical Recognized Environmental Condition (HREC)* – a previous release of hazardous substances or petroleum products affecting the subject property that has been addressed to the satisfaction of the applicable regulatory authority or authorities and meeting unrestricted use criteria established by the applicable regulatory authority or authorities without subjecting the subject property to any controls (for example, activity and use limitations or other property use limitations).
- *Controlled Recognized Environmental Condition (CREC)* – a recognized environmental condition affecting the subject property that has been addressed to the satisfaction of the applicable regulatory authority or authorities with hazardous substances or petroleum products allowed to remain in place subject to implementation of required controls (for example, activity and use limitations or other property use limitations).
- *De minimis conditions* - a condition related to a release that generally does not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. A condition determined to be a de minimis condition is not a recognized environmental condition nor a controlled recognized environmental condition.
- *Business Environmental Risk (BER)* – a risk which can have a material environmental or environmentally-driven impact on the business associated with the current or planned use of commercial real estate, not necessarily related to those environmental issues required to be investigated in this practice.

The importance of applying ASTM standards lies in the fact that they guarantee comparability with other types of similar studies, ensure that the assumptions made in the environmental survey during the contractual and decision-making phases of the transaction cannot be refuted, and guarantee that

internationally approved methodological standards recognised by international companies and credit institutions are applied.

The environmental due diligence process is conducted using a methodology based on two different levels of investigation: one non-invasive and one invasive, which includes the investigation of environmental matrices. The following activities may be undertaken during the pre-acquisition phase to support the decision-making process:

- **EDD Phase I:** non-invasive phase aimed at identifying potential environmental liabilities and providing a preliminary verification of compliance with current environmental regulations. This initial phase is aimed at defining a preliminary assessment of the asset and determining the need to carry out any additional investigations to define and quantify the environmental liabilities in economic terms.
- **EDD Phase II:** invasive phase of direct investigation that may include a detailed verification, through sampling and analysis, of the main issues such as soil, subsoil and groundwater, plant integrity, asbestos, PCBs, etc, which may involve intrusive activities such as geophysical surveys, boreholes and monitoring piezometers.

The operational steps of an EDD Phase I generally include:

1. Desktop study: collection of historical and documentary information relating to past and current use of the site from public sources.
2. Data room: review of documentation provided by the Client or Site Representative.
3. Site visit: visual inspection to identify any indicators of contamination or environmental risk, including interviews with site personnel and administrators to obtain useful information.
4. Reporting: as highlighted in the previous chapter, a report detailing the results of the procedure and the consequent recommendations.

Document analysis and information gathering, also known as Desktop Review, are one of the fundamental steps in Phase I. This activity therefore focuses on gathering and reviewing the information necessary for the territorial and environmental classification of the site, including neighbouring areas, to identify any sources of contamination outside the site through access to various sources. To this end, documents available from public sources are consulted, such as General Regulatory Plans (PRG, or Territorial Government Plans, PGT, in some municipalities), Provincial Territorial Coordination Plans (PTCP), Regional Territorial Plans (PTR), topographical maps, geological and hydrogeological maps, environmental publications, databases (e.g. those provided by the Ministry of the Environment and Energy Security (MASE) and ARPA (Regional Environmental Protection Agency), aerial photographs, and press reports to verify any findings of waste, spills, fires, etc. The main points investigated during the desktop study phase are:

- **Current and historical use of the site:** Consultation of historical aerial photographs, Regional Technical Maps (CTR) and any available documentation, possibly also from the client or site representative, that allows the historical use of the site to be traced. Specifically, the historical use of all areas of the site must be reconstructed in order to verify the possible presence of potential activities that could lead to the release of contaminants into the environmental matrices. Activities such as waste and chemical storage areas, asbestos roofs, missing flooring or soil alterations.
- **Territorial setting:** Determine whether the site is in areas designated for industrial/commercial or residential use, assessing the possible presence of sensitive elements such as residential settlements, nurseries/schools, water wells, environmental and nature protection areas, etc; define the geographical, geological, hydrological and hydrogeological characteristics, with particular attention to the vulnerability of the aquifer, if present, based on the stratigraphy of the soil and subsoil, as well as the possible sensitivity of the aquifer itself, defined on the basis of the use of the resource, such as wells for industrial, irrigation or residential use; Any critical issues relating to the territory, such as hydrogeological and seismic risk, widespread contamination, presence of radon; presence of potential sources of contamination such as

contaminated sites, SIN (Sites of National Interest), landfills, production plants, etc., which could pose a risk to the site under assessment.

The data room is defined as the physical or digital of site-specific documentation provided by the Client, or in any case by the third party involved in the area under investigation. In particular, the documentation made available should provide information on the characteristics of the site, the activities carried out, environmental compliance, and the risk control and prevention systems in place, including management methods. Typically, the information that can be found in a data room is as follows:

- General site plans and specific construction characteristics of buildings and facilities, as well as information on production cycles and the CAPEX spent or planned;
- Environmental authorisations, environmental monitoring data used to verify compliance with emissions, discharges, noise, odours, etc., reports issued by the authorities responsible for monitoring; also, the results of inspections by authorities.
- Soil and subsoil quality and groundwater, presence of fill material or buried waste, identified for example in monitoring campaigns or previous environmental surveys, risk analyses, remediation projects;
- Use of hazardous and/or restricted substances, methods of use and storage, and waste management;

The site inspection is an activity aimed at obtaining an overview of the area under examination with the purpose of gathering further information on the activities carried out, the operating methods in place, observing the state of conservation of any buildings and facilities present, confirming the information obtained during the previous phases or identifying possible sources of environmental criticalities not highlighted in the documentation consulted. During the visit, at least one site manager or representative is generally present to answer any questions regarding the operations carried out in the area and events that may have contributed to potential contamination, allowing, in many cases, any doubts that arose during the document collection to be clarified. This opportunity is also useful for understanding the maturity of the organisation in terms of skills and training regarding HSE aspects.

The reporting and interpretation phase constitutes the final stage of the Phase I process. The final report comprises a summary of the environmental conditions of the property, highlighting any contamination or risks detected, along with the possible implications for health and the environment. After the evaluation of the information collected, missing information may be requested during a Q&A session or providing the questions' list to target through proper communication channels, coordinated by the project manager. The findings are classified as:

- Significant – Confirmed or otherwise demonstrated impairment of environmental media or regulatory non-compliance that typically would require expenditures in excess of the significance threshold.
- Potentially Significant – Potential impairment of environmental media or potential regulatory non-compliance that has not been confirmed or otherwise demonstrated through appropriate collection of data or technical analysis. Expenditures in excess of the significance threshold could be required if potential impairment or regulatory non-compliance were to be confirmed.
- Unlikely Significant – Issues that are not expected to result in expenditures in excess of the significance threshold

The interpretation of the results is essential to provide decision-makers with a clear assessment of potential environmental liabilities and critical issues, regulatory obligations and any necessary remediation measures. The report also provides practical recommendations for managing or mitigating the risks identified, thus guiding owners or investors in strategic decisions regarding the purchase, management or disposal of the property.

Although this thesis work tries to focus on the analysis of the EDD Phase I findings, it is worth mentioning that in the case this first degree of investigation identifies potential environmental issues at

the site in question, it is strongly recommended the conduction of a more thorough investigation, as represented by Phase II of the EDD. This phase involves a series of field operations, which may include drilling and monitoring piezometers, sampling and analysing environmental matrices including soil, subsoil, groundwater, interstitial gases, wastewater, atmospheric emissions, noise, ACM and MMVF, and conducting geophysical surveys. The objective of this study is to investigate and consolidate the preliminary data, with a view to confirming or ruling out the presence of specific contaminants and compliance with regulations. In the event that the limits or concentrations stipulated by the legislator are exceeded, the extent of the potential liabilities identified is assessed, the relevant remediation actions are evaluated, and their consequences are defined. The methodological approach for the design and execution of a Phase II investigation consists of:

- *Planning and survey methods* - Potential Area of Concern (PAOC) are outlined and the type of matrix to be investigated, the type and characteristics of the investigation and the analytical set to be recreated (metals, BTEX, chlorinated compounds, etc.) are defined.
- *Geognostic surveys and installation of piezometers* - The work is conducted in accordance with meticulous procedures, ensuring precision and safety, while also preserving objectivity.
- *Sampling and analysis of soil, subsoil and groundwater* - Soil and groundwater sampling operations are conducted in accordance with methodologies that facilitate the acquisition of a representative sample from the matrix from which it originates. This enables chemical analysis to provide a comprehensive assessment of the quality of the matrix.
- *Interpretation of results and assessment of environmental risks* - All information and results obtained from surveys and sampling of environmental matrices are reported in a technical report that describes, in a detailed and objective manner, the stages of the survey, any limitations and the results obtained.
- *Recommendations and operational steps to follow in the event of Concentrations Contamination Threshold (CSC³) exceedances* - In the event that the results of Phase II activities conducted on site show that regulatory limits for certain substances have been exceeded, the necessary actions in line with the regulations (notification to public authorities, detailed characterisation plan, etc.) are generally recommended.

2.4 – Ramboll Group

Ramboll Group is an independent consultancy and engineering firm headquartered in Copenhagen, Denmark. Founded in 1945, Ramboll has grown to become a global leader in providing multidisciplinary services, now operating with a presence in more than 35 countries with more than 18,000 experts working from a well-established office network with 300 offices.

Geographical footprint

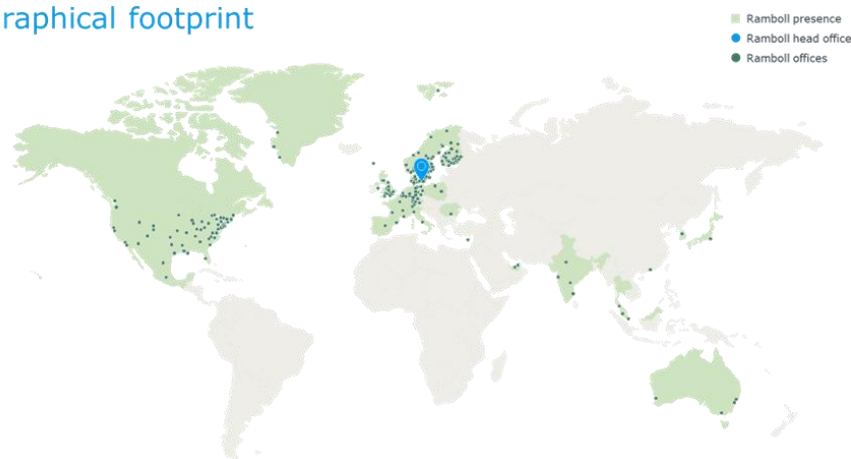


Figure 1 - Ramboll's office around the World

³ "Concentrazioni Soglia di Contaminazione" are defined by Legislative Decree 152/06 and specified in Annex 5 to Part IV, Title V, of the Decree. This decree establishes the criteria for assessing the contamination status of soil and groundwater. CSC are defined for a series of chemical parameters and are differentiated according to land use (residential, industrial, etc.).

Ramboll combines deep scientific expertise and technical acumen with a broad global footprint to deliver sustainable solutions that are protective of human health and the environment. Ramboll can rely on experienced, locally based due-diligence auditors for the proposed work, familiar with the appropriate national legislation, to enable their stakeholders to realise their goals and navigate the transition to a more sustainable future. The Company is owned by the Ramboll Foundation, which safeguards its independence and commitment to sustainable development. Ramboll's core activities span a wide range of sectors, including:

- **Buildings:** Planning, designing, and managing new and existing structures, with a focus on using sustainable materials and innovative architectural solutions.
- **Transport:** Delivering projects in urban mobility, rail infrastructure, roads, bridges, and public transportation systems to facilitate efficient and sustainable movement of people and goods.
- **Environment & Health:** Offering environmental impact assessments, climate adaptation strategies, site remediation, and health and safety consultancy to support responsible and sustainable business practices.
- **Water:** Designing solutions for water resources management, wastewater treatment, flood risk reduction, and sustainable urban drainage systems.
- **Energy:** Supporting the energy transition with expertise in renewable energy, district heating, power systems, and energy efficiency for public and private stakeholders.
- **Management Consulting:** Providing strategy development, process optimization, digital transformation, and sustainability advisory services to guide organizations toward future-proof operations.

Since 2007, has been part of the UN Global Compact, and our Code of Conduct states our standards for ethical business behaviour. Ramboll is committed to advancing the UN Sustainable Development Goals through its work, covering seven of the SDGs within its portfolio. In 2021, Ramboll's Science-Based Carbon Reduction targets were approved by the SBTi, committing to contributing our fair share in limiting the global temperature rise to 1.5°C. The company emphasizes collaboration, innovation, and holistic solutions to address complex challenges in today's society, always aiming to create lasting value for clients and communities.

The Partner for Sustainable Change

Ramboll is fully committed to working in close partnership with our clients to solve society's biggest challenges. Ramboll strategic ambition is to become a global leader within four sustainability areas where society's needs, client demands, and Ramboll's expertise all converge.

Decarbonise for net zero

Accelerate the Green Energy Transition: Renewables and new technologies.

Decarbonisation of the built environment in Buildings, Transport, Water and Energy-intensive industries via sustainable materials and reduced energy consumption.

Resilient societies and liveability

Planning, designing, and retrofitting for resilient, healthy, safe, inclusive and socially coherent societies, cities and communities with attractive and accessible infrastructure and services, mobility, clean water and environment, and economic opportunities.

Resource management and circular economy

Resource management for a transition to circular economy.

Design for re-purposing and re-use of natural resources, building materials, lifetime extension, end-of-life and reuse of secondary materials.

Biodiversity and ecosystem

Protection of natural habitats and biodiversity, restoration of nature and ecosystems, bio-economy, biomaterials, and natural carbon sequestration in ecosystems.



Figure 2 - Ramboll Group Strategy 2022 - 2026

Ramboll is ranked by Mergermarket⁴ as No. 2 environmental Consultant for M&A transactions in Europe for the period from January 2015 to June 2025 by deal volume. During that period Ramboll has advised on 393 M&A deals with disclosed aggregate transaction value of more than EUR 168bn. Ramboll's M&A advisory to the Manufacturing and Food sectors is n.1 largest by volume in Europe with respectively a total of 54 and 29 transactions recorded with total disclosed transaction value of more than EUR 20bn and recorded for the same period.

2.4.1. – Ramboll in Italy

Strategically located in Rome and Milan, since its foundation in 1999, Ramboll Italy has offered consultancy services at a national and international level. The activity is conducted by over 150 professionals with consolidated experience, able to identify, design and implement efficient and sustainable solutions. Ramboll Italy multidisciplinary team comes from different academic and professional backgrounds, with experience and expertise in environmental and civil engineering, geology, hydrogeology, chemistry, natural sciences and toxicology, biology, physics, economics. Ramboll Italy assists clients in various sectors: finance and banking, manufacturing, chemical, pharmaceutical, energy, infrastructure, real estate, legal, waste and water management, institutional.

The following chapters will focus and explain the analysis conducted and the results obtained from the reports' review of Phase I Environmental Due Diligence assessments, kindly provided by Ramboll Italy S.r.l., carried out across three commercial sectors, generically identified as Biogas, Industrial and Brownfield. For each market sector, reports related to ten EDD carried out in different years were reviewed to extract issues relating to the environmental aspects that were considered relevant and worthy of attention for the scope of work defined in agreement with the clients. Based on the data that has been collected, the analysis broadens to include the assessment of the risk classification associated with each concerning finding. The main recommendations provided by Ramboll, for the most represented categories, are documented in accordance with the identified issues. An analysis of the estimated costs related to the issues identified is then presented, expressed based on the auditor's experience and on the quality of information available.

⁴ www.mergermarket.com

Chapter 3 – Sectors Analysis

3.1 – Biogas Production and Europe situation

Biogas is produced by the process of bacterial degradation, whereby microorganisms break down organic matter and produce a mixture of gases within an anaerobic digester in several steps that need certain basic conditions to work efficiently: besides the absence of air, uniform temperature, optimum nutrient supply and optimum and uniform pH. The equipment of a biogas plant should be able to meet these basic requirements. Therefore, a biogas plant designer should know from the beginning what kind of substrate the plant will feed on so that the right equipment for efficient biogas production can be selected. There are three categories of biomass (Gomez, 2013):

1. substrate of farm origin such as liquid manure, feed waste, harvest waste and energy crops;
2. waste from private households and municipalities such as separately collected organic waste (in organic waste containers), market waste, expired food or food waste;
3. industrial by-products such as glycerine, by-products of food processing or waste from fat separators.

As with fossil natural gas, the main component of biogas that determines the energy content of the gas is flammable methane (CH_4). Depending on the substrate digested in the biogas plant, the methane volumetric content of the biogas fluctuates between 50% and 75%. The second main component of biogas is carbon dioxide (CO_2) with a share between 25% and 45%. Other components of biogas are nitrogen (N_2), oxygen (O_2), both below 2% in volume, and traces (<1%) of hydrogen (N_2), ammonia (NH_3) and hydrogen sulphide (H_2S). Water (H_2O) is also present in the mix. The output of this process is a raw renewable gas that can be used for various applications. After desulfurization, drying and scrubbing processes, biogas can be converted to electricity and heat in cogeneration units (combined heat and power – CHP – plant with efficiency up to 90%) or the biogas is burnt into boiler to produce heat. The process of upgrading biogas to biomethane involves the filtration of all contaminants and carbon dioxide. The resultant gas is chemically indistinguishable from natural gas, with a volumetric methane content exceeding 95%, that can be distributed through the existing natural gas networks and used for the same purposes, replacing it in all its end-uses. Biogas and biomethane produced from biogas are flexible renewable fuels that can be stored. The offsetting of fossil energy with biogases stimulates leadership in clean technologies and the creation of green jobs, boosting the development of a European Bioeconomy.

According to the European Biogas Association (EBA) report of 2025, “Decoding Biogases”, 22 billion of cubic meter (bcm) of combined biogas and biomethane were produced in 2023 in Europe, equal to the gas consumption of Belgium, Denmark and Ireland combined and 7% of EU natural gas consumption in 2023.

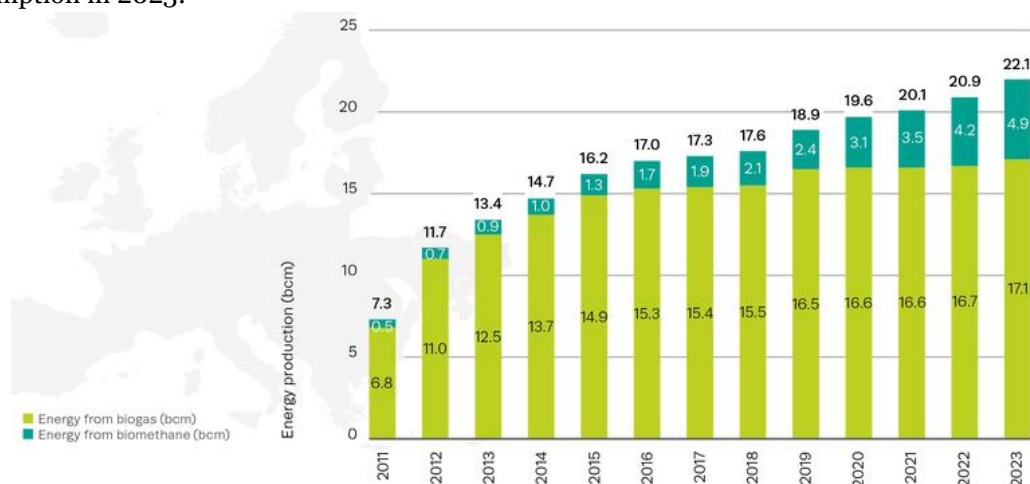


Figure 3. Combined biomethane and biogas production per year in Europe (bcm)

Biogases play a crucial role in complementing and enabling the growth of other renewables, serving as an important source of flexibility within the energy system. They provide clean, dispatchable power generation capacity, which is essential for bridging periods of prolonged low solar and wind output, but it is essential to require stronger connections between the electricity and gas systems to compensate for drops in dispatchable power, mitigate grid congestion, and ensure grid stability. The decarbonisation of the EU gas grid can be achieved through the direct injection of biomethane into existing gas infrastructure. Reusing this pre-existing asset in the energy transition avoids the significant costs and time associated with producing new vehicles, heating appliances, energy storage, or networks. Sustainable biomethane has been identified as a key factor in accelerating the decarbonisation of our energy system, providing heat and electricity for households and industries, as well as sustainable transport fuels. Moreover, digestate is a co-product of biogas production that can be used as an organic fertiliser. By doing so, different types of synthetic fertilisers can be replaced, on which EU is heavily dependent from third countries. This substitution can lead to a reduction in natural gas consumption, as the production of synthetic fertilisers is highly energy-intensive. Additionally, applying digestate to agricultural soils is recognised as a sustainable soil management practice. The stable organic fraction of digestate sustainably enriches the humus content of the soil, forming the foundation of our agri-food system. Soil regulates nutrient, carbon and water cycles, provides a habitat for biodiversity, and plays an essential role in the circular economy and climate change adaptation (European Biogas Association - EBA, January 2025).

3.1.1 – Biogas plants assessed by Ramboll Italy

In the biogas sector, the Phase I EDD assessment reports analysed formed parts of three different projects, spanning from 2021 to 2025, which were not linked to each other and were conducted in Italy at ten sites of different sizes and production volumes, built in the last 20 years. The assessments of the sites were completed in accordance with Ramboll's offers and their amendments, as agreed with each client. In general, the purpose of the review was to obtain an unbiased overview of the environmental conditions of the site in order to identify any potential issues associated with the past and current use of the area where the plant is located, both in terms of compliance with current regulations and in terms of risk prevention and management. In particular, the objectives of the assessments were to:

- verify the degree of compliance with applicable environmental regulations and requirements for activities/sites/plants/facilities, highlight critical issues or examples of good practice, and suggest improvements to be implemented in response to any issues encountered;
- identify existing and potential risk factors that may have generated or may generate impacts on environmental matrices;
- provide, for each critical issue or potential critical issue identified, the costs necessary to achieve compliance with current legislation or to reduce the associated risk;
- provide, where necessary, an assessment of the costs of any further investigations required in order to fill data gaps or obtain sufficient information to provide a specific assessment of the liabilities or potential liabilities identified.

Generically, the following activities were undertaken in order to achieve these objectives:

- review of publicly available documentation and data for the purposes of desktop analysis of the site, in particular historical aerial photographs, contaminated sites, restrictions and hydrogeological risks;
- review of environmental documentation available in the data room or provided directly by site personnel;
- when agreed, site inspection during which both external and internal areas were visited, where accessible in safe conditions, and site personnel were interviewed;
- preparation of the report, containing the results of the due diligence, the suggested actions and an estimate of the costs for further investigation and/or mitigation of the critical issues identified.

For each non-compliance identified, Ramboll typically assigns a priority level for intervention or a risk level of the issue, based on the possible consequences of non-compliance with legal requirements and prevention and protection systems designed to avoid possible accidents, having 3 level of risk (Low, Medium and High) and estimates the costs associated with the relevant corrective action. The assessments carried out could also highlights the risks and critical issues associated with environmental aspects that could have constituted a deal-breaker or a liability exceeding the various agreed materiality thresholds proposed for the critical issues identified. The economic assessment often considers a tolerance percentage associated with the uncertainty due to the lack of available information. For each of the critical issues identified during the site inspection, interview and document review, cost estimates were provided based on a “reasonably probable scenario” (RC) and a “reasonably worst-case scenario” (RWC). The reasonably probable scenario does not represent a best-case cost scenario which was not evaluated as it is associated with a lower probability of occurrence than RC and is not very cautious in the definition of the Sale and Purchase Agreement (SPA). Also, the worst-case scenario was not evaluated because it would represent an overly cautious scenario for the outcome of the assessment. When it was not possible to provide an estimate due to a lack of sufficient information, it was recommended that further investigations be carried out or that appropriate protections and guarantees be adopted in negotiations. Where the target has provided cost estimates that were considered acceptable based on the information available and Ramboll's experience, these have been accepted and assumed as the “reasonably probable scenario”. All aspects for which the operating costs and investments required for their resolution are lower are identified as “minor costs.” Ramboll's analysis does not include an assessment of administrative/criminal penalties that may be imposed by the competent authorities in the event of non-compliance.

The main technical limitations reported within the reviewed assessments pertain the circumscribed duration of site visits and the areas visited, the analysis of sites without such visits, and the failure to obtain pertinent documentation (e.g., documentation on waste management, water supply, or water discharge). These factors impeded the acquisition of useful information, thus preventing a comprehensive assessment of the issues involved which, in turn, limited the ability to express an opinion on the level of risk and the potential costs of the issues identified. These data gaps are often reflected in the subsequent analysis with the term "unclassified" or “-”, both for the level of risk and for the cost analysis.

3.1.2 – Biogas Findings’ Analysis

The analysis of the given samples was conducted by identifying the categories in which issues were detected and the number of findings for each category, with the relative level of risk and any costs associated with resolving the issue. The results obtained were incorporated into two two-dimensional data matrices: one for the purpose of enumerating the findings, and the other for the evaluation of costs. The categories containing the various findings, divided by risk level, were listed in rows, whilst the sites analysed were listed in columns. For the sake of reference, the overall matrix is displayed in **Appendix 1**. Following the review, fifteen categories were established. The subsequent description encompasses a selection of the key topics within these categories, some of which are in common with the following evaluations regarding Industrial sites and Brownfields. It is important to note that these descriptions are not exhaustive of all the possible topics falling within each category.

- *Permitting*: presents the authorisations that the facility holds, the compliance with the included requirements and the permits that it should hold.
- *CAPEX*: acronym for Capital Expenditure, refers to the money a company spends to acquire, maintain, or improve its long-term operating assets, such as buildings, land, equipment, or facilities; in this case, it is specifically referred to EHS investments list, if provided and its level of details.
- *Stakeholder Involvement*: refers to the involvement of public figures (e.g., citizens, associations, consortia, etc.) who may have initiated complaints or investigations by reporting to the competent authorities.

- *Compensation Measures*: concerns the progress of possible compensation measures for any changes to the status quo prior to the project, requested by the public authorities and required by environmental permits relating to the project's implementation.
- *HSE Management*: includes analysis of the status of general measures relating to health, safety, and environmental management, such as staff training and emergency systems.
- *Operational*: concerns the analysis of the status of the aspects inherent in the production phases in relation to what is reported in the environmental permits held by the site and to good practices in the sector.
- *Atmospheric Emissions*: concerns the assessment of aspects relating to the issue (e.g., chimney compliance, compliance with authorization limits, monitoring, etc.) with respect to what is reported in the environmental permits held by the site.
- *Odour Emissions*: analysis of compliance with the requirements set out in the authorization and any measures to limit such emissions, obtained by monitoring campaign.
- *Noise*: includes aspects identified in relation to the issue, such as surveys to characterize noise sources, the level of emissions and insertions detected, and compliance with regulatory limits.
- *Wastewater*: includes analysis of aspects relating to the management of industrial, sanitary and rainwater discharges, the related controls and implementation measures.
- *ODS and GHGs*: checks of the utilisation of these substances, with relative management measures, appropriate interventions and utilisation of non-banned gases.
- *Water Supply*: concerns the verification of compliance of the relevant documentation and the requirements imposed by the permits.
- *Waste Management*: concerns the control of waste produced on site in relation to the necessary documentation, the conditions of storage areas, labelling and related matters.
- *Chemicals Management*: shows the potential issues related to chemicals used on site that are stored, recorded, replenished, along with notes on the areas used for their management, including the evaluation of Underground and Above-ground Storage Tanks (USTs and ASTs).
- *Potential Soil and Groundwater Contamination*: outline the connections between unsafe practices within the previous categories and the potential presence of soil and subsoil contamination phenomena.

Table 1 - Categories established with number of findings for each risk level in Biogas sector

CATEGORY	LOW	MEDIUM	HIGH	UNCLASSIFIED	TOTAL
CAPEX	1	0	0	0	1
Stakeholder Involvement	0	0	1	0	1
Compensation Measures	2	0	0	0	2
HSE Management	0	2	0	0	2
Operational	0	2	0	0	2
Atmospheric Emissions	1	0	1	0	2
Odour Emissions	0	0	3	0	3
Noise	4	0	1	1	6
Wastewater	5	3	0	0	8
ODS and GHG	9	0	0	0	9
Potential Soil and Groundwater Contamination	4	5	1	0	10
Water Supply	5	4	0	2	11
Permitting	5	8	1	0	14
Waste Management	0	10	0	5	15
Chemicals Management	6	7	2	5	20
TOTAL	42	41	10	13	106

As showed into Table 1, across the ten Environmental Due Diligence reports, a total of 106 environmental findings were identified. The majority (around 79%) are categorized as low to medium risk, indicating a generally moderate environmental profile across assessed sites. However, topics such as Chemicals Management, Waste Management, Permitting, Water Supply and Potential Soil and Groundwater Contamination stand out due to their higher number of findings, representing roughly 66% of the data, and the presence of multiple risk levels, suggesting that these areas should be prioritized for corrective or preventive actions. The limited number of high-risk findings implies that severe environmental non-conformities are relatively contained but should be addressed promptly due to their potential impact.

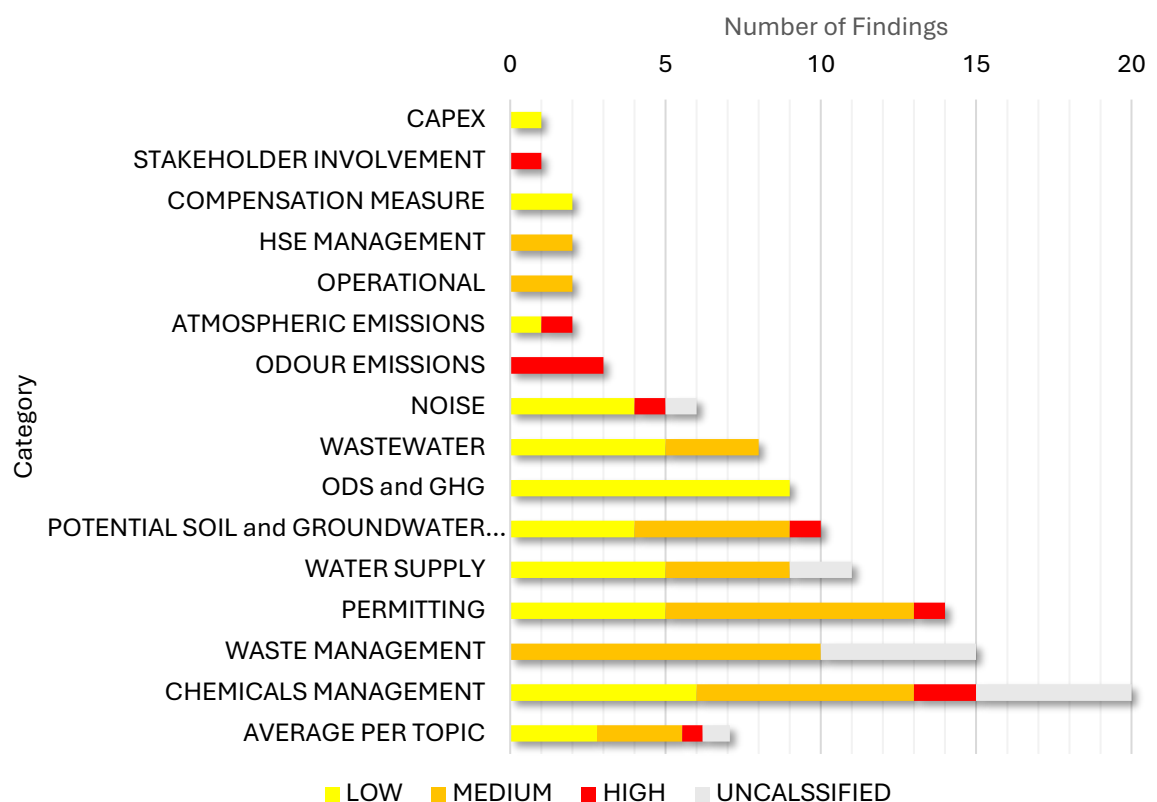


Figure 4 - Categories and number of findings in Biogas sector

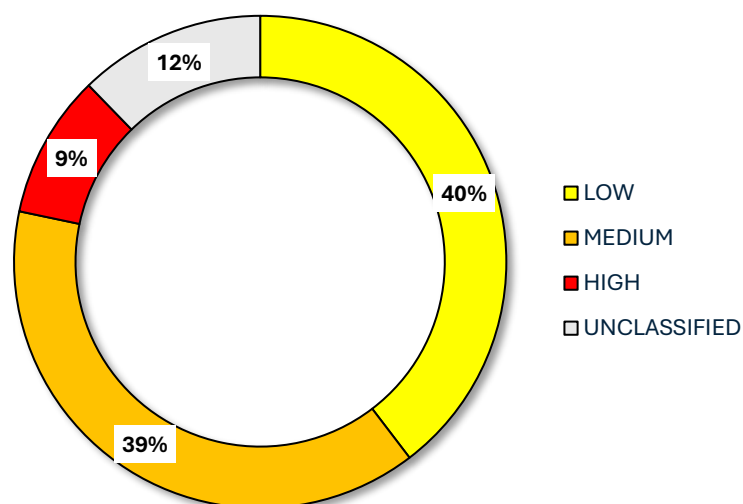


Figure 5 - Percentage division of the risk level of the findings in Biogas sector

While the majority of findings were successfully categorized into defined risk levels, approximately 12% of findings remain unclassified, without any cost estimation, which is typically due to insufficient or pending information (e.g. lack of site data, missing permits, pending analytical results) and further verification is required. These findings predominantly relate to administrative or management aspects of waste, water supply and chemical handling, operational and documentation-heavy areas, which strongly suggests data gaps or pending confirmation, rather than true absence of risk. Indeed, they should be viewed as potential sources of latent risk and trigger the Client to follow-up actions rather than ignored them, requiring additional data collection and verification during subsequent phases to confirm their actual risk classification and to estimate the cost for the potential correction of the issue identified.

The number of findings identified is strictly associated with the site visit. Figure 4 demonstrates that, for reports B1 to B5, which incorporate documentation analysis and an assessment of the actual site conditions, a higher number of findings were detected, with a more comprehensive characterisation of the risk level and, consequently, an absence of unclassified issues. By contrast, for projects B6 to B10, the EDD analysis was only able to examine the documentation without an actual site visit and discussion with site managers, due to agreements with clients. This resulted in fewer findings, less risk characterisation and, consequently, a greater spike in unclassified issues.

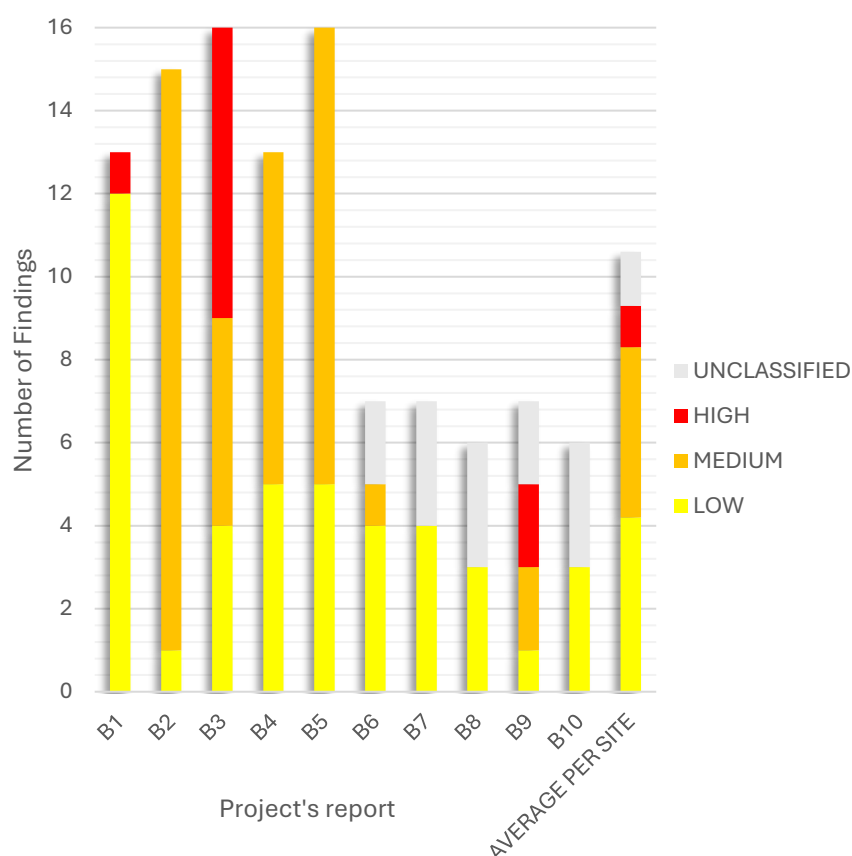


Figure 6 - Number of findings each Biogas reviewed report

Table 2 - Average number of findings for each risk level in Biogas sector

AVERAGE NUMBER OF FINDINGS	LOW	MEDIUM	HIGH	UNCLASSIFIED	TOTAL
Average Per Topic	2,8	2,7	0,7	0,9	7,1
Average Per Site	4,2	4,1	1	1,3	10,6

The Table 2 above shows the topic-basis and site-basis average number of findings, revealing that the typical topic contains about 7 findings, while the typical site has about 10-11 findings in total, mostly

low or medium risk in both cases. In particular, the Low-risk and the Medium-risk findings occur with roughly the same frequency, with difference between the two of only 0.1 or less than 5%, negligible in practical terms, both contributing almost equally to the total environmental findings. This indicates that minor and moderate issues are equally common within the assessed portfolio. Analogous considerations may be drawn from the averages of the remaining two risk categories, suggesting that environmental conditions and management practices are broadly consistent across the portfolio of sites, identifying systematic issues, not isolated anomalies, through the EDD process.

Isolating the five most significant categories for number of findings, it is interesting to notice that they enclose 70 findings out of 106 identified, roughly 66% of the data, doubling the overall average per topic, reaching the value of 14 average total findings and 7 out of almost 11 findings per site comes from these five topics. This concentration indicates that these are the core environmental exposure area across the portfolio, accounting for almost two-thirds of all identified findings. The minor issues remain relevant (28.6% of 70) but lower minor issues among these top categories, the high-risk findings are limited in number (5.7% of 70) but remained spread across topics, while it is notable the contribution of unclassified issues (17.1% of 70), which are higher in percentage in respect to the overall categories. The Medium-risk level is the dominant risk class, representing half of total findings in these five categories and the 83% of the overall medium-risk findings identified within the checked sites portfolio. Addressing these five categories could reduce the total number of issues by two-thirds and substantially improve overall environmental performance. In the hypothesis of expand this analysis across the entire sector, it may represent an opportunity to target the corrective actions efficiently and thoughtfully, thanks also to the cost estimations.

Table 3 – Focus on categories with highest number of findings in Biogas sector

CATEGORY	LOW	MEDIUM	HIGH	UNCLASSIFIED	TOTAL
Potential Soil and Groundwater Contamination	4	5	1	0	10
Water Supply	5	4	0	2	11
Permitting	5	8	1	0	14
Waste Management	0	10	0	5	15
Chemicals Management	6	7	2	5	20
TOTAL	20	34	4	12	70

Table 4 - Average values for focused categories in Biogas sector

AVERAGE NUMBER OF FINDINGS	LOW	MEDIUM	HIGH	UNCLASSIFIED	TOTAL
Average Per Topic	4	6,8	0,8	2,4	14
Average Per Site	2	3,4	0,4	1,2	7

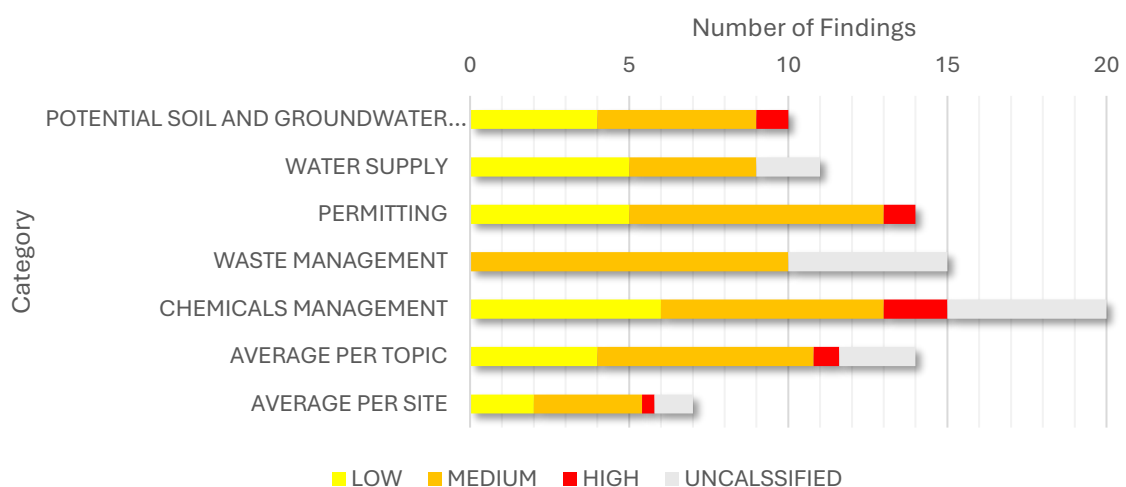


Figure 7 - Focus on Categories with highest number of findings in Biogas sector

3.1.3 – Ramboll's Recommendations

The investigation and assessment of various issues conclude with suggestions for improvement measures to be implemented, alongside an estimate of the costs (see the next subparagraph) of further investigation and/or mitigation of critical issues, also aiming to raise awareness of environmental management. Below it is reported a summary of the issues identified and the Ramboll's recommendations for the previously mentioned five categories with the highest number of findings.

Permitting – In this category, having mostly medium and low risk findings, three types of issues were identified relating to:

- discrepancies between the actual situation on site and the environmental authorisations issued by the competent authority (AIA, AUA, etc.),
- the lack of evidence of any monitoring and/or related analytical reports required, and
- the presence of plant modifications that were not properly communicated to the competent authority.

Ramboll's recommendations suggest:

- obtaining documentation providing evidence of the implementation of the requirements (e.g. characterisation analysis of the solid and liquid digestate produced, six-monthly monitoring of biogas composition) or to carry out modifications or analyses to comply with them, storing them at the site,
- to submit the changes for the authorities' opinion as soon as practically possible to avoid potential significant consequences that may affect production. Failure to comply with authorisation requirements may result in a warning from the competent authorities in the event of inspections, as well as administrative penalties.

Water Supply - The main issues encountered have predominantly low and medium risk level, with some unclassified findings, and concern:

- the total or partial absence of documentation required to carry out a thorough review (e.g. concession for groundwater abstraction through wells, payment of periodic fees, etc.),
- the need to provide the competent authority with technical reports on the construction of derivative structures and the monitoring of local issues that could lead to the review or revocation of permits in the case of alternative water supply sources.

Ramboll recommended:

- to clearly define the water supply source and align the project documentation,
- to find evidence of the water concession and payments of withdrawal fees, from both aqueduct and any derivative structures used,
- to provide local authorities with pending documentation.

Waste Management – The majority of the identified issues have been assessed as medium risk level, with few unclassified findings, and they are related to:

- the conditions of the waste storage area, the absence of proper signage,
- the presence of waste that had not been properly declared and disposed of in accordance with regulations,
- the general total or partial lack of documentation or information relating to the waste generated and the methods of storage and disposal, which are essential in the event of a site visit not being carried out.

Ramboll therefore recommended that:

- the areas used for temporary waste storage to comply with the best practices,
- the waste being properly managed and labelled, including according to its hazardous characteristics, and
- that plant operating personnel be adequately trained in HSE management to ensure that the necessary documentation is completed.

Chemicals Management –Issues have all the three level of risk together with some unclassified findings that regard the following:

- the presence of chemical products stored without the required permits,
- used oil stored together with unused one, sharing the same containment basin,
- the lack of containment basins and spill kits as protection measures,
- stains on the flooring of the storage area,
- the lack of product identification labels, Material Safety Data Sheets and, in some cases, the absence of information on chemical management in the documentation reviewed.

It is therefore recommended:

- to remove unauthorised chemical tanks,
- to label and store the products present in accordance with regulations,
- installing appropriate containment basins and spill kits,
- to establishing operating procedures describing how to store and handle chemicals in compliance with legislation and good environmental practices, and
- to provide the relevant training/information to personnel working on site,
- the SDSs of the products be stored on site in paper format near the storage areas so that they are readily available for consultation by the workers responsible for handling them.

Potential Soil and Groundwater Contamination - The points reported show mostly medium and low risk with one high risk finding:

- the integrity check of liquid digestate storage required by Regional Regulations,
- the interference of the surface aquifer with underground structures,
- potential accidental leaks of chemicals resulting from critical issues observed in the storage of oils, chemicals and waste on unpaved areas and from unchecked water discharge oil separator,
- periodic monitoring results not promptly communicated to the competent authorities and
- in addition, one site was built on an area that had previously been industrially developed (brownfield) and described by the local Master Plan as highly compromised in its environmental status due to potential soil contamination, as well as having found the limited presence of pollutants and being in proximity to an area characterised by soil contamination with a high probability of impact on the site section.

It is therefore recommended to:

- verify the integrity of product storage, the location of oil or chemical tanks on covered and paved areas with secondary containment basins,
- verify and manage the water discharge oil separator,
- carry out soil and water characterisation surveys and to transmit the monitoring results to the authorities, highlighting any exceedances and following any instructions received (possible further detailed investigations),
- in the event of possible excavation work and reuse of the soil obtained for levelling and filling, as per the regulatory requirements, excavated soils must be subjected to characterisation analysis prior to their reuse. If the analysis identifies contamination, a remediation process should be initiated and construction work stopped until its completion, which may significantly impact the construction work timeline and costs. The site could consider a back-up plan, such as the disposal of excavated soil and the use of soils purchased externally for backfilling and levelling operations, implying additional costs than budgeted.

3.1.4 – Estimated Cost Analysis

The cost analysis of the issues identified was conducted on the basis of estimates made by the various auditors who conducted the Phase I EDD assessments. As previously stated, the restrictions encountered also imposed limitations on the capacity to formulate a reliable estimate of the costs associated with the issues. The issues that were categorised as "unclassified" risk level (12%) did not

undergo cost evaluation due to a substantial absence of relevant information. The economic interpretation of the other environmental findings was listed with estimated remediation or corrective costs (in k€) divided per risk level and scenario, RC and RWC. It should be noted that, in any case, the estimated RWC cost scenario cannot be lower than the RC scenario; at most, it could be equal, for clear reasons related to the definition of the scenarios. The cost assessment is also influenced by estimates that are not strictly numerical but indicative with respect to the established materiality threshold. Such estimates may include:

- Minor Costs (MC) - All aspects for which the operating costs and investments required for their resolution are generically below the pre-established materiality threshold.
- Internal Resources (IR) - Indicates the possibility of resolving issues using personnel already assigned to the site during one or more work shifts.
- Potentially Material Costs (PMC) – The costs could reach the materiality threshold but cannot be estimated at this stage of the investigation.
- Not Estimable (NE) - Costs exceeding RC and the materiality threshold but cannot be estimated more accurately based on the limited information currently available.
- Not Defined (-) - Costs that cannot be defined due to absent or limited information, often associated to “unclassified” findings.

The portfolio analysed shows a total cost estimate of 130 k€ for the RC scenario and 231 k€ for the RWC scenario, a +77% higher that reflects significant uncertainty or possible escalation in some items. It can be noted that, while the Low-risk issues account for almost 40% of total number of findings, they represent minor costs, including just 4.4% share of RC and 6.5% share of RWC, unlikely reaching the materiality thresholds recognised with clients. By contrast, high-risk findings incur higher costs in relation to a smaller number of findings (9% of the total), accounting for 21.5% of total RC estimated cost and 26.4% of total RWC estimated cost. Medium-risk items dominate the total cost exposure, covering for the 74% of reasonable cost scenario and 67.1% of worst cost scenario, also confirmed by the average values per topic and per site. On average, each site could face a total of around €13,000 in planned corrective actions, which could rise to €23,000 in the worst-case scenario, while each category could face total costs averaging €1,200-2,200, but this figure varies considerably depending on the risk class. The discrepancy between the two cost scenarios at varying risk levels in percentage terms is substantial in all instances, indicating elevated uncertainty that escalates as the risk level increases, as expected, although in absolute terms it remains constrained. As illustrated in Table 6, which presents the mean cost scenarios according to the number of topics, sites analysed and findings, the metrics approximately double from RC to RWC. This reflects the inherent uncertainty in cost estimation, primarily due to the limited sample size considered. By comparing the cost of resolving issues to the number of findings divided by risk level, it is evident that low risk levels are associated with negligible costs, while increasing risk levels lead to higher costs per event. Under RWC scenario, each high-risk issue costs approximately 17 times more than a low-risk issue.

Table 5 – Numerical cost estimates of categories across risk levels in Biogas sector

CATEGORY	LOW		MEDIUM		HIGH		TOTAL	
	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)
Permitting	1	-	25	45	0	0	26	45
CAPEX	0	0	0	0	0	0	0	0
Water Supply	0	0	10	-	0	0	10	-
Wastewater	0	0	10	-	0	0	10	-
Waste Management	0	0	35	35	0	0	35	35
Compensation Measure	0	0	0	0	0	0	0	0
Stakeholder Involvement	0	0	0	0	0	0	0	0
Potential Soil and Groundwater Contamination	0	0	-	75	3	20	3	95
HSE Management	0	0	10	-	0	0	10	-
Operational	0	0	-	-	0	0	-	-
Odour Emissions	0	0	0	0	15	25	15	25

CATEGORY	LOW		MEDIUM		HIGH		TOTAL	
	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)
ODS And GHG	4	-	0	0	0	0	4	-
Chemicals Management	0,75	-	6,25	-	0	0	7	-
Noise	-	15	0	0	5	8	5	23
Atmospheric Emissions	0	0	0	0	5	8	5	8
TOTAL (k€)	5,75	15	96,25	155	28	61	130	231
% of Total Cost Scenario	4,4%	6,5%	74,0%	67,1%	21,5%	26,4%		

Table 6 – Average cost scenario from Biogas reports

AVERAGE	LOW		MEDIUM		HIGH		TOTAL	
	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)
Average Cost Per Topic	0,38	1,00	6,42	10,33	1,87	4,07	8,67	15,40
Average Cost Per Site	0,58	1,50	9,63	15,50	2,80	6,10	13,00	23,10
Average Cost Per Finding	0,14	0,36	2,35	3,78	2,80	6,10	1,23	2,18

The analysis of non-numerical cost estimates within the Biogas sector provides additional context for understanding the overall cost landscape. As illustrated in Table 7, a notable portion of cost estimates (57 in total) are not associated with a defined numerical cost estimate. Instead, these findings are described through qualitative cost references, as outlined earlier. Among these, the “Internal Resources” (IR) category is the most recurrent, appearing 10 times, primarily under the Low-risk (6 cases) and Medium-risk (3 cases) levels, and once for High-risk. These findings reflect situations where issues can be managed through existing personnel or operational adjustments and, therefore, would not substantially alter the total estimated financial exposure. The “Minor Cost (MC)” category, though limited to only two medium-risk cases, represents low-value interventions well below the materiality threshold. Enhancing the definition of these estimates would slightly improve cost precision but would not materially affect overall expenditure projections. The “Potentially Material Cost (PMC)” category appears only once under the Medium-risk level, suggesting that in just one RWC case costs could approach the materiality threshold but remain too uncertain for quantification at this stage. The “Not Estimable (NE)” costs (six total, all medium-risk) indicate findings where expenditures likely exceed materiality limits by a lot but cannot be quantified due to limited or uncertain information. These cases represent the most significant potential for future upward cost adjustments, particularly in the Reasonable Worst Case (RWC) scenario. Finally, the “Not Defined” category, with 38 cases (67% of the total non-numerical estimates), accounts for findings lacking sufficient information for cost classification. These are mostly distributed across the Low-risk (21 cases) and Unclassified (13 cases) levels, highlighting information gaps rather than true absence of cost relevance.

Approximately 53% of non-numerical estimates (IR and MC) correspond to low or medium-risk issues that are unlikely to significantly increase overall costs once refined. Conversely, the remaining 47% (NE and Not Defined) represent the main source of cost uncertainty and should be prioritized for data improvement or sensitivity testing. Given these uncertainties, it is plausible that the currently reported RC (€130 k) and RWC (€231 k) figures are slightly understated.

Table 7 – Non numerical cost estimates from Biogas reports

UNDEFINED COST CATEGORIES		Cost Scenario	LOW	MEDIUM	HIGH	UNCLASSIFIED	TOTAL
Minor Cost	MC	RC (k€)	0	2	0	0	2
		RWC (k€)	0	0	0	0	0
Potentially Material Cost	PMC	RC (k€)	0	0	0	0	0
		RWC (k€)	0	1	0	0	1
Internal Resources	IR	RC (k€)	6	3	1	0	10
		RWC (k€)	0	0	0	0	0
Not Estimable	NE	RC (k€)	0	1	0	0	1
		RWC (k€)	0	5	0	0	5

UNDEFINED COST CATEGORIES		Cost Scenario	LOW	MEDIUM	HIGH	UNCLASSIFIED	TOTAL
Not Defined	-	RC (k€)	21	2	2	13	38
		RWC (k€)	0	0	0	0	0
TOTAL			27	14	3	13	57

Table 8 – Count of non-numerical cost estimates related to categories and risk level from Biogas reports

CATEGORY	COUNT																				TOTAL
	LOW					MEDIUM					HIGH					UNCLASSIFIED					
	MC	PMC	IR	NE	-	MC	PMC	IR	NE	-	MC	PMC	IR	NE	-	MC	PMC	IR	NE	-	
Permitting	0	0	0	0	4	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	7
CAPEX	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Water Supply	0	0	0	0	3	0	0	0	1	2	0	0	0	0	0	0	0	0	0	2	8
Wastewater	0	0	1	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	5
Waste Management	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	5	6
Compensation Measure	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Stakeholder Involvement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Potential Soil and Groundwater Contamination	0	0	0	0	1	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	5
HSE Management	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Operational	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Odour Emissions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ODS and GHG	0	0	1	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Chemicals Management	0	0	4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	5	10
Noise	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
Atmospheric Emissions	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL	0	0	6	0	21	2	1	3	6	2	0	0	1	0	2	0	0	0	0	13	57

Finally, it is worth considering the categories analysed above with the highest number of findings. As regard for the Permitting category, the “non numerical” estimation cost spread across the 3-risk level, including 2 as “Not Estimable” within the medium risk classification. This category displays the second highest cost, showing that regulatory compliance and legal risks are significant. Water Supply do not present high costs estimation, and it is dominated by uncertainty of “Not defined” classification within all risk class. It should be noted that the presence of “Not Estimable” cost may suggest possible material impacts pending more data. Waste management has a stable cost estimate but large cost base (35 k€), with several uncertainty linked to unclassified risk classifications of the issues. Chemical Management, despite having the highest number of findings, shows low RC cost, also backed by issues manageable internally (IR), with 5 of the cost estimation of the sample falling into uncertainty. Potential contamination of soil and groundwater is the single largest source of financial exposure of this portfolio, with the largest gap between the RC and RWC scenarios; some issues may be solved internally, showing strong dependence on further site investigation.

3.2 – Industrial sector and Europe situation

Among all the industrial sectors, the Phase I EDD assessments sampled for analysis belong to food and fashion industry sites, built in different period of time, located in Italy and covered in various projects conducted by Ramboll Italy between 2022 and 2025.

The food and drink industry is the second largest manufacturing industry in EU27, after fabricated metal products. In 2022, the EU food and drink industry has over 300,000 enterprises accounting for 14.5% of the total EU27 manufacturing industry, employing 4.7 million persons and accounting for 15.7% of the manufacturing industry. It contributes 1.6% to the EU GDP and generates the largest value added (€266 billion) in the manufacturing industry. An important characteristic of the food and drink industry is the large share of small and medium size enterprises (SMEs) which make up about 99% of enterprises in the EU food and drink industry, generating 40.3% of the total value added in 2022. The industry is extremely diverse and encompasses 10 product categories, and the top three are bakery and farinaceous (49%), other products (12%) and drinks (11%) that, combined with meat sub-sector, account for 89% of the enterprises. The EU food and drink industry is a major contributor to the extra-EU trade surplus, with France, the Netherlands and Italy being leading exporters. Within the EU27, Germany and France have the largest food and drink industries, followed by Italy and Spain. Germany has a relatively large bakeries industry, meat processing industry, and beer production. France is particularly strong in dairy products, while Italy has a larger than average fruit and vegetables processing industry, as well as pasta production. In 2023, total EU27 extra-EU exports of food and drink products were valued at €183 billion, with 23 out of 27 EU countries being net exporters of food and drink products. The major products exported are other food products, drinks, meat products and dairy products, with the UK (€42.9 billion), the US (€24.9 billion), China (€12 billion), Switzerland (€8.4 billion) and Japan (€6 billion) as top destinations. Between 2008 and 2022, the EU food and drink industry has maintained its strong position as a key contributor to EU27 economic development, adapting to numerous economic, social, and environmental challenges, the food and drink industry's value added, and turnover increased by 59% and 61%, respectively. In comparison, the industry's turnover was 50.7% higher than that of the chemicals industry, and 8.1% higher than the automotive industry in 2020.

One of the major strengths of the food and drink industry is the large scale of EU's market that is strongly rooted in the EU internal market, serving around 449 million consumers in 27 Member States, which it is paired with its access to the extra-EU market bolsters trade with positive reputation of its products quality, safety and sustainability. The weaknesses of the industry are represented by the relatively lower labour productivity and investments in and adoption of innovation and technology, especially compared to the US and China. The sector is currently facing a number of external threats such as high energy prices, high commodity prices, climate change impact on commodity sourcing, increased concentration at the retail level, lack of skilled labour and increasing labour costs. On the other side the EU is well positioned to meet consumers' demand for sustainable products and improvement of the industry's productivity can be achieved by increasing automation and new technologies adoption with consistent and increased investments in the industry that will further contribute to improving its competitiveness. The European Commission is dedicated to rebooting EU competitiveness through the competitiveness compass framework. The food and drink industry, as a leading manufacturing industry, is well positioned to contribute to the competitiveness in the EU (Tidjani, Selten, & van Galen, February 2025).

According to Centre for Industrial Studies (CSIL) report of 2021 about the competitiveness of the EU textile ecosystem, the textile ecosystem comprises a series of interconnected activities that result in the production of a diverse range of final products. The transformation of natural (e.g. cotton, flax, wool, linen) and synthetic (e.g. polyester, viscose) fibres into yarns and fabrics, home textiles, industrial filters, technical textiles, carpets and clothing is a key aspect of the process. The ecosystem also includes the production of leather and fur, leather goods and footwear. Conversely, the fashion industry has emerged as the predominant platform for textile products. The manufacturing of intermediate goods and fashion goods is a key component of this sector, along with the distribution of these products to the

markets operated by wholesalers, agents, and retailers. The industries that constitute this ecosystem are of considerable importance to the EU economy. Indeed, the textile ecosystem is one of the fourteen industrial ecosystems that the Commission has identified as strategic in the recovery from the Covid-19 pandemic and for building a stronger single market. In 2018, the EU's textile industry contributed 3.1% of the value added to manufacturing and 6.5% of the manufacturing jobs. It generated a turnover of about 205 billion EUR and a production value of 198 billion EUR, which grew by 4% and 5% respectively between 2015 and 2018. The ecosystem is host to 221 000 firms, a number which has increased since 2015 (+5%). The demand for EU textile and fashion products originates from both sales within the internal market, amounting to 166.9 billion EUR, and exports to countries outside the EU, totalling 94 billion EUR. Of this latter figure, 79 billion EUR, or 84%, were constituted of fashion products. The top 3 subsectors of the textile ecosystem are represented by:

- The manufacturing of *textile wearing apparel and accessories*, representing the most substantial subsector of the textile ecosystem, that has produced goods to the value of over 64 billion EUR, with over 120,000 enterprises and 880,000 persons employed in 2018 (value-added of 19.6 billion EUR);
- *Footwear* is the second-largest manufacturing subsector of the ecosystem in terms of both production (26 billion EUR) and value added (7.5 billion EU). While value added grew rapidly (+7%), the subsector's employment (272,000 persons in 2018) decreased after 2015 (-4%), maybe caused by offshoring and the automation of production;
- *Man-made fibres, yarns and fabrics* production occupy together the third position, accounting for 39 billion EUR overall in production terms, with over 253 000 persons employed in 18 000 enterprises. Despite export growth for all three subsectors, the share of turnover generated by extra-EU exports remained low, mirrored by a low dependence on imports;
- The rest of the share are occupied by *technical and industrial textiles*, a promising market segment for the EU having every key parameters on positive growth between 2015 and 2018, *home textile*, with an expanding production basis and higher value added but decreasing exports, *tanned and dressed leather and fur*, facing both sluggish demand in the EU market (partly because of changed consumer preferences) and increasing competition from non-EU countries, *leather-goods industry (clothes and accessories)* has performed well in terms of the key variables of relevance and competitiveness.

Italy, Germany, France and Spain hold the most prominent positions in the ecosystem across nearly all subsectors. They have the largest number of enterprises and produce the highest values in terms of production and turnover. Moreover, the majority of the EU's main companies operating in the ecosystem are headquartered in these countries. Central and Eastern European MS specialise in more labour-intensive activities and generate a smaller share of turnover. Nonetheless, the main EU companies often locate certain production facilities in these countries.

The textile, leather and fashion industries have a significant environmental footprint, and consequently, they are often labelled as polluting and resource-intensive industries. The EU produces 5kg of textile waste per capita. The largest European markets are also the main producers of waste (e.g. Italy, Germany, France, Belgium, and Poland), although waste levels reduced significantly from 2004 onwards (-46%), in 2018 textile waste in the EU27 still amounted to 2.17 million tonnes. The development of second-hand and renting business models in the fashion industry may also constitute a promising strategy. These models are witnessing important growth in terms of consumption, although they still represent only a small fraction of the entire market (Centre for Industrial Studies - CSIL, November 2021).

3.2.1 – Industrial sites assessed by Ramboll Italy

The ten Phase I EDD assessment reports analysed concern industrial sites of varying sizes and production volumes. The objectives of the Environmental Reviews were to verify information provided, assess existing and identify and evaluate the potential for material environmental liabilities from past and present uses associated with the facilities, which could give rise to third party actions, remedial measures, capital expenditures or other compliance costs. Furthermore, the objectives included to

verify compliance status and to review “on the ground” conditions with respect to assessing the existing and/or identifying potentially material environmental and health & safety risks and liabilities associated with companies’ activities. In particular, the objectives of these EDDs were to assist clients in identifying risks and liabilities associated with the sites, such as:

- Operating environmental permits;
- General fit for use of the buildings, limited to the overall structure;
- Environmental issues (listed below) that may result in material expenditures and/or significantly impair operations;
- Non-compliance with environmental permits or environmental legislation that may result in the need for material expenditures and/or lead to regulatory actions that may impair operations;
- Potential upgrades involving material expenditures that may be required to comply with known changes in environmental legislative requirements in the future;

Generically, the Environmental Review comprised the following review elements:

- Review of publicly available documentation and data for the purposes of desktop analysis of the site, in particular historical aerial photographs, contaminated sites, restrictions and hydrogeological risks;
- Review of the documentation shared through a Virtual Data Room (“VDR”) or provided directly by site personnel;
- Limited or Complete Site visits during which both external and internal areas were visited, where accessible in safe conditions, and site personnel were interviewed;
- Q&A sessions with Management, when feasible;
- Evaluation and preparation of the report, containing the results of the due diligence, the suggested actions and an estimate of the costs for further investigation and/or mitigation of the critical issues identified.

Ramboll’s scope of services for these assignments did not include collection of samples of any environmental media. As such, Ramboll cannot rule out the existence of conditions, including, but not limited to, contamination not identified and defined by the data and information available to and/or obtained by Ramboll.

The assessments carried out could also highlights the risks and critical issues associated with environmental aspects that could have constituted a deal-breaker or a liability exceeding the various agreed materiality thresholds proposed for the critical issues identified. The identified findings have been further ranked as Low, Medium and High risk considering possible associated impacts for the site activities/exposure to fines by competent authorities considering the following criteria:

- High – Non-compliance/critical issues involving significant potential risks to the environment and/or the health and safety of workers, with an economic impact exceeding the materiality threshold.
- Medium – Non-conformities/critical issues that do not pose significant risks to the environment and the health and/or safety of workers, or for which corrective measures are being implemented, with an economic impact close to the materiality threshold.
- Low - Minor non-conformities/critical issues, which do not pose significant risks to the environment and/or the health and safety of workers, with limited economic impact.

The potential economical liabilities have been estimated for an assumed reasonable scope of works and assumed that the facility use will remain unchanged according to two scenarios, namely the Reasonable Probable Case (RC) and Reasonable Worst Case (RWC). Where applicable, the estimates include indicative costs for additional work that would enable the issues to be understood more clearly. Cost estimates for identified material issues are based upon Ramboll’s experience and/or using financial data obtained from site management (for example estimated or budgeted within CAPEX plans). Potential business loss and interruption costs have been excluded from cost estimates. The reasonable probable scenario does not represent a best-case cost scenario which was not evaluated as it is associated with a lower probability of occurrence than RC and is not very cautious in the definition of

the Sale and Purchase Agreement (SPA). Also, the worst-case scenario was not evaluated because it would represent an overly cautious scenario for the outcome of the assessment. When it was not possible to provide an estimate due to a lack of sufficient information, it was recommended that further investigations be carried out or that appropriate protections and guarantees be adopted in negotiations. Where the target has provided cost estimates that were considered acceptable based on the information available and Ramboll's experience, these have been accepted and assumed as the "reasonably probable scenario". All aspects for which the operating costs and investments required for their resolution are lower are identified as "minor costs." Ramboll's analysis does not include an assessment of administrative/criminal penalties that may be imposed by the competent authorities in the event of non-compliance.

The main technical limitations reported within the reviewed assessments pertain the circumscribed duration of site visits and the areas visited and the failure to obtain pertinent documentation (e.g., documentation on waste management, water supply, or water discharge). These factors impeded the acquisition of useful information, thus preventing a comprehensive assessment of the issues involved which, in turn, limited the ability to express an opinion on the level of risk and the potential costs of the issues identified. These data gaps are often reflected in the subsequent analysis with the term "unclassified" or "-", both for the level of risk and for the cost analysis.

3.2.2 – Industrial Findings' Analysis

The analysis of the given samples was conducted by identifying the categories in which issues were detected and the number of findings for each category, with the relative level of risk and any costs associated with resolving the issue. The results obtained were incorporated into two two-dimensional data matrices: one for the purpose of enumerating the findings, and the other for the evaluation of costs. The categories containing the various findings, divided by risk level, were listed in rows, whilst the sites analysed were listed in columns. For the sake of reference, the overall matrix is displayed in **Appendix 2**. Following the review, fourteen categories were established. The subsequent description encompasses a selection of the key topics within these categories, some of which are in common with the precedent and following evaluations regarding Biogas plants and Brownfields. It is important to note that these descriptions are not exhaustive of all the possible topics falling within each category.

- *Permitting*: presents the authorisations that the facility holds, the compliance with the included requirements and the permits that it should hold.
- *HSE Management*: includes analysis of the status of general measures relating to health, safety, and environmental management, such as staff training and emergency systems.
- *Atmospheric Emissions*: concerns the assessment of aspects relating to the issue (e.g., chimney compliance, compliance with authorization limits, monitoring, etc.) with respect to what is reported in the environmental permits held by the site.
- *Odour Emissions*: analysis of compliance with the requirements set out in the authorization and any measures to limit such emissions, obtained by monitoring campaign.
- *Noise*: includes aspects identified in relation to the issue, such as surveys to characterize noise sources, the level of emissions and insertions detected, and compliance with regulatory limits.
- *Asbestos*: includes the evaluation of the current and past presence of asbestos containing materials on-site, its conditions, its remediation, previous asbestos surveys and monitoring results of eventual airborne asbestos fibres.
- *Energy Consumption*: consider the possibility of dealing with an "energy-consuming company" and the evaluation of the energy audits as required by Legislative Decree 102/2014.
- *Wastewater*: includes analysis of aspects relating to the management of industrial, sanitary and rainwater discharges, the related controls and implementation measures.
- *ODS, GHGs and F-gases*: checks of the utilisation of these substances, with relative management measures, appropriate interventions and utilisation of non-banned gases.

- *PCB*: assessment of the past or present presence of equipment using PCBs, their condition and any necessary remediation.
- *Water Supply*: concerns the verification of compliance of the relevant documentation and the requirements imposed by the permits.
- *Waste Management*: concerns the control of waste produced on site in relation to the necessary documentation, the conditions of storage areas, labelling and related matters.
- *Chemicals Management*: shows the potential issues related to chemicals used on site that are stored, recorded, replenished, along with notes on the areas used for their management, including the evaluation of Underground and Above-ground Storage Tanks (USTs and ASTs).
- *Potential Soil and Groundwater Contamination*: outline the connections between unsafe practices within the previous categories and the potential presence of soil and subsoil contamination phenomena.

Table 9 - Categories established with number of findings for each risk level in Industrial sector

CATEGORY	LOW	MEDIUM	HIGH	UNCLASSIFIED	TOTAL
HSE Management	2	0	0	0	2
Odour Emissions	0	2	0	0	2
PCB	1	1	0	0	2
Noise	1	1	0	2	4
Energy Consumption	1	1	0	2	4
Water Supply	3	1	0	1	5
ODS, GHG, F-Gases	2	4	0	0	6
Waste Management	4	2	0	1	7
Chemicals Management	2	1	1	3	7
Potential Soil and Groundwater Contamination	0	7	1	0	8
Atmospheric Emissions	2	4	1	1	8
Permitting	3	1	3	1	8
Asbestos	3	1	2	3	9
Wastewater	3	8	2	0	13
TOTAL	27	34	10	14	85

Across the ten Environmental Due Diligence reports, a total of 85 environmental findings were identified. The majority (around 72%) are categorized as low to medium risk, indicating a generally moderate environmental profile across assessed sites. However, topics such as Wastewater, Permitting, Asbestos, Atmospheric Emissions in equal number with Potential Soil and Groundwater Contamination stand out due to their higher number of findings and the presence of multiple risk levels, suggesting that these areas should be prioritized for corrective or preventive actions (discussed below). The limited but significant number of high-risk findings implies that severe environmental non-conformities are relatively contained but should be addressed promptly due to their potential impact. It is notable that this elevated level of criticality is concentrated in a subset of six categories, which also exhibit the highest number of findings.

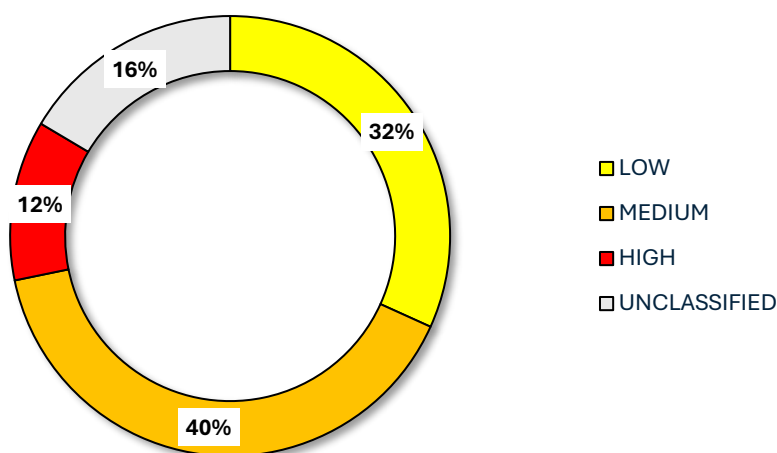


Figure 8 - Percentage division of the risk level of the findings in Industrial sector

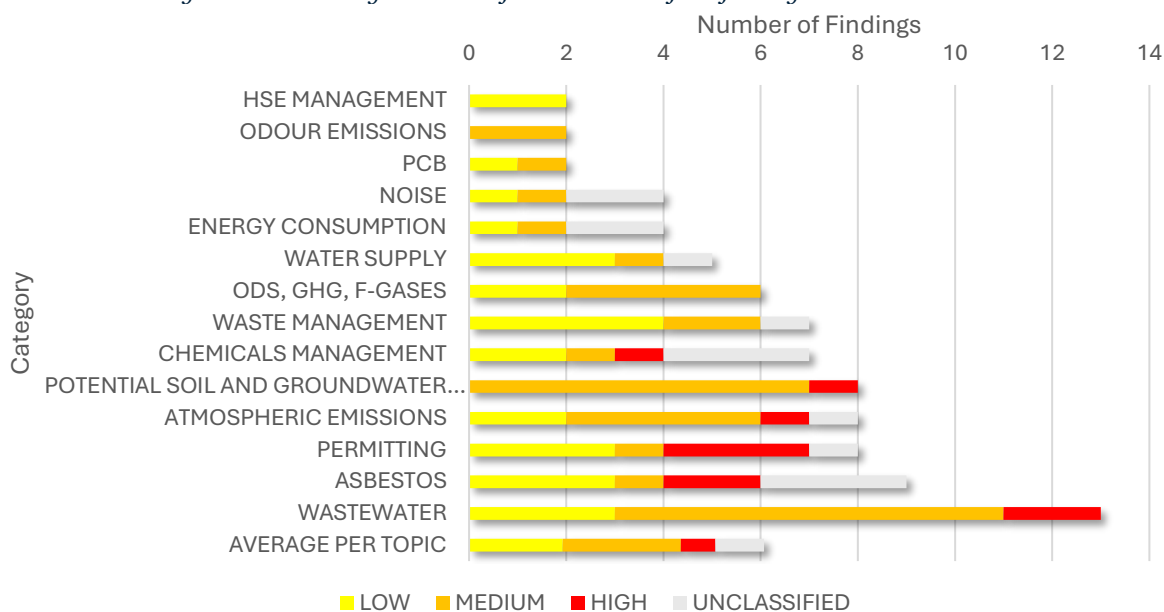


Figure 9 - Categories and number of findings in Industrial sector

As also resulted from Biogas analysis, most findings were successfully categorized into defined risk levels, but approximately 16% of findings remain unclassified, without any cost estimation, which is typically due to insufficient or pending information (e.g. lack of site data, missing permits, pending analytical results) and further verification is required. These findings predominantly relate to almost all findings' category, except for two (HSE Management and Odour Emissions), in varying degrees for each one, but still affecting the management aspects of chemicals management and asbestos, together with noise, energy consumption, waste, permitting and atmospheric emissions, operational and high-density documentation areas, potential suggesting data gaps or pending confirmation, rather than true absence of risk. Indeed, they should be viewed as potential sources of latent risk and trigger the Client to follow-up actions rather than ignored them, requiring additional data collection and verification during subsequent phases to confirm their actual risk classification and to estimate the cost for the potential correction of the issue identified.

In contrast to the reports analysed for biogas, these reports were all compiled following site visits and site personnel interviews, thereby providing an overview of the current situation at the various sites. The failure to provide documentation at this time is indicative of a new perspective, one which is more closely associated with the absence of documentation than a lack of availability. From the standpoint of

the quantity of findings for each site, it is evident that the count aligns with critical issues that are adequately characterised in terms of risk level, although, as already stated, there remains a level of issues that are not precisely classified. The average number of findings per site (8.5) is slightly higher than the median (7), indicating a moderately right-skewed distribution and typically suggesting this type of behaviour associated to a limited number of data that exhibit a significantly higher concentration of issues or number of findings. Figure 9 indicates that a significant proportion of the analysed sites exhibit between 10 and 5 findings, with a single case displaying a higher value (21), indicative of an outlier within the set. Excluding the outlier site, the mean returns to more typical levels of 7.1 findings per site are calculated Site I3 is a tannery, a facility that is recognised by due diligence experts as a type of site necessitating particular attention due to the various activities that could result in non-compliance and potential pollution risks.

Table 10 - Average number of findings for each risk level in Industrial sector

AVERAGE NUMBER OF FINDINGS	LOW	MEDIUM	HIGH	UNCLASSIFIED	TOTAL
Average Per Topic	1,9	2,4	0,7	1,0	6,1
Average Per Site	2,7	3,4	1,0	1,4	8,5

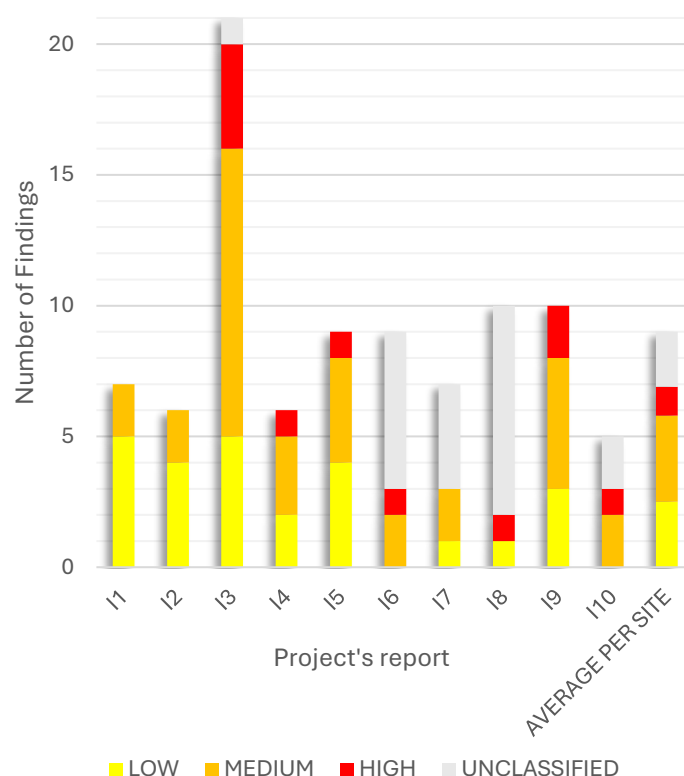


Figure 10 - Number of findings each Industrial reviewed report

The Table 10 above shows the topic-basis and site-basis average number of findings, revealing that the typical topic contains about 6 findings, while the typical site has about 8.5 findings in total, mostly low or medium risk in both cases. Together, Low and Medium findings account for the majority of all findings (~72%), with medium occurring more often but still suggesting that while most issues are not critical, they still require consistent follow-up and corrective actions. High-risk findings are limited on average to one finding per site and almost one topic, shows generally controlled risk exposure, but the few high findings likely relate to specific complex topics (e.g., soil contamination, wastewater, or chemical management). Unclassified findings also are limited to some areas, indicating where additional data or confirmations are needed.

Table 11 - Focus on categories with highest number of findings in Industrial sector

CATEGORY	LOW	MEDIUM	HIGH	UNCLASSIFIED	TOTAL
Potential Soil and Groundwater Contamination	0	7	1	0	8
Atmospheric Emissions	2	4	1	1	8
Permitting	3	1	3	1	8
Asbestos	3	1	2	3	9
Wastewater	3	8	2	0	13
TOTAL	11	21	9	5	46

Table 12 - Average values for focused categories in Industrial sector

AVERAGE TYPE	LOW	MEDIUM	HIGH	UNCLASSIFIED	TOTAL
Average Per Topic	2,2	4,2	1,8	1,0	9,2
Average Per Site	1,1	2,1	0,9	0,5	4,6

In this case the five most represented categories for number of findings enclose 46 findings out of 85 identified, roughly 54% of the data, gaining some point above the overall average per topic, reaching the value of 9.2 average total findings and almost 5 out of 9 findings per site comes from these five categories, showing that the main environmental challenges are concentrated but recurring. This concentration indicates that these are the core environmental exposure area across the portfolio, accounting for more than half of all identified findings. The minor issues (11 out of 46, 24%) appear to occur with almost the same frequency as high-risk issues (9 findings, 20%), the latter of which are practically all contained within these five categories (10 in total across all categories). The medium risk findings dominate these categories (21 out of 46 findings, 46%), occurring with different quantities in each category and remaining consistent with the observations recorded across the entire portfolio of sites. Unclassified findings are below the overall average, showing that the issues in question are only partially yet affected by the lack of documents or information. So, priority actions should focus on wastewater management, permit compliance and asbestos risk reduction, while maintaining control over emissions and site contamination prevention. Addressing these 5 categories could cut at least by half the total number of issues and substantially improve the overall environmental performances of the sites. In the hypothesis of expand this analysis across the entire sector, it may represent an opportunity to target the corrective actions efficiently and thoughtfully, thanks also to the cost estimations.

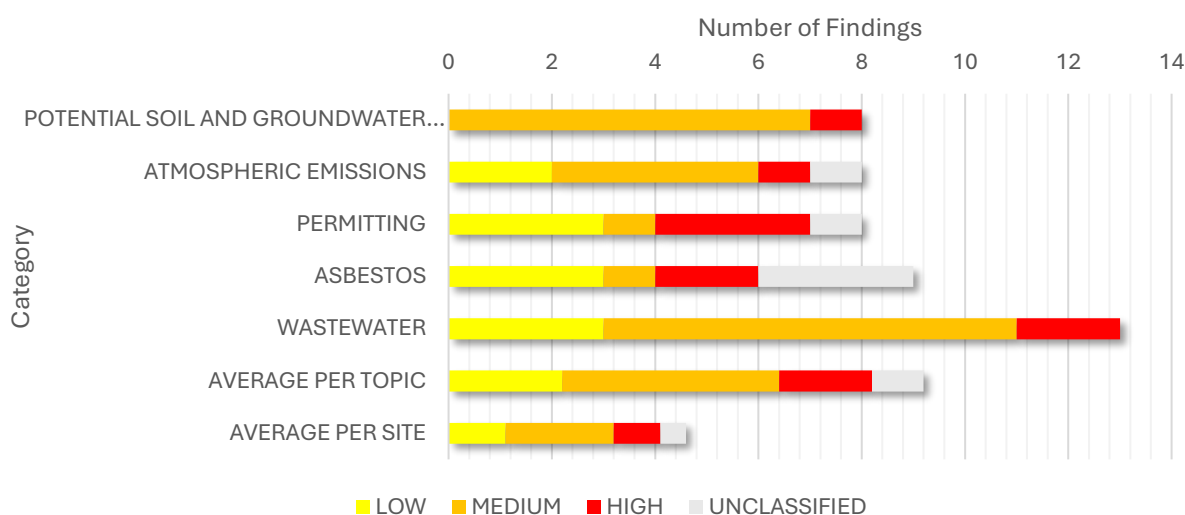


Figure 11 - Focus on Categories with highest number of findings in Industrial sector

3.2.3 – Ramboll's Recommendations

The investigation and assessment of various issues conclude with suggestions for improvement measures to be implemented, alongside an estimate of the costs (see the next subparagraph) of further investigation and/or mitigation of critical issues, also aiming to raise awareness of environmental management. Below it is reported a summary of the issues identified and a generic version of Ramboll's recommendations for the previously mentioned five categories with the highest number of findings.

Permitting - In this category, the findings are divided mostly with low and high-risk level, with few medium and unclassified findings, three types of issues were identified relating to:

- discrepancies between the actual situation on site and the environmental authorisations issued by the competent authority (AIA, AUA, etc.),
- implemented plants modifications without feedback from competent authorities,
- plan to apply for Integrated Environmental Authorisations (AIA) which may require stricter limits and controls and possible investments to ensure them,
- the lack of evidence of any monitoring and/or related analytical reports required, and
- the presence of plant modifications that were not properly communicated or authorised by the competent authority.

Ramboll's recommendations suggest:

- obtaining documentation providing evidence of the implementation of the requirements (e.g. logbook of the maintenance operations) or to carry out modifications or analyses to comply with them, storing them at the site,
- to submit any changes and/or any new request of authorisation to the authorities as soon as practically possible to avoid potential significant consequences (requirements) that may affect activities. Failure to comply with authorisation requirements may result in a warning from the competent authorities in the event of inspections, as well as administrative penalties, suspension or seizure of facilities with interruption of activities in the most serious cases.

Asbestos Containing Materials – The category presents all the three level of risks and unclassified findings in equal number to low-risk; the main issues encountered concern:

- the lack of asbestos survey, any updated version or one covering all areas of the site, required to carry out a thorough evaluation,
- the lack of any asbestos airborne fibres monitoring assessment,
- the need to appoint an asbestos manager for the site.

Ramboll recommended:

- to conduct an ACMs survey and, in the event of detection, appoint an asbestos manager and determine the quantities/extent of the material containing asbestos and related conservation conditions,
- to carry out monitoring campaigns for airborne fibres and manage the removal or remediation of such material.

Wastewater – This category has the highest number of findings, mainly associated with a medium level of risk and a few others associated with low and high levels of risk. It is also notable for the absence of unclassified findings. Issues were identified relating to:

- lack of wastewater discharge authorisation from competent authority,
- planned works of construction of connection to the municipal sewer system,
- lack of equipment as required by wastewater discharge permits (e.g. oil separator, sand separator, flooding detection system, equalisation tank cover, etc.),
- provision for the renovation of the wastewater treatment plant (WWTP), as part of the site development plan, due to decay and improvement of treatment capacity,
- modification of the WWTP has not been communicated to competent authorities,

- potential risk of contamination of first rainwater due to the storage of hazardous substances without adequate protection from atmospheric events,
- exceedance of regulatory limits at the final discharge point of the wastewater treatment plant, which was ascertained following the periodical sampling activity carried out by public wastewater and water management company, that lead to a prescription of a new sample and technical note to be transmitted to ARPA; lastly, the payment of a fine.

Ramboll therefore recommended that:

- installation and/or planning the maintenance of equipment required by environmental and discharge permits,
- realisation of connection between wastewater discharges of the site and municipal sewage system,
- undertake the procedure to require the proper or new discharge permit and/or environmental permit due to improvement of the wastewater treatment capacity of the plant,
- provide for the covering of hazardous substance storage areas or, where possible, transfer storage to the portion of the external area already provided with the first rainwater tank,
- properly communicate the changes made to the competent authority,
- fully comply with the prescription and require professional assistance to prepare technical documents and in case required by environmental authorities, complete any intervention for the upgrade/maintenance of the WWTP.

Atmospheric Emissions – The category presents all the three level of risks, mainly medium and low-risk findings, with few unclassified and high findings. Issues regarded the following:

- air emission stacks not properly labelled, sampling position points not complying with standard UNI EN 15259:2008 and with safety and other measures required by authorisations,
- changes in operating conditions not properly communicated to the competent authorities,
- reported damages to aspiration systems,
- lack of periodical monitoring analysis.

It is therefore recommended:

- promptly communicate any plant modifications relating to atmospheric emissions to the competent authorities to receive related feedback,
- installation of appropriate safety measures at stack sampling points (e.g. vertical ladders, fall protection devices) as required by environmental authorisation and, where this is not feasible, it is recommended to define an operating procedure for sampling methods that ensures compliance with the mandatory requirements of Legislative Decree 81/08,
- proceed with the repair or replacement of damaged suction devices and with the timely verification of compliance of stacks with the requirements of standard regulations,
- verify the compliance of monitoring results with environmental limits assigned by the environmental permits, potentially through the upgrade of the existing abatement units or the provision of new ones.

Potential Soil and Groundwater Contamination - The findings in this category mainly indicate a medium level of risk and, to a lesser extent, a high level of risk. These are:

- presence of underground storage tank (UST) for storage of diesel and associated of underground piping without providing the related technical information (e.g. installation date, volume, construction material, overflow alarm systems),
- underground tanks and aboveground storage tanks (AST) containment basins appearing damaged, not lined with impermeable material and no leak tests or visual inspections has been conducted,
- damaged paving not lined with impermeable material for areas used to store hazardous process solutions or waste,

- absence of inspection and integrity verification activities for underground wastewater collection pipelines and wastewater collecting and treatment tanks,
- lack of recent soil and groundwater investigations in areas of potential concerns,
- risk of contamination migration from neighbouring properties to the target site,
- lack of execution of soil characterization activities requested by authorities,
- potential areas of concern with respect to soil and/or groundwater contamination related to past activities conducted at the site (e.g. spill or leakage of chemicals stored, management, handlings and storage of waste and chemicals, presence of abandoned underground storage tanks, historical fires) where no soil and groundwater investigation have ever been conducted,
- pending results of the annual groundwater monitoring analysis.

It is therefore recommended to:

- complete integrity test of USTs, ASTs and of associated underground piping systems and other underground structure associated to the sewer line to assess potential leakage or poor maintenance conditions; assuming limited leakage from tank/pipe with limited hot spot soil impact, proceed to remove the tank/pipe and localised soil contamination,
- carry out the characterization plan and based on its results the responsible party is required to complete a site-specific risk assessment and submit the results to the relevant authorities; if the calculated Risk Threshold Concentrations (RTCs) are exceeded, the responsible party is required to conduct soil and/or groundwater remediation and prepare and submit a clean-up/remediation design for approval by the competent authorities,
- repair of damaged sections of paving and coating with epoxy resin; coating of concrete chemical containment basins and sedimentation and equalisation tanks of the wastewater treatment plant,
- conducting an updated soil and groundwater investigation in potentially critical areas (e.g. treatment plant, storage facilities, underground structures) and, if the renovation work identifies the presence of contaminated soil in the first layer of fill, proceeding to hot spot removal, also to verify that no contamination is affecting the site from the nearby contaminated sites,
- in case monitoring identifies exceedances, additional investigations are required, followed by a human health risk analysis and emergency remediation measures (i.e. hydraulic barrier).

3.2.4 – Estimated Cost Analysis

The cost analysis of the issues identified was conducted based on estimates made by the various auditors who worked on the Phase I EDD assessments. As previously stated, the restrictions encountered also imposed limitations on the capacity to formulate a reliable estimate of the costs associated with the issues. The issues that were categorised as "unclassified" (16%) did not undergo cost evaluation due to a substantial absence of relevant information. The economic interpretation of the other environmental findings was listed with estimated remediation or corrective costs (in k€) divided per risk level and scenario, RC and RWC. It should be noted that, in any case, the estimated RWC cost scenario cannot be lower than the RC scenario but at most, it could be equal, for clear reasons related to the definition of the two scenarios. The cost assessment is also influenced by estimates that are not strictly numerical but indicative with respect to the established materiality threshold. Such estimates may include:

- Minor Costs (MC) - All aspects for which the operating costs and investments required for their resolution are generically below the pre-established materiality threshold.
- Internal Resources (IR) - Indicates the possibility of resolving issues using personnel already assigned to the site during one or more work shifts.
- Potentially Material Costs (PMC) – The costs could reach the materiality threshold but cannot be estimated at this stage of the investigation.

- Not Estimable (NE) - Costs exceeding RC and the materiality threshold but cannot be estimated more accurately based on the limited information currently available.
- Not Defined (-) - Costs that cannot be defined due to absent or limited information, often associated to “unclassified” findings.

The portfolio analysed shows one order of magnitude higher than the Biogas results, with a total cost estimate of 3817 k€ for the RC scenario and 6164 k€ for the RWC scenario, a +61.5% higher that reflects significant uncertainty or possible escalation in some items. It can be noted that, while the Low-risk issues account for almost 32% of total number of findings, they represent minor costs, including just 11% share of RC and 16% share of RWC, unlikely reaching the materiality thresholds recognised with clients. By contrast, high-risk findings incur higher costs in relation to a smaller number of findings (12% of the total), accounting for 38% of total RC estimated cost and 36% of total RWC estimated cost. Medium-risk items dominate the total cost exposure, covering for half (51%) of the reasonable cost scenario and 48% of reasonable worst cost scenario, as also showed by the average values per topic and per site, and confirming the numerical relevance of this risk level across findings (40% of total findings have medium risk level).

On average, each site could face a total of around € 381 700 in corrective actions, which could rise to € 616 400 in the reasonable worst-case scenario, while each category could face total costs averaging from € 272 640 to € 440 290, but this figure varies considerably depending on the risk class for both cost scenario. The discrepancy between the two cost scenarios at varying risk levels in percentage terms is substantial in all instances, indicating elevated uncertainty that escalates as the risk level increases, as expected, although in absolute terms it remains constrained. As illustrated in Table 14, which presents the mean cost scenarios according to the number of topics, sites analysed and findings, the metrics approximately double from RC to RWC. This reflects the inherent uncertainty in cost estimation, primarily due to the limited sample size considered. By comparing the cost of resolving issues to the number of findings divided by risk level, it is evident that low risk levels are associated with lower costs, below most of materiality threshold encountered during the reports’ review, while increasing risk levels lead to higher costs per event. Within RWC scenario, each high-risk issue costs approximately 6 times more than a low-risk issue.

Overall, medium-risk issues should be prioritized for preventive investment to potentially reduce total exposure, addressing them early, while high-risk areas should be monitored for escalation potential, particularly for soil and groundwater contamination and asbestos, where remediation could become capital-intensive. Several blanks (“-”) in the RC or RWC columns correspond to findings still tagged as IR, MC, PMC or NE, the “non-numerical” cost estimates findings which lead to an incomplete assessment of the costs. The refinement of these points will help improve the cost estimate of both scenarios and close the gaps between the two for each category.

Table 13 - Numerical cost estimates of categories across risk levels in Industrial sector

CATEGORY	LOW		MEDIUM		HIGH		TOTAL	
	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)
Permitting	5	7	10	10	40	240	55	257
Water Supply	0	0	-	150	0	0	-	150
Wastewater	160	200	1377	1770	400	590	1937	2560
Waste Management	6	7	0	0	0	0	6	7
Asbestos	50	100	10	50	180	250	240	400
Potential Soil and Groundwater Contamination	0	0	62,5	470	-	300	62,5	770
HSE Management	15	60	0	0	0	0	15	60
Odour Emissions	0	0	150	200	0	0	150	200
ODS, GHG, F-Gases	70	330	290	150	0	0	360	480
Chemicals Management	15	60	0	80	687,5	825	702,5	965
PCB	0	0	5	10	0	0	5	10
Noise	0	100	4	-	0	0	4	100

Atmospheric Emissions	-	50	30	50	150	-	180	> 100
Energy Consumption	90	90	10	15	0	0	100	105
TOTAL (k€)	411	1004	1948,5	2955	1457,5	2205	3817	6164
% of Total Cost Scenario	11%	16%	51%	48%	38%	36%		

Table 14 - Average cost scenario from Industrial reports

AVERAGE	LOW		MEDIUM		HIGH		TOTAL	
	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)
Average Cost Per Topic	29,36	71,71	139,18	211,07	104,11	157,50	272,64	440,29
Average Cost Per Site	41,10	100,40	194,85	295,50	145,75	220,50	381,70	616,40
Average Cost Per Findings	15,22	37,19	57,31	86,91	145,75	220,50	44,91	72,52

The analysis of “non-numerical” cost estimates within the sample may provide additional insight into the overall cost picture. As demonstrated in Table 14, a significant proportion of cost estimates (46) do not possess a numerical classification of costs. Instead, they are characterised by “non-numerical” reference outlined in the opening of the paragraph. The “Minor Cost” has been assigned 24 times, mostly for reasonable case scenario and more than half of it belong to low-risk level, while the few others are assigned to medium and high-risk levels; improving the definition of these cost estimates would allow for a greater degree of detail but would not result in a significant increase in the total estimated cost. No estimates have emerged that could potentially reach the materiality threshold (PMC) for any risk category. Internal resources are associated with the estimated cost of resolving an issue in a reasonable cost scenario with a medium level of risk, but even in this case, it would not result in significant changes to the estimated financial level. Costs that cannot be estimated and exceed the materiality thresholds (NE) are associated with the medium risk level and, to a lesser extent, with the low and high-risk levels. These have been assigned to scenarios with limited information, but which, if implemented, could lead to a significant increase in the total estimated cost for the RWC. A limited portion of the cost estimate remains undefined, mainly associated with a level of risk that has not been classified due to a lack of information. In conclusion, 54% of “non-numerical” estimates are associated with categories such as IR and MC which, with a higher level of detail in the available information, it is anticipated that there would not be a significant increase in the final cost, despite the variability of the assigned risk level; a smaller subset (46%), particularly the “Not Estimable” and “Not Defined” cost estimates), represents the primary source of cost uncertainty and should be prioritized for follow-up investigation or sensitivity analysis. Therefore, it can be deduced that the current RC (3817 k€) and RWC (6164 k€) figures are likely to be understated.

Table 15 – Count of non-numerical cost estimates from Industrial reports

UNDEFINED COST CATEGORIES		Cost Scenario	LOW	MEDIUM	HIGH	UNCLASSIFIED	TOTAL
Minor Cost	MC	RC (k€)	13	7	3	0	23
		RWC (k€)	1	0	0	0	1
Potentially Material Costs	PMC	RC (k€)	0	0	0	0	0
		RWC (k€)	0	0	0	0	0
Internal Resources	IR	RC (k€)	0	1	0	0	1
		RWC (k€)	0	0	0	0	0
Not Estimable	NE	RC (k€)	0	0	0	0	0
		RWC (k€)	1	4	1	0	6
Not Defined	-	RC (k€)	1	0	0	13	14
		RWC (k€)	0	0	0	1	1
TOTAL			16	12	4	14	46

Table 16 - Count of non-numerical cost estimates related to categories and risk level from Industrial reports

CATEGORY	COUNT																				TOTAL
	LOW					MEDIUM					HIGH					UNCLASSIFIED					
	MC	PMC	IR	NE	-	MC	PMC	IR	NE	-	MC	PMC	IR	NE	-	MC	PMC	IR	NE	-	
Permitting	2	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	5
Water Supply	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6
Wastewater	1	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	4
Waste Management	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5
Asbestos	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	5
Potential Soil and Groundwater Contamination	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
HSE Management	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Odour Emissions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ODS, GHG, F-Gases	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3
Chemicals Management	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3
PCB	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Noise	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	4
Atmospheric Emissions	2	0	0	0	0	2	0	1	0	0	0	0	0	1	0	0	0	0	0	1	7
Energy Consumption	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
TOTAL	14	0	0	1	1	7	0	1	4	0	3	0	0	1	0	0	0	0	0	14	46

Finally, it is worth considering the categories analysed above with the highest number of findings in relation to Table 16 results. As regard for the Permitting category, the “non numerical” estimation cost spread across the 2 out 3-risk level, including 3 as “Minor Cost” within the low and high-risk classification. This category displays the fifth highest cost, showing that regulatory compliance and legal risks could be significant for this case. Asbestos also presents high costs estimation, and it is affected by uncertainty of “Not Defined” classification with “Unclassified” and Low-risk classification, highlighting the possibility of changes in cost estimation. Atmospheric Emissions cost estimates are not particularly high, and it is partially affected by “Minor Cost” and “Internal Resource” estimates that would not affect the overall costs, particularly the RC scenario. The Potential contamination of soil and groundwater is defined by great difference between RC and RWC cost scenarios, but no substantial non-numerical cost estimate is present. However, it should be noted that the related cost estimates never include groundwater remediation, even in the RWC, as this is considered a worst-case scenario. Wastewater, in addition to the highest number of findings, has the highest cost estimate of the portfolio, showing a difference of more than 600 k€ between the two cost scenarios. The possibility of being affected by non-numerical cost estimates can be assessed as medium having the “Minor Cost” associated to all the three risk level.

It is important to note the significant financial implications of the chemical management category, which are largely attributed to the documented capital expenditure (CAPEX) associated with the refurbishment of the ammonia refrigeration system at a single site. As previously stated, the analysis is primarily influenced by the examination of a limited number of samples, which precludes the confirmation of the representativeness of the analysed sample with respect to the sector.

3.3 – Brownfield and Europe situation

According to the European Environment Agency (EEA), soil is one of the essential components of land that plays a crucial role in nature's cycles, particularly water and nutrient cycles and it is the source of 90% of all food, feed, fibre and fuel production in the EU, providing also valuable raw material for the horticulture and construction sectors. The multitude of essential natural processes that take place in the soil are under threat from pollutants released by industry, transport and other economic activities, besides unsustainable farming practices, fertilisers and pesticides that also contaminate the soil. Eventually, this pollution affects plants, animals and human health. Along with contamination, the soil is affected by other threats mainly driven by human activity, such as soil erosion, decline in soil organic matter, soil compaction, soil sealing, soil salinization, desertification, flooding, landslides and decline in soil biodiversity. As reported on the EEA website, their assessments have pointed out that:

- Soil degradation in the EU also comes with an economic cost of more than EUR 50 billion per year.
- Around 2.8 million contaminated sites are found in Europe. Industrial activities and waste disposal are primary sources of contamination, with heavy metals and mineral oil the most frequent contaminants at European investigated sites.
- Nutrient imbalances are estimated to affect 74% of agricultural land. For example, nitrogen surplus is increasing and can be harmful to human health, crops, eco-systems, and the climate.
- Over 80% of soils tested in one study contained pesticide residues, with 58% containing two or more types of residues.
- Overall soil erosion is estimated to amount to 1 billion tonnes per year across the EU. At present date, approximately a quarter (24%) of EU soils are affected by water erosion, mainly in cropland, with projections referring to a possible increase of 13-25% by 2050.
- In 2019, EU Member States reported net greenhouse gas emissions of 64 MtCO₂e from soils to the atmosphere, which is equivalent to just under 2% of the total net emissions reported in that year.

For these and many other reasons, soil protection should be prioritized across Europe. The UN Sustainable Development Goals set the specific target 15.3:

“By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world”

“Brownfield” refers to a site that has been affected by the former uses of the site and the surrounding land, typically characterised by being derelict and underused, and may possess real or perceived pollution issues. These sites are predominantly located in developed urban areas and require intervention to return them to beneficial use. The redevelopment of these areas is backed by many reasons, like the protection against environmental contamination and health risks, the lack of clean industrial sites within the European densely populated and built-up regions, to limit urban sprawl and avoid new land take. Compared to greenfields, the brownfields are often well located with available infrastructure but often requires public incentives that need to be sustainable, e.g. promoting partial reuse of buildings/infrastructure materials, spatial planning leading to brownfield instead of greenfield land and citizen participation in these kinds of projects (Stolte, et al., November 2015).

The article “Sustainable Brownfields Redevelopment in the European Union: An Overview of Policy and Funding Frameworks” (Morar, Berman, Unkart, & Erdal, November 2021) reports that several funding frameworks supported the brownfields redevelopment in the European Union between 2014 and 2020, such as the *Cohesion Fund*, the *ERDF*, the *LIFE Programme*, the *Horizon 2020*, etc., having as budget millions or billions of Euros and representing opportunities that can potentially reduce the loss of ecosystem services associated with future development or restore struggling ecosystems by improving air, water, and soil quality—ultimately improving overall environmental, economic, and community health.

On October 23rd, 2025, the European Parliament approved the Soil Health Directive to establish a common framework for monitoring and assessing soil health across the EU. The directive requires member states to set up soil monitoring systems based on common descriptors, identify and address contaminated sites, and reduce emerging contaminants like PFAS, pesticides, and microplastics to achieve healthy soils across Europe by 2050, which is crucial for food security, biodiversity, and climate action, and Member States will have three years after entry into force to transpose the new rules into national law.

3.3.1 – Brownfield assessed by Ramboll Italy

The ten assessment reports analysed concerning brownfields, of varying sizes with different past purposes and active in different periods, are part of several projects of Phase I Environmental Site Assessment (ESA) conducted between 2020 and 2025. These Phase I ESAs were mainly undertaken in accordance with the scope and limitations of the American Society for Testing and Materials (ASTM) Standard Practice E1527-21 “*Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*” (and any and all subsequent amendments thereto) and, part of these ESAs, in accordance with the United States Environmental Protection Agency’s (EPAs) standards for All Appropriate Inquiries (AAI) as far as applicable in Italy. Indeed, it should be noted, that the ASTM standard is not fully applicable in Italy, given the lack of publicly available historical information and publicly available site-specific information databases.

Generically, the purpose for carrying out a Phase I ESA was to assess the current environmental conditions of the site, including the potential for soil and groundwater contamination, both within the site area and in its immediate proximity, and to assess its significance in terms of risks to potential liabilities for the site owner, and where necessary, identify further checks and investigations in order to gain a deeper understanding of possible environmental liabilities, such as environmental and/or geotechnical investigations (invasive and non-invasive) aimed at acquiring the geognostic information necessary for the development of the project. No sampling or laboratory analysis of soil, water or other materials was carried out as part of the assessment.

The issues associated with the site, within the reports, are categorised as Recognized Environmental Conditions (RECs), Historical Recognized Environmental Conditions (HRECs), Controlled Recognized Environmental Conditions (CRECs), Business Environmental Risks (BERs) and De minimis conditions (DMCs) (see Chapter 2 for definitions of these categories). For this thesis work, these environmental conditions/risks have been adapted on the basis of their standards’ definition in order to achieve a uniform risk classification with the results of the previous sectoral analyses:

- De Minimis Conditions (DMCs) have been classified as Low-risk findings.
- Controlled Recognized Environmental Conditions (CRECs) have been classified as Medium-risk findings.
- Recognized Environmental Conditions (RECs) and Business Environmental Risks (BERs) have been classified as High-risk findings.
- Historical Recognized Environmental Conditions (HRECs) have been grouped with “Unclassified” findings.

The generic scope of work for the Phase I ESA included the following:

1. Review of current and/or historical documents and maps regarding local geology and hydrogeology conditions;
2. Review of historical aerial photographs of the site and surrounding areas;
3. Review of building information, permits and plans, including renovations referred to construction characteristics of existing buildings (i.e. age, basic construction, square footage, number of floors, presence of windows, ventilation and exhaust system) and to identify potential environmental-related building systems (i.e. USTs, air pollution controls, wastewater treatment systems) when applicable;
4. Review of a regulatory database report that pertains to the property and covers the minimal search distances as defined in the Phase I ESA ASTM Standards for surrounding properties (in

countries where available) in order to help assess the likelihood of an impact to the Property from migrating Hazardous Materials or petroleum products;

5. Review of local, national agency lists and public databases for all known property addresses as obtained from the historical review and local research, to identify if the property and sites near the property are areas and/or sites of known soil, soil vapor, and/or groundwater contamination, are currently under investigation, or have been identified as sites subject to future investigation, when applicable;
6. Review of pertinent documents and maps to evaluate the potential for the presence of radon gas, oil and gas wells, flood plains and wetlands;
7. A Site Reconnaissance. The inspection included a review of the following features (when applicable):
 - a. general layout description of property buildings and property improvements;
 - b. current and past use/s of the property and property buildings;
 - c. current and past use/s of adjacent properties and surrounding areas;
 - d. geology, hydrogeology, hydrology, and topographic conditions;
 - e. potable water supply;
 - f. sewage disposal systems and septic systems;
 - g. sumps, clarifiers, trench drains, oil water separators;
 - h. use or storage of toxic or Hazardous Materials and/or petroleum products;
 - i. aboveground and underground storage tanks;
 - j. odours;
 - k. pools of liquids;
 - l. on-site ponds, landfills, waste streams or other disposal units;
 - m. visible soil contamination, such as on-site spills and/or distressed vegetation;
 - n. polychlorinated biphenyl (PCB) transformers and/or other PCB-containing equipment (i.e. capacitors, light ballasts, hydraulic equipment);
 - o. asbestos containing materials (ACM);
 - p. drums, barrels, and other storage containers;
 - q. wells;
 - r. visual review of suspect building materials (i.e. asbestos, lead based paint) in the accessible areas;
 - s. such other matters as may be required by environmental practices where the environmental services are performed.
8. preparation of the report, containing the results of the site assessment and the suggested actions such as further investigation and/or mitigation of the critical issues identified.

Even though materiality thresholds are adopted for these assessments, above which identified noteworthy issues which individually exceed these limits have been reported, the estimation of costs associated with potential corrective actions for the issues lies beyond the scope of this preliminary investigative stage and its purpose of work due to the general complexity of potential environmental liabilities observed on site and identified through the available documentation. Consequently, cost estimates are not typically provided in such cases. However, should a client request one, it becomes part of another project involving significant assumptions if any further and detailed investigations are not completed (check subparagraph 3.3.4 for further details).

Specific assumptions and limitations identified by Ramboll as being relevant are set out in the various reports, such as the lack of documentation or the limited access to specific areas during the site visit due to high vegetation, unstable building conditions, etc.

3.3.2 – Brownfield Findings’ Analysis

The analysis of the given samples was conducted by identifying the categories in which issues were detected and the number of findings for each category, with the relative level of risk and any costs associated with resolving the issue. The results obtained were incorporated into two two-dimensional data matrices: one for the purpose of enumerating the findings, and the other for the evaluation of costs.

The categories containing the various findings, divided by risk level, were listed in rows, whilst the sites analysed were listed in columns. For the sake of reference, the overall matrix is displayed in **Appendix 3**. Following the review, eleven categories were established. The subsequent description encompasses a selection of the key topics within these categories, some of which are in common with the precedent and evaluations regarding Biogas plants and Industrial sites. It is important to note that these descriptions are not exhaustive of all the possible topics falling within each category.

- *Permitting*: presents the authorisations that the site may have or could have had, to obtain information on structures/activities that may have an impact on the target, in particular on soil and subsoil and groundwater or surface water bodies.
- *Asbestos*: includes the evaluation of the current and past presence of asbestos containing materials on-site, its conditions, its remediation, previous asbestos surveys and monitoring results of eventual airborne asbestos fibres.
- *Wastewater*: includes analysis of aspects relating to the management of industrial, sanitary and rainwater discharges, the related controls and implementation measures.
- *ODS, GHGs and F-gases*: checks of the utilisation of these substances, with relative management measures, appropriate interventions and utilisation of non-banned gases.
- *PCB*: assessment of the past or present presence of equipment using PCBs, their condition and any necessary remediation.
- *Water Supply*: concerns the verification of the existence of groundwater wells, the assessment of their conditions, and the evaluation of the risk associated with the connection of multiple aquifers, or the location of the well in areas that may compromise water quality.
- *Waste Management*: concerns the presence of possible a waste and abandoned machinery and the conditions of storage areas, labels and related matters.
- *Chemicals Management*: shows the potential issues related to chemicals used on site that are stored, recorded, replenished, along with notes on the areas used for their management, including the evaluation of Underground and Above-ground Storage Tanks (USTs and ASTs).
- *Potential Soil and Groundwater Contamination*: outline the connections between unsafe practices within the previous categories and the potential presence of soil and subsoil contamination phenomena.
- *Unexploded Ordnance (UXO)*: public and detailed information regarding potential unexploded ordnance on the site area and surroundings.

Table 17 - Environmental conditions and risks identified within Brownfield reports

CATEGORY	DMC	CREC	BER	REC	HREC	-
Permitting	0	0	0	0	0	1
Wastewater	0	0	0	0	0	1
UXO	0	0	0	0	0	2
ODS, GHG, F-Gases	0	0	0	0	0	2
PCB	2	0	0	0	0	2
Water Supply	3	0	0	0	0	2
Chemicals Management	5	0	0	0	0	2
Waste Management	8	0	0	0	0	1
Asbestos	8	0	0	1	0	0
Potential Soil and Groundwater Contamination	1	2	0	7	1	1
TOTAL	27	2	0	8	1	14

Table 18 - Categories established with number of findings for each associated risk level in Brownfield sector

CATEGORY	LOW	MEDIUM	HIGH	UNCLASSIFIED	TOTAL
----------	-----	--------	------	--------------	-------

Permitting	0	0	0	1	1
Wastewater	0	0	0	1	1
UXO	0	0	0	2	2
ODS, GHG, F-Gases	0	0	0	2	2
PCB	2	0	0	2	4
Water Supply	3	0	0	2	5
Chemicals Management	5	0	0	2	7
Waste Management	8	0	0	1	9
Asbestos	8	0	1	0	9
Potential Soil and Groundwater Contamination	1	2	7	2	12
TOTAL	27	2	8	15	52

The ten Environmental Site Assessments reported a total of 52 environmental findings, corresponding to each environmental conditions and risks as ASTM standards rules. The majority (around 81%) are categorized as low-risk and unclassified findings, while medium- and high-risk findings together account for roughly 19%, indicating a generally controlled but uncertain environmental profile across assessed sites, with spots of elevated concern. However, topics such as Potential Soil and Groundwater Contamination, Asbestos in equal numbers with Waste Management and Chemical Management emerge as the most significant areas, collectively accounting for over 70% of total findings. In particular, Potential Soil and Groundwater Contamination category alone includes seven high-risk and few lower-risk findings, making it the most critical category in terms of potential environmental and financial impact, also reflecting to Europe situation. The presence of high-risk findings in a limited number of topics linked to contamination and hazardous materials appears to indicate that while severe nonconformities are not widespread, they are strategically significant and warrant priority action. In contrast, the unclassified findings are spread across all the categories suggesting that further data collection must be pursued to confirm whether these could evolve into material risks. The reported risk and finding distributions suggest that targeted remediation, improved data accuracy, and proactive risk management should remain key priorities to mitigate potential long-term liabilities.

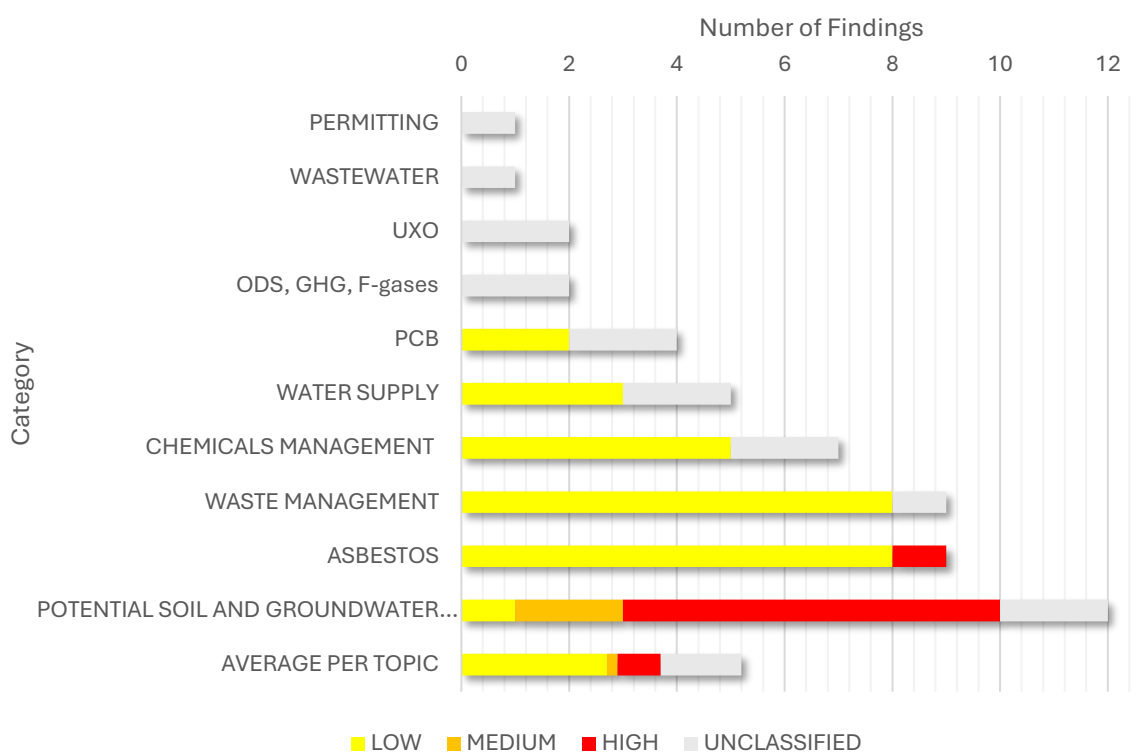


Figure 12 - Categories and number of findings in Brownfield sector

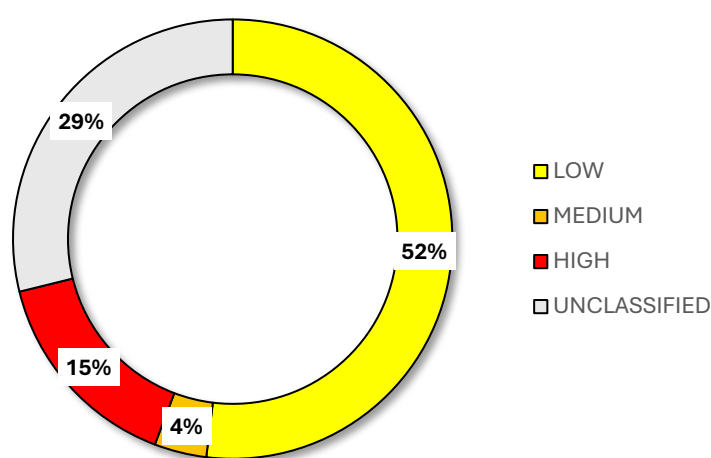


Figure 13 - Percentage division of the risk level of the findings in Brownfield sector

Most findings were successfully categorized into defined risk levels, but a considerable amount accounting for approximately 29% (15 out 52) of findings remain unclassified, which is typically due to insufficient or pending information (e.g. lack of site data, lack of information on historical water/waste/chemical management or analytical results), requiring further verification. These findings are distributed across several categories, except for asbestos, in varying degrees for each one, particularly Water Supply, Wastewater, ODS/GHG/F-Gases, PCB, Chemicals Management and Potential Soil and Groundwater Contamination, suggesting that the lack of classification is primarily linked to data limitations, rather than true absence of risk. Indeed, these findings should be regarded as potential latent risks, warranting targeted follow-up actions rather than being dismissed as low priority, requiring additional data collection and verification during subsequent phases, such as invasive investigations, to assign their actual risk classification, along with improving the cost estimates

for the potential remediation of all issues identified. The refinement of the accuracy of the overall risk classification profile will benefit also the strategic prioritization and resource allocation across brownfield redevelopment activities.

In a similar manner to industrial sites, the site visit and current owner or manager interview were conducted at all brownfields included in the sample, providing an overview of the current situation at the various sites. The absence of the requested documentation may be interpreted as an indication of the state of abandonment of the brownfield site, whose documentation could have been misplaced or is difficult to locate. Brownfield sites are often left abandoned for extended periods, resulting in a notable absence of historical memory and the loss of historical documentation. It is noteworthy that the respondents interviewed are frequently not the individuals who managed the sites in question, but rather real estate agents or developers who lack familiarity with the characteristics of the sites in question. Therefore, the experience of the auditor is of crucial importance, as they are tasked with the reconstruction of potential risks based on the available information. However, uncertainties remain as the audit must be thorough and objective and not speculative.

From the standpoint of the quantity of findings for each site, a moderate variation in the number of findings and their risk classifications was identified through analysis of the findings for each site. This dispersion indicates the presence of site-specific variability, which is presumably associated with the varying nature, historical utilisation, or contemporary status of each brownfield area. The Table 19 below shows the topic-basis and site-basis average number of findings, and it should be noted that the number of sites and number of topics are equivalent (10 analysed sites and 10 topics, respectively), revealing that the typical topic and the typical site presents about 5 findings in total, mostly low-risk and unclassified, while high-risk findings presence has to be considered even though its low numerosity. The medium-risk finding appears to be almost absent from the samples analysed (4%) with an average value of 0,2 per site and per topic. The sample appears to have a generally controlled risk exposure, but it should be remembered that these assessments are not related to any cost estimates due to lack of precise availability data regarding the several categories. For these and other reasons, a further subsequent investigation phase, such as a Phase II investigation, is very often recommended in order to clarify and quantify as accurately as possible all the issues and liabilities contained within each risk level, in addition to those that are unclassified.

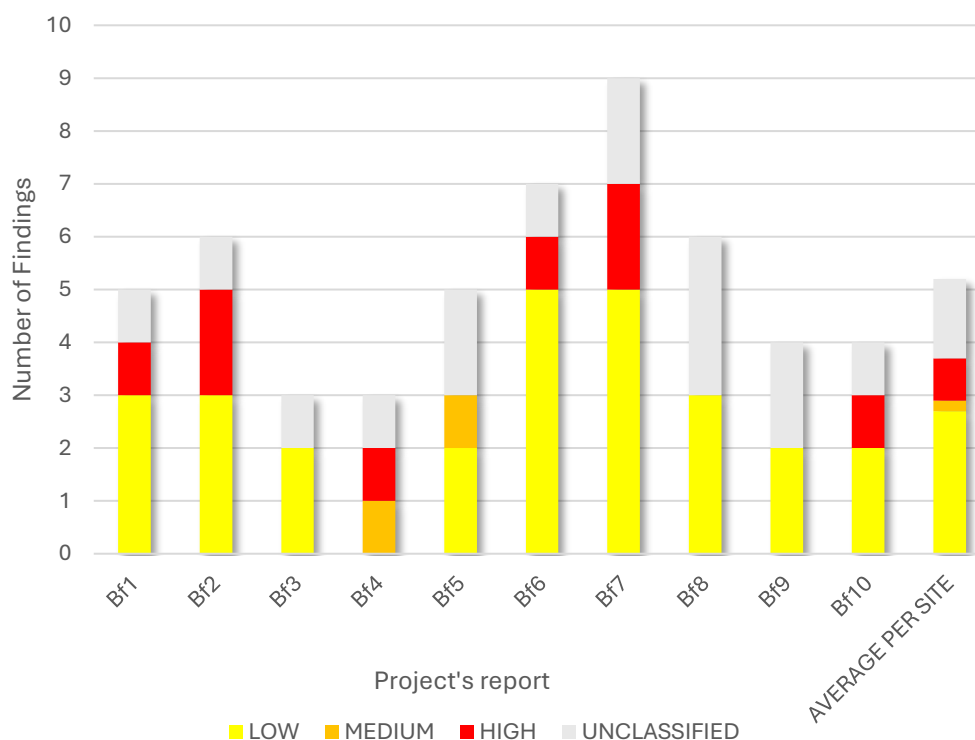


Figure 14 - Number of findings each Brownfield reviewed report

Table 19 - Average number of findings for each risk level in Brownfield sector

AVERAGE FINDINGS NUMBER	LOW	MEDIUM	HIGH	UNCLASSIFIED	TOTAL
Average Per Topic	2,7	0,2	0,8	1,5	5,2
Average Per Site	2,7	0,2	0,8	1,5	5,2

In this case, the five most represented categories for number of findings enclose 42 findings out of 52 identified, roughly 81% of the data, therefore capturing the majority of the environmental issues observed across the dataset of this sector. The mean number of findings per topic within the focused group reaches 8,4, compared to the overall sectoral average of 5,2, indicating a strong concentration of non-conformities in a limited number of topics and, similarly, about 4,2 findings per site are attributed to these five categories, showing that the main environmental challenges are both recurrent and concentrated across facilities. The Low-risk issues (25 out of 42, 60%) stands out also within these 5 categories, followed by the high-risk (8, 19%) and unclassified (7, 16%), while the average per topic of the medium-risk findings has grown of 0,2 because it is represented only by two findings within the Potential Soil and Groundwater Contamination category. Focusing corrective and preventive measures on these categories could potentially address over three-quarters of all identified findings and significantly enhance environmental performance across the portfolio. In the broader sectorial context, this analytical focus supports a targeted and cost-efficient approach to environmental risk management and compliance improvement.

Table 20 - Focus on categories with highest number of findings in Industrial sector

CATEGORY	LOW	MEDIUM	HIGH	UNCLASSIFIED	TOTAL
Water Supply	3	0	0	2	5
Chemicals Management	5	0	0	2	7
Waste Management	8	0	0	1	9
Asbestos	8	0	1	0	9
Potential Soil and Groundwater Contamination	1	2	7	2	12
TOTAL	25	2	8	7	42

Table 21 - Average values for focused categories in Industrial sector

AVERAGE FINDINGS NUMBER	LOW	MEDIUM	HIGH	UNCLASSIFIED	TOTAL
Average Per Topic	5,0	0,4	1,6	1,4	8,4
Average Per Site	2,5	0,2	0,8	0,7	4,2

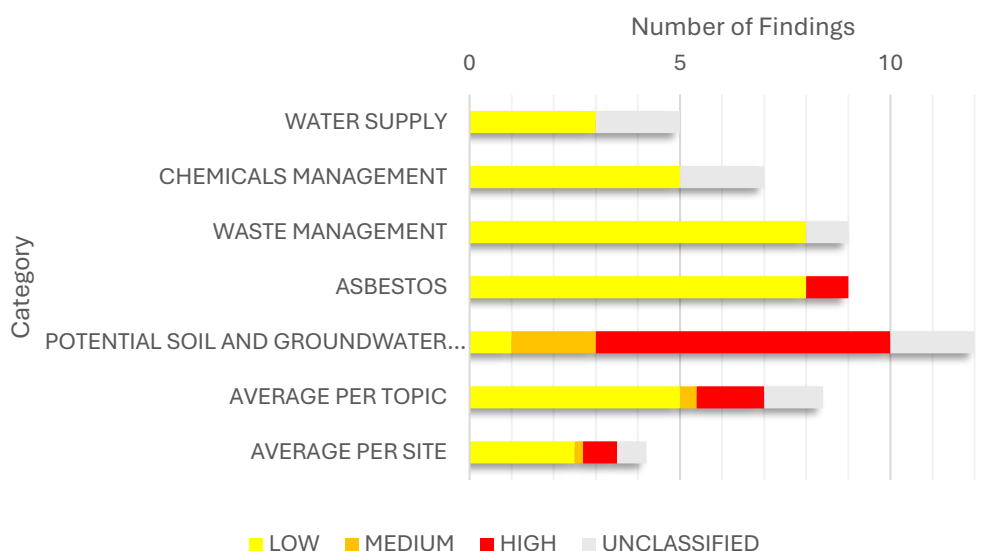


Figure 15 - Focus on Categories with highest number of findings in Brownfield sector

3.3.3 – Ramboll's Recommendations

The investigation and assessment of various issues conclude with suggestions for improvement measures to be implemented, and only when required with an estimate of the costs (see the next subparagraph) of further investigation and/or mitigation of critical issues, also aiming to raise awareness of environmental management. Below it is reported a summary of the issues identified and a generic version of Ramboll's recommendations for the previously mentioned five categories with the highest number of findings.

Water Supply - The main issues encountered have low-risk level, as De Minimis Conditions, with few unclassified findings, and concern:

- the total or partial absence of documentation required to carry out a thorough review, such as documentation related to the decommissioning of groundwater abstraction wells, well's date of construction, features and utilization.

Ramboll recommended:

- to verify the well's characteristics including e.g. construction details, cadastral identification, specific use of water and period of activity,
- to confirm that the well has been sealed, otherwise conduction of a video inspection of the existing wells aimed at assessing their construction features and conservation status; such information would be necessary to design the well sealing and evaluate associated costs.

Asbestos Containing Materials (ACM) – The category presents itself mainly with low risk, as De Minimis Conditions, and in one case as high-risk (REC); the main issues encountered concern:

- the observed presence of ACM (occasionally also Man-Made Vitreous Fibers) as building covers, as fragments on the ground, in the putty of window frames and in the downpipes,
- lack of asbestos survey, any updated version or one covering all areas of the site,
- the lack of any asbestos airborne fibres monitoring assessment,
- the lack of an asbestos manager for the partially active site.

Ramboll recommended:

- to conduct an ACMs survey and, in the event of detection, appoint an asbestos maintenance and control manager and determine the quantities/extent of the material containing asbestos and related conservation conditions,
- to carry out monitoring campaigns for airborne fibres and manage the removal or remediation of such material,

Waste Management – The majority of the identified issues have been assessed as low-risk level (De Minimis Conditions) with one unclassified finding, and they are related to:

- presence of abandoned waste material (i.e. roofing felt, unlabelled drums containing liquid and solid waste, metal components, general urban wastes and electronical wastes) abandoned across the property on unpaved ground or underground concrete basins,
- the potential presence of buried waste underneath the property area,

Ramboll therefore recommended that:

- the request the current site owner to properly dispose the various type of waste within the property prior to the deal closure or to require advice and technical-operational support for the disposal,
- in the event of the presence of fill material being confirmed during clearance and excavation activities, it is imperative that it is managed in accordance with current legislation.

Chemicals Management – Issues have mainly low-level of risk, as De Minimis Conditions, together with some unclassified findings that regard the following:

- presence of aboveground storage tanks (AST) and underground storage tanks (UST) for storage of oils, fuels, solvents or other substances without availability of the related technical information (tank's specification, installation date, volume, construction material, decommissioning documentation, leak test),

- presence underground basin for collecting spills but no information was available on the construction characteristics and volume of the basin,
- the lack of information on the integrity conditions of pipes for chemical transfer .

Ramboll therefore recommended:

- to remove chemical tanks and dispose any potential contents as waste, offering to provide advice and technical-operational support.

Potential Soil and Groundwater Contamination - The findings in this category mainly indicate high level of risk (RECs) and, to a lesser extent, a low (DMC), medium (CREC) and unclassified (HREC) level of risk. These are:

- the presence of backfill material was found to represent a potential source of contamination for groundwater (i.e. the leaching test conducted on samples of such material returned concentration in excess of the regulatory groundwater screening threshold values – CSC for Arsenic, Lead, Fluorides, Copper, Sulphates),
- the presence of contamination of soil (i.e. analysed samples showed exceedances of the regulatory limits for Heavy TPH (C > 12)),
- damaged paving not lined with impermeable material for areas used to store hazardous process solutions or waste,
- potential risk for pesticides/herbicides substances in soil and subsequent potential migration to groundwater beneath due to extensive historical use of the site for agricultural purposes,
- site currently under a soil and groundwater remediation process due to historical contamination by Chlorinated Solvents, Hydrocarbons and Metals (mainly nickel); from human risk assessment approved by authorities emerged necessity for remediation activities for the soils and monitoring campaign for groundwater quality assessment,
- presence of significant black stains on the floor of the workshop and oil storage area, generally in good condition, with slight cracks,
- no documented information available on the filling of exhausted quarries that would allow for a complete assessment of the compliance of the backfilling operations or an assessment of the soil quality in the relevant areas,
- potential external sources of groundwater contamination present at the site from contaminated areas located upgradient,
- potential for contamination associated with structures that currently remain in the ground e.g. underground passageways, or beneath existing buildings that are yet to be demolished, wastewater treatment system, process sewer, dry wells, etc.
- shallow soil contamination identified at the site related to exceedances of regulatory limits for several pollutants, without inform/formally notify regulatory authorities.

It is therefore recommended:

- the conduction of a Phase II ESA aimed at assessing extension and characteristics of the backfill material and determine whether such material has the potential to leach contaminants to groundwater, thus requiring corrective actions or risk mitigation measures to be taken,
- the conduction of Phase II ESA to assess potential contamination on-site that includes drilling of boreholes, to be installed as monitoring wells, if a shallow aquifer is encountered, then installation of Nesty Probes to allow for soil gas sampling and soil and groundwater sampling at each borehole and monitoring well and associated laboratory analysis; each operation will be adapted to the case necessity,
- intrusive works will be anticipated by a utility services clearance carried out through Ground Penetrating Radar (GPR) technique for H&S reasons and to identify any potential underground utility (if any) or underground object.

3.3.4 – Estimated Cost Analysis

As already mentioned, the Phase I ESA does not comprehend any cost estimates within its typical scope of work due to general complexity of potential environmental liabilities observed on site and identified through the available documentation. The ASTM Standard E1527-21 states that no environmental site assessment can wholly eliminate uncertainty regarding the potential for recognized environmental conditions in connection with a subject property. Performance of this practice is intended to reduce, but not eliminate, uncertainty regarding the potential for recognized environmental conditions in connection with a subject property, and this practice recognizes reasonable limits of time and cost. There is a point at which the cost of information obtained, or the time required to gather it outweighs the usefulness of the information and, in fact, may be a material detriment to the orderly completion of transactions. One of the purposes of this practice is to identify a balance between the competing goals of limiting the costs and time demands inherent in performing an environmental site assessment and the reduction of uncertainty about unknown conditions resulting from additional information.

In instances where a customer requests a cost estimate to address specific critical issues with this level of information, the estimate is provided along with all the relevant assumptions, which in many cases, are of considerable significance, resulting in a substantial gap between the two cost scenarios reported (RC and RWC). Much frequently it is recommended to conduct Phase II investigations, to confirm or quantify potential environmental liabilities identified during the Phase I Environmental Due Diligence or Environmental Site Assessment. In particular, it is recommended for issues such as potential soil and groundwater contamination, asbestos presence, or waste and chemical management practices that require analytical verification, but the cost of these investigations may vary significantly depending on the level of detail required, the extent of sampling and testing, and the complexity of the site conditions. However, these Phase II assessments are essential to reduce uncertainty, validate preliminary risk evaluations, and define the scope and cost of any necessary remediation or corrective measures and, in this sense, supports informed decision-making regarding liability management, budget allocation, and prioritization of environmental actions within the sites' portfolio.

For instance, among the ten reports analysed, the execution of Phase II investigations was requested by clients in only two cases, which both unearthed the presence of buried waste, consequently necessitating the estimation of management and disposal costs. In the first case, a range between €1.4 million and €1.7 million was reported for RC and between €11 million and €13 million for RWC, while in the second case, €800,000 and €1.2 million were reported for RWC.

The demolition cost estimations were requested in one case and resulted in a range of costs that spans from 34 M€ for RC and 72,5 M€ for RWC, which has included a full investigation of materials and structures, the preparation of the demolition plan and site activities, the activity of strip-out in all buildings, the activity of demolition of buildings and foundations, the activity of removal of asphalt and use of mobile crusher where needed, contractor mobilization, in the worst-case scenario, 100% of the materials (concrete and asphalt) would be disposed of, whereas in the best-case scenario, 60% of them could be reused on-site and, lastly, workday of 8 hours for 5 days a week.

In another case, an assessment of cost scenarios for various issues was requested, which led to the indication of a cost range between €80,000 and €300,000 to manage limited potential soil contamination from hydrocarbons and to remove a tank. For another site, the estimates requested led to an RC of €1.3 - €1.65 million in the case of achieving remediation objectives with mitigation measures, and an RWC of €1.8 million and €2.3 million with the implementation of mitigation measures and subsequent full-scale remediation.

It is important to note the substantial difference between the cases in terms of area and volumes involved, and consequently the quantity of waste or contaminated soil and/or groundwater involved, precludes any further elaboration on the issues in terms of representativeness.

Chapter 4 – Conclusions

This thesis endeavoured to provide an analysis of the Environmental Due Diligence process, its findings, and costs, based on real cases handled by Ramboll Italy S.r.l., at the conclusion of a training internship carried out in the previous months. The examination began with a theoretical framework, exploring the general and specific objectives of environmental due diligence, its operational phases, and the relevant national and international regulations and best practices. The analysis of the case studies highlighted the importance of a methodical and structured approach to addressing environmental issues in relation to land purchase and sale procedures, with the aim of emphasising the fundamental steps of Phases I of EDD of environmental investigations in assessing environmental liabilities and optimally managing business risk in Merger and Acquisition (M&A) negotiations. After framing the sector using European data, a detailed analysis of 30 case studies in the biogas, industrial and brownfield sectors (10 each) was conducted to identify potential environmental criticalities, trying to allow for both comparative analysis across sectors and prioritization of corrective actions. For each sector analysis:

- Issues were categorised and quantified based on their typology and level of risk (Low, Medium, High and Unclassified).
- The 5 categories with the greatest number of findings were highlighted and discussed, providing also Ramboll's recommendations.
- Associated cost scenarios (Reasonable Case – RC, Reasonable Worst Case – RWC) were analysed and integrated with non-numerical cost estimates (Minor Cost, Potentially Material Cost, Internal Resources, Not Estimable, Unclassified).

Across all sectors, the same core of environmental themes recurs, and it consists mainly of Potential Soil and Groundwater Contamination, Environmental Permitting, Chemical Management, Waste Management, Water Supply and Asbestos. The trending that emerges is dominated by Low and Medium risks, typically representing from 60 to 75% of total findings, suggesting an overall moderate environmental conditions but widespread nonconformities. The high-risk findings are lower in number, between 10 and 15%, but concentrated within key categories (potential contaminations, permitting, asbestos, chemicals), while unclassified findings, usually 15-20%, reflects data or documentation gaps rather than actual unknown risks, pointing to areas where additional information and investigations are needed and affecting also the cost estimations. On average, there are approximately 8,5 findings per site relating to the industrial sector, approximately 10,5 findings relating to biogas plants and approximately 5,2 findings for brownfield sites.

The cost analysis, conducted for the Biogas and Industrial sectors, shows that the cost exposure is driven by the medium-risk findings, due to frequency and entity, while high-risk findings, although fewer, can lead to disproportionately high costs. The non-numerical cost categories represent for a significant share of uncertainty that clarified, may materially affect the cost estimates, but at the same time, even in the absence of specifics, they provide a readily interpretable guideline of potential expenses. The estimated average cost per site to address the issues identified for biogas sites is approximately €13,000 for MLC and approximately €23,100 for RWC, while for industrial sites it is approximately €381,700 for MLC and approximately €616,400 for RWC. Overall, the total cost scenarios might be understated, partially due to unclassified findings and non-numerical estimates. Due to the substantial uncertainty surrounding the various findings caused by the lack of precise information and the complexity of the issues, the Brownfield Phase I ESA reports do not include an estimate of the costs of potential corrective actions within the scope of the work. Further investigations, such as Phase II operations, are recommended in order to better characterise the site and the issues identified.

In consideration of prospective future developments, the present analysis methodology has the capacity to be implemented on a larger sample, which would provide a more precise and representative perspective of individual sectors, with regard to the typology and number of findings and in terms of cost estimates, as well as allowing for the addition of further levels of characterisation. This could enable corrective actions to be targeted efficiently and provide a reference point for experts in the field.

Furthermore, defining non-numerical estimates numerically would allow for more reliable expenditure profiles. It is also possible that further insights can be gained by analysing Phase II reports relating to the Brownfield study. In addition to references to the issues identified, these reports could offer a cost estimation profile for the associated corrective actions.

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Appendix 1

BIOGAS
Findings Count

	TOPIC	FLAG	PROJECT										TOTAL LOW	TOTAL MEDIUM	TOTAL HIGH	TOTAL UNCLASSIFIED	TOTAL
			B1	B2	B3	B4	B5	B6	B7	B8	B9	B10					
FINDINGS COUNT	PERMITTING	LOW	1	1				1		1		1	5	8	1	0	14
		MEDIUM		1		2	4				1						
		HIGH			1												
		UNCLASSIFIED															
	CAPEX	LOW	1										1	0	0	0	1
		MEDIUM															
		HIGH															
	UNCLASSIFIED																
		LOW	3		1				1				5	4	0	2	11
		MEDIUM		2				1			1						
	HIGH																
	UNCLASSIFIED								1		1						
	WASTEWATER	LOW	1				2	1	1				5	3	0	0	8
		MEDIUM		3													
		HIGH															
	UNCLASSIFIED																
		LOW											0	10	0	5	15
		MEDIUM		2	3	2	3										
	HIGH																
	UNCLASSIFIED						1	1	1	1	1						
	COMPENSATION MEASURE	LOW	2										2	0	0	0	2
		MEDIUM															
		HIGH															
	UNCLASSIFIED																
		LOW											0	0	1	0	1
		MEDIUM															
	HIGH	1															
	UNCLASSIFIED																
	POTENTIAL SOIL AND GROUNDWATER CONTAMINATION	LOW	4										4	5	1	0	10
		MEDIUM		2	1	1	1										
		HIGH									1						
	UNCLASSIFIED																
		LOW											0	2	0	0	2
		MEDIUM		2													
	HIGH																
	UNCLASSIFIED																
	OPERATIONAL	LOW											0	2	0	0	2
		MEDIUM		2													
		HIGH															
	UNCLASSIFIED																
		LOW											0	0	3	0	3
		MEDIUM															
	HIGH			3													
	UNCLASSIFIED																
	ODS, GHG and F-Gases	LOW			1	1	2	1	1	1	1	1	9	0	0	0	9
		MEDIUM															
		HIGH															
	UNCLASSIFIED																
		LOW			2	3	1						6	7	2	5	20
		MEDIUM			1	3	3										
	HIGH			2													
	UNCLASSIFIED						1	1	1	1	1						
	NOISE	LOW				1		1		1		1	4	0	1	1	6
		MEDIUM															
		HIGH			1												
	UNCLASSIFIED							1									
		LOW							1				1	0	1	0	2
		MEDIUM															
	HIGH										1						
	UNCLASSIFIED																
TOTAL			13	15	16	13	16	7	7	6	7	6	42	41	10	13	106

Cost estimates

TOTAL RC (k€)	4,002	90	28	0	122,002
TOTAL RWC (k€)	15	155	61	0	231

Appendix 2

INDUSTRIAL
Findings Count

TOPIC		FLAG	PROJECT										TOTAL LOW	TOTAL MEDIUM	TOTAL HIGH	TOTAL UNCLASSIFIED	TOTAL
			I1	I2	I3	I4	I5	I6	I7	I8	I9	I10					
FINDINGS COUNT	PERMITTING	LOW	1		1		1						3	1	3	1	8
		MEDIUM					1										
		HIGH				1	1				1						
		UNCLASSIFIED						1									
	WATER SUPPLY	LOW	1		2								3	1	0	1	5
		MEDIUM									1						
		HIGH															
		UNCLASSIFIED			1												
	WASTEWATER	LOW		1							2		3	8	2	0	13
		MEDIUM	1		3			1	1		1	1					
		HIGH			1							1					
		UNCLASSIFIED															
	WASTE MANAGEMENT	LOW	1	1	1		1						4	2	0	1	7
		MEDIUM			2												
		HIGH															
		UNCLASSIFIED						1									
	ASBESTOS	LOW	1	1							1		3	1	2	3	9
		MEDIUM					1										
		HIGH			2												
		UNCLASSIFIED						1	1			1					
	POTENTIAL SOIL AND GROUNDWATER CONTAMINATION	LOW											0	7	1	0	8
		MEDIUM		1	2	3	1										
		HIGH									1						
		UNCLASSIFIED															
	HSE MANAGEMENT	LOW				1	1						2	0	0	0	2
		MEDIUM															
		HIGH															
		UNCLASSIFIED															
	ODOUR EMISSIONS	LOW											0	2	0	0	2
		MEDIUM									2						
		HIGH															
		UNCLASSIFIED															
	ODS, GHG, F-gases	LOW			1						1		2	4	0	0	6
		MEDIUM						1	1	1		1					
		HIGH															
		UNCLASSIFIED															
	CHEMICALS MANAGEMENT	LOW				1	1						2	1	1	3	7
		MEDIUM									1						
		HIGH						1									
		UNCLASSIFIED						1	2								
PCB	LOW		1									1	1	0	0	2	
	MEDIUM			1													
	HIGH																
	UNCLASSIFIED																
NOISE	LOW									1		1	1	0	2	4	
	MEDIUM	1															
	HIGH																
	UNCLASSIFIED							1			1						
ATMOSPHERIC EMISSIONS	LOW	1						1				2	4	1	1	8	
	MEDIUM		1	3													
	HIGH			1													
	UNCLASSIFIED						1										
ENERGY CONSUMPTION	LOW									1		1	1	0	2	4	
	MEDIUM					1											
	HIGH																
	UNCLASSIFIED						1		1								
TOTAL			7	6	21	6	9	9	7	5	10	5	27	34	10	14	85

INDUSTRIAL
Cost estimates

TOPIC	FLAG	PROJECT																		TOTAL LOW	TOTAL MEDIUM	TOTAL HIGH	TOTAL UNCLASSIFIED	TOTAL					
		11		12		13		14		15		16		17		18		19							110				
		RC (k€)	RWC (k€)	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)	RC (k€)	RWC (k€)						RC (k€)	RWC (k€)			
PERMITTING	LOW	MC								5	7														5	10	40	0	55
	MEDIUM										10	10													7	10	240	0	257
	HIGH										10	50	30	70					MC	120									
WATER SUPPLY	LOW	MC																											
	MEDIUM																		MC	150						0	0	0	0
	HIGH																												
WASTEWATER	UNCLASSIFIED																									0	150	0	150
	LOW	2	50		MC																								
	MEDIUM																		MC	250						160	1377	400	0
WASTE MANAGEMENT	HIGH																												
	UNCLASSIFIED																												
	LOW																												
ASBESTOS	MEDIUM																												
	HIGH																												
	UNCLASSIFIED																												
SOIL AND GROUNDWATER CONDITIONS	LOW																												
	MEDIUM																												
	HIGH																												
HSE MANAGEMENT	UNCLASSIFIED																												
	LOW																												
	MEDIUM																												
ODOUR EMISSIONS	HIGH																												
	UNCLASSIFIED																												
	LOW																												
ODS, GHG, F-gases	MEDIUM																												
	HIGH																												
	UNCLASSIFIED																												
CHEMICALS MANAGEMENT	LOW																												
	MEDIUM																												
	HIGH																												
PCB	UNCLASSIFIED																												
	LOW																												
	MEDIUM																												
NOISE	HIGH																												
	UNCLASSIFIED																												
	LOW																												
ATMOSPHERIC EMISSIONS	MEDIUM																												
	HIGH																												
	UNCLASSIFIED																												
ENERGY CONSUMPTION	LOW																												
	MEDIUM																												
	HIGH																												
TOTAL		6	50	2.5	50	855	995	45	375	81	254	1027.5	1200	800	700	300	290	250	1600	450	650				50	50	0	0	0

TOTAL RC (k€)	411	1948.5	1457.5	0	3817
TOTAL RWC (k€)	1004	2955	2205	0	6164

Appendix 3

BROWNFIELD
Findings Count

	TOPIC	FLAG	PROJECT										TOTAL LOW	TOTAL MEDIUM	TOTAL HIGH	TOTAL UNCLASSIFIED	TOTAL
			Br1	Br2	Br3	Br4	Br5	Br6	Br7	Br8	Br9	Br10					
Findings count	PERMITTING	LOW											0	0	0	1	1
		MEDIUM															
		HIGH															
		UNCLASSIFIED	1														
	WATER SUPPLY	LOW	1						1	1			3	0	0	2	5
		MEDIUM															
		HIGH															
		UNCLASSIFIED					1			1							
	WASTEWATER	LOW											0	0	0	1	1
		MEDIUM															
		HIGH															
		UNCLASSIFIED									1						
	WASTE MANAGEMENT	LOW	1	1	1		1	1		1	1	1	8	0	0	1	9
		MEDIUM															
		HIGH															
		UNCLASSIFIED							1								
	ASBESTOS	LOW	1				1	1	2	1	1	1	8	0	1	0	9
		MEDIUM															
		HIGH		1													
		UNCLASSIFIED															
	POTENTIAL SOIL AND GROUNDWATER CONTAMINATION	LOW			1								1	2	7	2	12
		MEDIUM				1	1										
		HIGH	1	1		1		1	2			1					
		UNCLASSIFIED				1				1							
	UXO	LOW											0	0	0	2	2
		MEDIUM															
		HIGH															
		UNCLASSIFIED		1	1												
	ODS, GHG, F-gases	LOW											0	0	0	2	2
		MEDIUM															
		HIGH															
		UNCLASSIFIED					1			1							
CHEMICALS MANAGEMENT	LOW		1				2	2				5	0	0	2	7	
	MEDIUM																
	HIGH																
	UNCLASSIFIED								1	1							
PCB	LOW		1				1					2	0	0	2	4	
	MEDIUM																
	HIGH																
	UNCLASSIFIED					1		1									
TOTAL			5	6	3	3	5	7	9	6	4	4	27	2	8	15	52

BROWNFIELD
Findings Count

TOPIC		FLAG	PROJECT										FINDINGS COUNT					
			Br1	Br2	Br3	Br4	Br5	Br6	Br7	Br8	Br9	Br10	REC	HREC	CREC	DMC	BER	-
PERMITTING	LOW																	
	MEDIUM																	
	HIGH																	
	UNCLASSIFIED	-																
WATER SUPPLY	LOW	DMC																
	HIGH																	
	UNCLASSIFIED																	
	LOW																	
WASTEWATER	LOW																	
	MEDIUM																	
	HIGH																	
	UNCLASSIFIED																	
WASTE MANAGEMENT	LOW	DMC	DMC	DMC		DMC	DMC											
	MEDIUM																	
	HIGH																	
	UNCLASSIFIED																	
ASBESTOS	LOW	DMC																
	MEDIUM																	
	HIGH		REC															
	UNCLASSIFIED																	
POTENTIAL SOIL AND GROUNDWATER CONTAMINATION	LOW																	
	MEDIUM																	
	HIGH	REC	REC		REC	CREC	REC	REC										
	UNCLASSIFIED																	
UXO	LOW																	
	MEDIUM																	
	HIGH																	
	UNCLASSIFIED																	
ODS, GHG, F-gases	LOW																	
	MEDIUM																	
	HIGH																	
	UNCLASSIFIED																	
CHEMICALS MANAGEMENT	LOW		DMC															
	MEDIUM																	
	HIGH																	
	UNCLASSIFIED																	
PCB	LOW		DMC															
	MEDIUM																	
	HIGH																	
	UNCLASSIFIED																	
			1	2	0	1	0	1	2	0	0	1	8	1	2	27	0	14
			TOTAL															
REC			1	2	0	1	0	1	2	0	0	1						
HREC			0	0	0	0	0	0	0	1	0	0						
CREC			0	0	0	1	1	0	0	0	0	0						
DMC			3	3	2	0	2	5	5	3	2	2						
BER			0	0	0	0	0	0	0	0	0	0						
-			1	1	1	1	2	1	2	2	2	1						